Installation and Operating Instructions

EBA AF400 2515864 / 27.03.02

WILO-RainSystem AF400

Subject to technical alterations!

Contents:

1 General Information

Installation and service by qualified personnel only!

1.1 Uses

The factory-assembled compact module is designed for the commercial and industrial use of rainwater to save on drinking water. The unit guarantees a fully automatic supply of rainwater from buried tanks or wells using a submersible motor-driven pump as a feed pump. The fully electronic control unit drives the well pump, the water-supply pumps and the fresh water backfeed unit. The large-volume hybrid reservoir with all its built-in functions offers a backfeed of fresh water into the consumer network that is designed to meet the customer's needs in the case of unfilled wells.

The main areas of use are:

- Toilet flushing,
- Supplying washing water,
- Garden sprinkling and watering,

Rainwater is not drinking water! Rainwater pipes must be labelled separately!

1.2 Product data

1.2.1 Rating plate

Example:

Wilo-AF 400-2 MP 605 DM/RCH 2+1

AF	Automatic rain-water supply and fresh-water backfeed system
400	Volume of hybrid reservoir [litres]
2	Number of water-supply pumps
MP	normal-suction, horizontal, multi-stage centrifugal pump of the MultiPress series
6	Flow rate (m^3/h) at optimum efficiency
05	Number of switching positions
DM	Three-phase current 3 ~ 400 V, 50 Hz
EM	1 ~ 230 V, 50 Hz
RCH	Control unit: RainControl Hybrid
2+1	Number of water-supply pumps: 2 ; number of feed pumps:1

1.2.2 Connection and electrical data

Flow rate of pumps:	max. 16 m^3/h
Flow level:	max. 56 m
Flow rate of well pump:	max. 16 m^3/h
Operating pressure:	max. 10 bar
Medium temperature:	+5°C to +35°C

Volume of hybrid reservoir:	400 l
Ambient temperature:	max. 40°C
Mains voltage	1 ~ 230 V, 50 Hz (L, N, PE)/EM specification 3 ~ 400 V, 50 Hz (L1, L2, L3, N, PE)/spec. DM
Nominal power per pump [P_2]:	550 / 750 / 1100 W (according to pump type plate)
Motor protection:	built-in electronic motor protection
Pump control:	electronic pressure transmitter
Connection to supply line cistern:	PE pipe, external diameter 50 mm
Pressure pipe connection:	Collective pipework R 1½“
Backfeed fresh water connection:	via free intake; magnetic valve connection 1“
Overflow connection:	DN 100 with overflow siphon

2 Safety

These instructions contain important information, which must be followed when installing and operating the pump. These operating instructions must therefore be read before assembly and commissioning by the installer and the responsible operator.

Both the general safety instructions in the “Safety precautions” section and those in subsequent sections indicated by danger symbols should be carefully observed.

2.1 Indication of instructions in the Operating Instructions

Safety precautions in these operating instructions, which, if not followed, could cause personal injury, are indicated by the symbol:

 ,

When warning of electrical voltage with

.

The following symbol is used to indicate that by ignoring the relevant safety instructions, damage could be caused to the pump/machinery and its functions:

ATTENTION!

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2.2 Staff training

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

2.3 Risks incurred by failure to comply with the safety precautions

Failure to comply with the safety precautions could result in personal injury or damage to the pump or installation. Failure to comply with the safety precautions could also invalidate any claim for damages.

In particular, lack of care may lead to problems such as:

- Failure of important pump or machinery functions,
- Injury resulting from electrical or mechanical factors.

2.4 Safety precautions for the operator

Existing regulations for the prevention of accidents must be followed.

Dangers caused by electrical energy are to be excluded. Directives issued by the VDE [German Association of Electrical Engineers] and the local electricity supply companies are to be observed.

2.5 Safety information for inspection and assembly

The operator is responsible for ensuring that inspection and assembly are carried out by authorised and qualified personnel who have studied the operating instructions closely.

Work on the pump/machinery should only be carried out when the machine has been brought to a standstill.

2.6 Unauthorized modification and manufacture of spare parts

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

2.7 Unauthorised operating methods

The operating safety of the pump or installation supplied can only be guaranteed if it is used in accordance with paragraph 1 of the operating instructions. The limiting values given in the catalogue or data sheet must neither be exceeded nor allowed to fall below those specified.

3 Transport and interim storage

ATTENTION! The unit is to be protected against moisture and mechanical damage caused by blows/impacts. Temperatures outside the range 0°C to + 40°C are to be avoided.

4 Product and accessory description

4.1 Pump description

The unit has been designed as a compact industrial and rainwater supply system with two pumps. The pumps work alternately or in parallel at peak times. They receive water from the reservoir. With the help of a pressure transmitter located in the collective pipework at the discharge end, the control unit regulates the required flow of water through the pumps. A flowed-through diaphragm pressure vessel (8 l) to DIN 4807 prevents the pumps from switching on constantly whenever there is a slight drop or leak. To ensure the reservoir is filled to a certain level, a level sensor has been fitted in the hybrid reervoir, which sends switch pulses to the control unit at corresponding water levels. This guarantees that the reservoir is topped up at the right time from the well by means of the feed pump installed in the well. If the well is empty, the control unit receives a corresponding signal from the level sensor in the hybrid reservoir. In this case backfeed takes place from the drinking water network via the drinking water backfeed unit. (see fig. 1).

4.2 Description of control unit

4.2.1 Description of functions

The control unit (type RCH 2+1) controls and regulates rainwater utilisation systems that are constructed as hybrid systems.

The system's storage reservoir (hybrid reservoir) contains a level sensor for controllng the system (see fig. 7).

The float level S0 serves as dry-run protection for the pumps. If the level falls below the switching point of level S1, the well pump is switched on. The well pump supplies the reservoir with rainwater until level S2 is exceeded in the reservoir.

If the level in the reservoir falls below level S3, the solenoid valve for the drinking water backfeed is opened. Backfeeding continues until the level exceeds level S4. The superimposed arrangement of switches S3 and S1 ensures that fresh water is only backfed if the well is empty or if there is a fault in the vicinity of the well pump.

An electronic pressure transmitter provides the actual system pressure value as a 4 – 20 mA current signal. The regulator then keeps the system pressure constant.

If the required power of a pump cannot be met, the second pump is engaged.

4.2.2 Construction of the control unit

The control unit consists of the following components:

- **Main switch:** isolates the power supply and is used to connect the network input
- **Control panel for the well pump:** mains supply circuit for the l-v section of this panel, connecting terminals for the power supply and connecting terminals for external signals, as well as potentiometer and gravity switch for setting the operating modes and parameters of this section of the system.

- **Control panel for the booster pumps:** mains supply circuit for the l-v section of this panel, connecting terminals for the power supply and connecting terminals for external signals, as well as potentiometer and gravity switch for setting the operating modes and parameters of this section of the system.
- **Display panel:** location of LED display and rotary switch.
- **Level panel:** connection of level giver in storage reservoir

4.2.3 Device functions in the control section of the well pump

- **Internal electronic motor protection:** to protect against the motor overloading the overcurrent trip on potentiometer P1 (fig. 3) must be set to the nominal current of the pump/motor (according to type plate). The WSK terminals are to be bridged.
- **External motor protection WSK / PTC:**
  If the motor is protected by a winding earthing contact (WSK) or PTC, potentiometer P1 is set to the maximum value (right stop).
- **Subsequent running time:** The subsequent running time for the cistern pump is set on the P2 Pententiometer (diagram 3) between 0 and 2. (factory setting: 0 min).
- **TLS:** (dry-running protection) The pumps of water supply systems must not run dry. As low-water protection a float switch (WA 65/95) or immersible electrodes are built into the well which switch off the well pump of the minimum water level in the well is fallen short of.
- **TLS delay:** The switching-off of the pump after the low-water protection has been activated and its switching back on after the fault signal has been reset can be delayed. The delay time can be set on potentiometer P3 (fig. 3) to between 2 sec and 2 min.
- **Test run:** With the "test run" setting the pump runs for 10 s after being switched off for 10 hrs. Closing gravity switch S 3 (fig. 3) prevents a test run from taking place. To prevent the storage reservoir from overflowing, the test run is to be deactivated in switchbox RCH.

4.2.4 Device functions in the control section of booster pumps

- **Internal electronic motor protection:** to protect against the motor overloading the overcurrent trip on the potentiometer (fig. 5, P1, P2) must be set to the motor's nominal current in accordance with the rating plate for each motor. The WSK terminals are to be bridged.
- **External motor protection WSK / PTC:** If the motors are protected by a winding earthing contact (WSK) or motor protection with thermistor (PTC), for each motor the WSK or PTC connected to the terminals and the potentiometer (fig. 5, P1, P2) is set to the maximum value (right stop).
- **Reset time:** The reset time for the constant-load pump is set on potentiometer $t_{\uparrow}$ (fig. 5, P8) to between 0 and 2 min. It begins when the 1st pump starts.
- **Low-water protection:** As low-water protection the storage reservoir contains the level sensor with the switching level S0, whichshuts down the pumps one after the

other of the minimum water level is fallen short of. Self-acknowledgement when the water shortage is rectified.

- **WM delay:** The switching-off of the pump after the low-water protection has been activated and its switching back on after the fault signal has been reset can be delayed. The delay time can be set on potentiometer $t_{\circlearrowleft}$ (fig. 5, P9) to between 2 sec and 2 min. This delay is to be set to left stop (minimum) in switchbox RCH.
- **Peak load on/off delay:** The switching on of peak-load pumps is delayed by approx. 4 s, and switching off by approx. 8 s. These times are pre-programmed and cannot be changed.
- **Fault change-over:** If one pump shuts down as a result of a fault the other pump automatically takes over its functions.
- **Pump swap:** If the same pump always took on the role of constant-load pump, it would be subjected to greater stress than the peak-load pump. To equally divide the running times of the pumps and thus prevent the premature breakdown of one of the pumps, the "pump swop" function is provided, i.e. each time the system starts up the next pump takes on the constant-load function. Pump swapping also takes place if one or more pumps are runnign constantly approx. every 6 hours.
- **Test run:** With the "test run" setting one pump runs in each case for approx.15 s. after being switched off for approx. 6 hrs. The test-run intervals are pre-programmed and are not affected either by the operating times of the pumps or the notification of a low water level or sensor breakdown. Closing gravity switch S 2 (fig. 5) prevents a test run from taking place.

4.3 Switchgear operation

4.3.1 Control elements on the front of the switchgear

The switchgear is used to automatically control the pumps. The front plate of the switchbox contains the following switches/displays:

- **Main switch** 3-pole (L1, L2, L3) (fig. 2, pos. 5)
  0 → OFF
  I → ON

4.3.2 Control elements on the front of the switchgear for the well pump

- **Control switch** (fig. 2, pos. 1)
  Automatic → Automatic mode with all safety functions, electronic motor protection and dry-running protection.
  0 → Off
  ✋→ Manual mode; pump engages regardless of current requirements and without safety functions. WSK function is retained. This setting is intended for test runs. The manual mode runs for approx. 2 min and then switches off.
- **Operating display** (fig. 2, pos. 4): lights up green when pump is running, flashes green if there is a motor fault.
- **Fault display** (fig. 2, pos. 4): lights up red if there is a fault in the water circuit.

4.3.3 Control elements on the front of the switchgear for the booster pumps

- **1 Control switch for both pumps**, (fig. 2; pos. 2)
  0 → Off for both pumps
  ✋ → Manual mode; pump 1 or 2 engages regardless of current requirements and without safety functions. WSK function is retained. This setting is intended for test runs. The manual mode runs for approx. 2 min and then switches off.
  Automatic → Automatic mode with all safety functions, electronic motor protection and low-water shutdown.
  Automatic 1: In automatic mode pump 1 running, pump 2 switched off (e.g. because of fault).
  Automatic 2: In automatic mode pump 2 running, pump 1 switched off (e.g. because of fault).
  Automatic 1+2: both pumps running in addition mode as constant- and peak-load pumps.
- **Operating display** (fig. 2, pos. 3) for each pump lights up green for corresponding pump, flashes green if there is a motor fault.
- **Fault display** (fig. 2, pos. 3): lights up red if there is a fault in the water circuit.

4.4 Products delivered

- factory-assembled compact unit AF400 on rack
- Backfeed unit for installation in backfeed line
- Installation and Operating Instructions

4.5 Accessories

Accessories must be ordered separately.

- Submersible motor-driven pump TS..., TP...
- Float switch WA 65

5 Assembly / Installation

5.1 Assembly

The unit is delivered completely assembled. It must be installed on a flat surface in a frost-free room. The unit is aligned vertically using the height-adjustable vibration-dampers (rubber feet). Make sure the unit does not come into direct contact with adjacent walls, to prevent possible noise interference through impact sound.

ATTENTION! The unit's instalation site must be higher than the highest water level in the well, otherwise there is a risk that the well will drain into the canal system via the unit.

ATTENTION! All pipework connections are to be made off-load, pipework forces are to be supported and may not be led to connections of the unit.

5.1.1 Pressure pipe

There is a pipe connection on both the right- and left-hand side of the unit with an outside thread R1½“ for connecting the pressure pipe. For connection, we recommend flexible connection pipes in order to avoid body sound transmission to the consumers cable. The unused connection is to be sealed with a standard sealing cap (pressure rating PN10).

5.1.2 Connecting supply line from well

The connecting branch is located on the top of the reservoir (ø 50, 100 mm long, material PE) and can be connected to the supply line from the well using standard connecting techniques (e.g. clamped joint).

ATTENTION! The feed quantity from the well should not exceed 16 m³/h (if necessary fit a regulating flap)! Furthermore, a backflow preventer is required in the supply line, as otherwise the unit can drain back into the well.

5.1.3 Overflow connection

The overflow DN 100 with overflow siphon as air trap and free passage to DIN 1986 (outer ø 110 mm, 100 mm long, material PE) is to be connected to the drains using HT, KG or other waste-water piping. **There must be no possibility whatsoever of the system backing up**.

5.1.4 Backfeed

A backfeed line 1“ from the drinking water mains via free intake to DIN 1988 is to be installed in the unit for automatic backfeeding if the well is empty. The free outlet in the installation is ensured by DIN 1988. The pipe is to be fitted to the 1” solenoid valve with outlet pipe, whereby the outlet is to be positioned directly above the reservoir’s inlet funnel (DIN 1986 P.4).
The suply line to the valve is to be of such a size that the required backfeed quantity (maximal 16 m³/h) is achieved. The network pressure before the 1” solenoid valve must be at least 2.5 bar during backfeed.
It is recommended that an additonal regulating flap be fitted in the backfeed line by the customer, to be able to throttle back in the case of high network pressures and thereby avoid water hammering at the solenoid valve and spraying from the funnel.

5.2 Electrical connection

Electrical connection should be made by a qualified electrician. Current national regulations must be observed (e.g. VDE regulations in Germany).

- Current type and voltage of the mains connection must match the data on the rating plate
- Observe pump rating plate data

- Observe supply fuse protection in accordance with unit rating plate
- If residual current-operated circuit-breakers are used, the corresponding regulations are to be observed.
- Pump/installation must be earthed in compliance with regulations.
- The connecting lines are to be laid such that at no stage are the pipes and the pump/motor housings touched.
- Set motor protecting switch and/or electronic curent monitor to the nominal pump motor current specified on the rating plate.

ATTENTION! **Die Pumpen dürfen nicht trocken laufen. Dry running damages the mechanical seal**

Mains connection:

The 5-wire cable (L1, L2, L3, N, PE) is to be provided by the customer. Connection direct to main switch 1Q1.

Well pump connection: (for EM – or DM network: observe X4 bridge)

U, V, W, PE:
Three-phase connections for the pump/motor (see diagram 3)

U, V, PE:
Alternating current connections for the pump/motor (see diagram 3)

MOR / MER:
Connection for an external Multiple Operating Rerading or Multiple Error Reading (pump fault or lack of water), potential-free change-over contact, max. contact load 250 V, 1 A.

Transmitter P:
Connection of pressure or float switch to switch pump on and off (standard factory wiring)

TLS:
Dry-running protection. The various dry-running protection options and their connections are shown in fig. 4.

WSK:
Connection for motor protection WSK (winding earthing contact) or PTC (motor protection with thermistor)

The gravity switch and potentiometer for the various device functions must be set on the device panel. They are described in table 1.

Booster pump connection: (for EM – or DM network: observe X0 bridge)

U1, V1, W1, PE / U2, V2, W2, PE:
Three-phase connection for the pumps/motor (see diagram 5)

U1, V1, PE / U2, V2, PE:
AC connections for the pumps/motor (see diagram 5)

SM/WM:
Connection for an external Multiple Error Reading (pump fault or lack of water), potential-free change-over contact, max. contact load 250 V, 1A.

BM1 to **BM2:**
Connections for external Single Operating Readings for each pump, potential-free make contact, max. contact load 250 V, 1 A. If the motor is running, the contact is closed.

SM1 to **SM2:**
Connections for external Single Error Readings for each pump, potential-free change-over contact, max. contact load 250 V, 1 A. If there is a fault with the motor, the contact changes. These contacts can optionally be fitted in the switchbox.

WSK1 to **WSK2**:
Connections for motor protection WSK (winding earthing contact) or PTC (motor protection with thermistor).

+ u. IN:
Connection for the pressure sensor (4 - 20 mA) for switching the pumps on and off.

WM:
Low-water protection in the AF400 is provided by the SO switch level on the level giver.

The gravity switch and potentiometer for the various device functions must be set on the pump control panel. They are described in table 2.

6 Operation

We recommend having the unit put into operation by the Wilo customer service.

Before switching on the unit for the first time, check the wiring made by the customer to make sure it is correct, especially the earthing.

Before commissioning the unit for the first time, the pumps and pipework must be thoroughly rinsed, filled and if necessary vented.

ATTENTION! Tighten all connecting terminals prior to commissioning!

7 Maintenance

To guarantee optimum operating safety at the lowest possible operating costs, we recommend taking out a maintenance contract.

The gas pressure in the diaphragm pressure vessel is to be checked every 6 months. For this purpose, the container is to be drained of all pressure (close pressure fittings and bleed the remaining water via the outflow). Now check the gas pressure on the membrane pressure container valve using the pneumatic measuring instrument, if necessary, adjust the pressure (P_{N2} = pump activation pressure p_{min} minus 0.2-0.5 bar, or according to the table on the container) by adding nitrogen.

If out of service for long periods, the fresh water inlet is to be closed, the mains plug removed ad the pump/unit drained by opening the lower discharge screw on the pump.

8 Problems, Causes and Solutions

- **Pumps do not start.** Check fuses and power supply.

- **Green LED flashes:** Motor protection of the pump in question has been activated. No self-acknowledgement after fault ractified. Acknowledgement: set control switch to “0“. If necessary allow motor to cool down first.

- **Red LED lights up:** Shut down because of lack of water / dry-running protection. Automatic acknowledgement after fault has been rectified.

- **Pump leaks.** Mechanical seal faulty. Replace mechanical seal. Tighten screws on step housing. (Pay attention also to the pump EBA).

If the fault cannot be remedied, please contact WILO customer services.

Switch/ Potentiometer	Functions	Factory setting
P1 (R10)	Potentiometer for setting to nominal motor current (in amperes, setting range 0 ... 10 A)	According to the Type of pump used
P2 (R27)	Reset time after pump switches off (0 – 2 min)	0 min
P3 (R48)	Delay for low-water shut down (0 – 2 min)	0 min
S2	Function reversal for sensor input: S 2 open: pump running with closed sensor contact S 2 closed: pump running with open sensor contact	S2 open
S3	Test run: S 3 open: with test run S 3 closed: without test run	S3 open
S4	Function reversal for TLS input: S 4 open: pump shuts down for lack of water S 3 closed: pump cuts in in case of overflow	S4 open
S6	Function reversal for TLS input S 6 upper closed: pump shuts down for lack of water S 6 lower closed: pump cuts in in case of overflow	S6 upper closed
F1	Control fuse: 5 & x 20 mm; 0.1 A; 440 V	

Table 1: Functions of the potentiometer and gravity switch on the well pump's control board

Switch/ Potentiometer	Functions	Factory setting
①	Potentiometer for setting to nominal motor current (in amperes, setting range 0 ... 10 A) P1 for pump 1	According to the Type of pump used
②	P2 for pump 2	
$t_{\uparrow}$	P8 for reset time after pump switches off (0 – 2 min)	2 min
$t_{\circlearrowleft}$	P9 for delay for low-water shut down (0 – 2 min)	30 sec
	Setting of set pressure values (see characteristic curve, fig. 6)	
$p_{max}2$	P5 for cut-out pressure of constant-load pump	1.0 bar
$p_{max}1$	P6 for cut-out pressure of peak-load pump	0.7 bar
p_{min}	P7 for cut-in pressure of all pumps	Nominal pump pressure less 0.5 bar
S1	Function reversal for low-water protection input: S1 open: unit running with closed contact at WM terminals unit stops with open contact at WM terminals S1 closed: function reversed	S1 open
S2	Test run: S 2 open: with test run S 2 closed: without test run	S2 open
S3	Setting to the number of pumps installed: Number of pumps: Gravity switch: S3 1 closed 2 open	S3 open
S5	Sensor input: S 5 open: unit stops with interrupted pressure sensor (without error reading) S 5 closed: unit running with interrupted pressure sensor (all pumps)	S5 open
F1-3 F4-6 F7	Motor fuses: 6.3 & x 32 mm, 16 A slow, 440 V for all pumps: phases: L1 (L) L2 (N) L3 P1 Fuses: F1 F2 F3 P2 F4 F5 F6 Control fuse: 5 & x 20 mm; 0.1 A; 440 V	

Table 2: Functions of the potentiometer and gravity switch on the booster pumps' control board

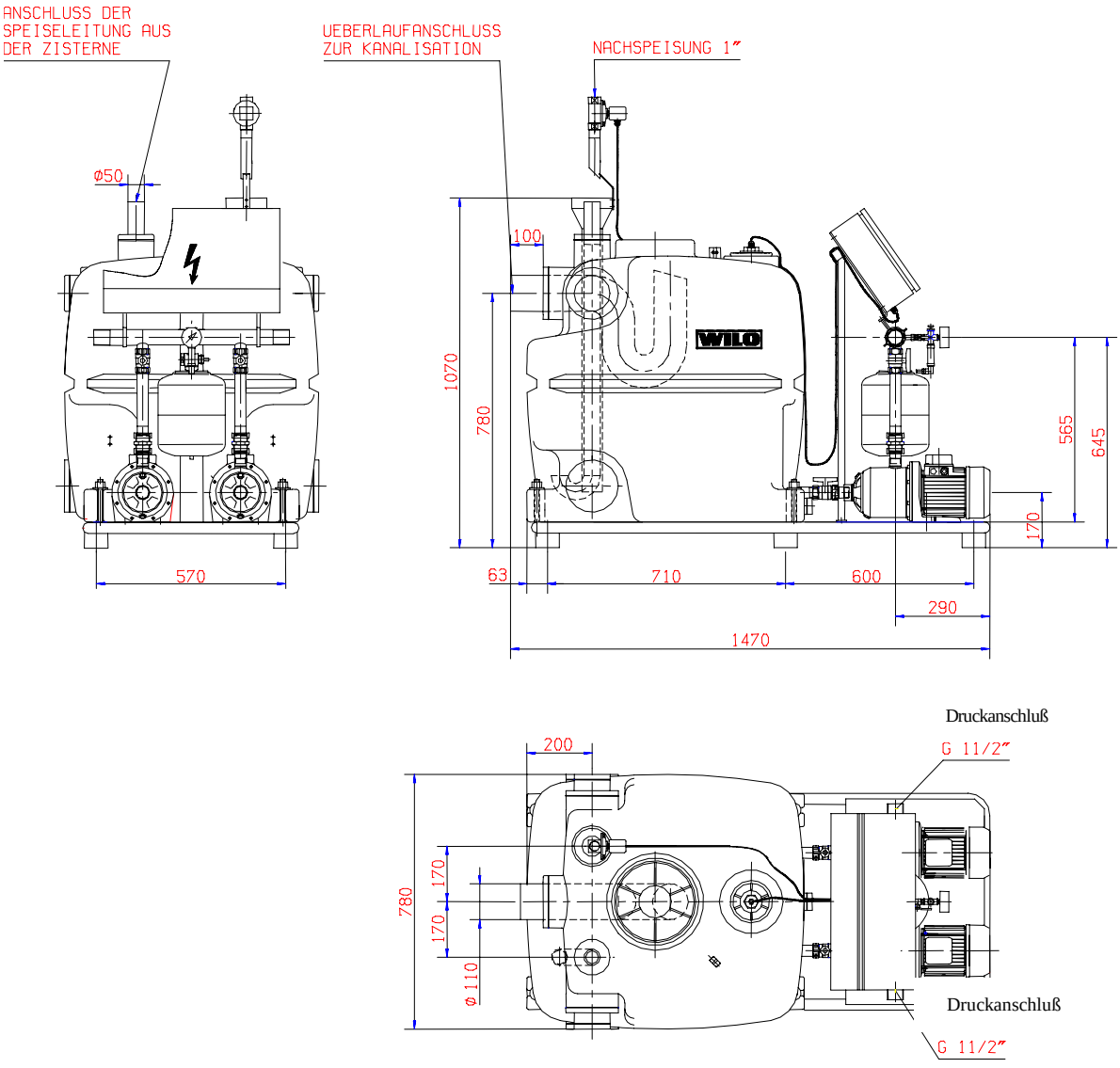

Fig. 1: Installation plan of AF 400

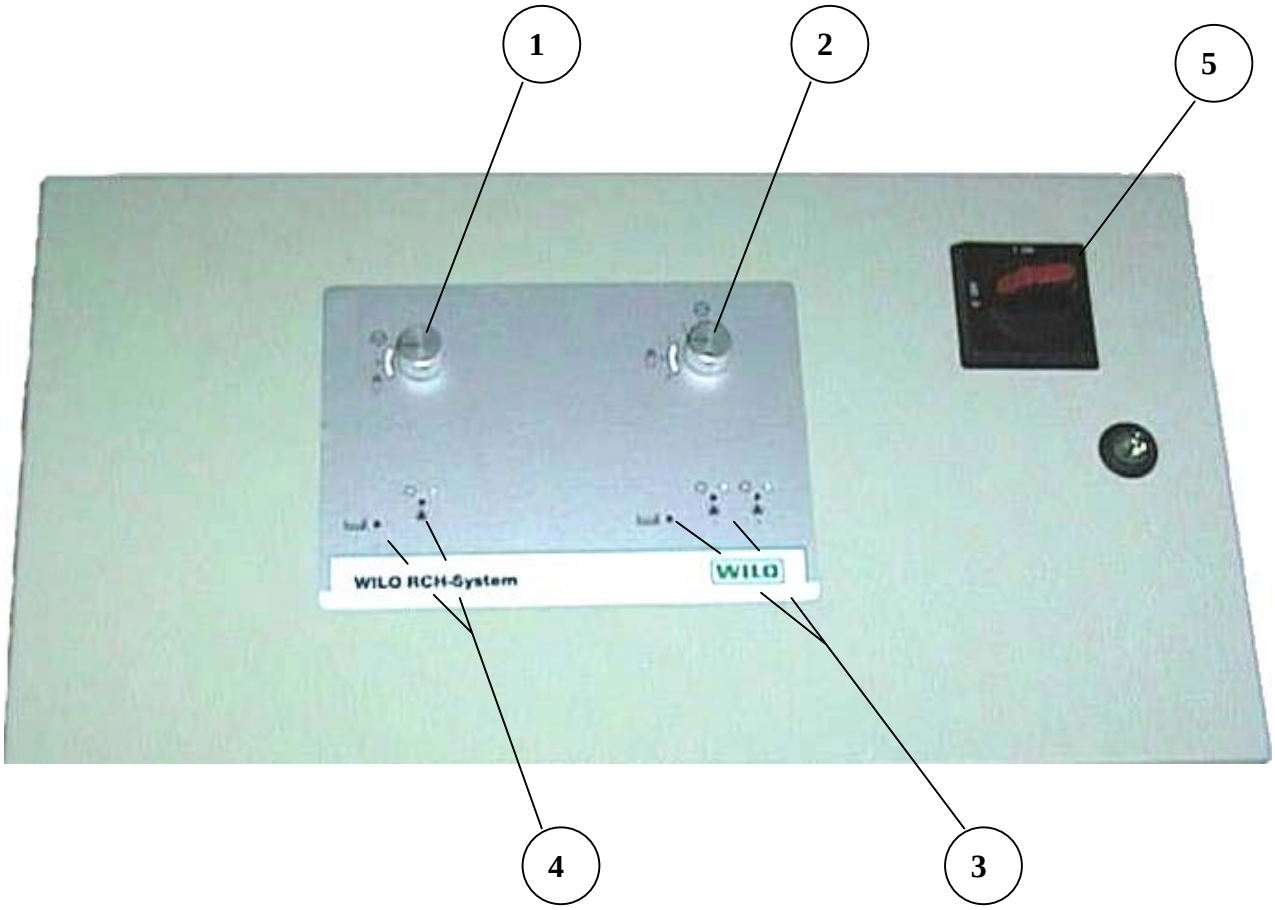

Fig. 2: View of switchgear

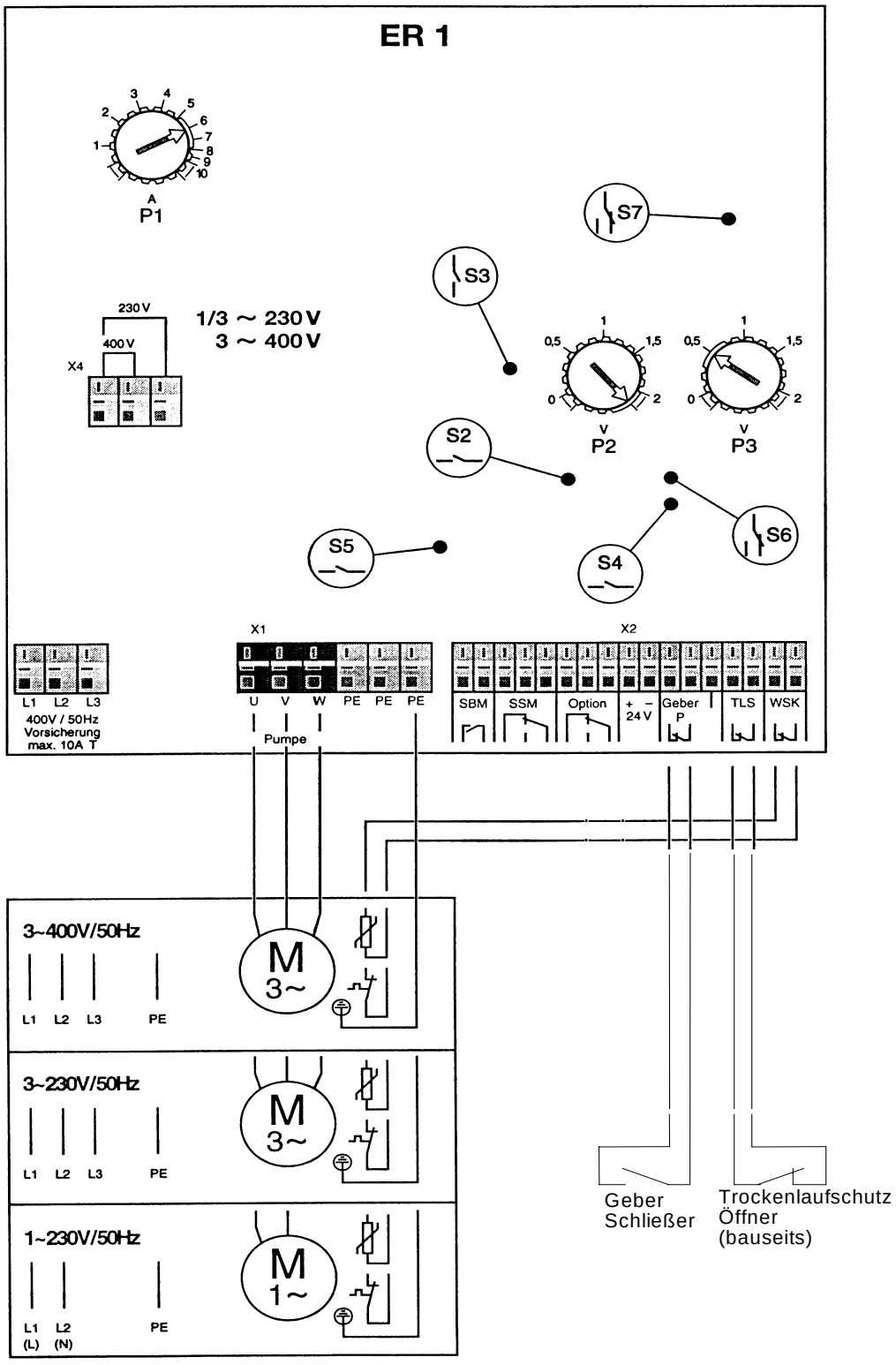

Fig. 3: Pin assignment on the board for controlling the well pump

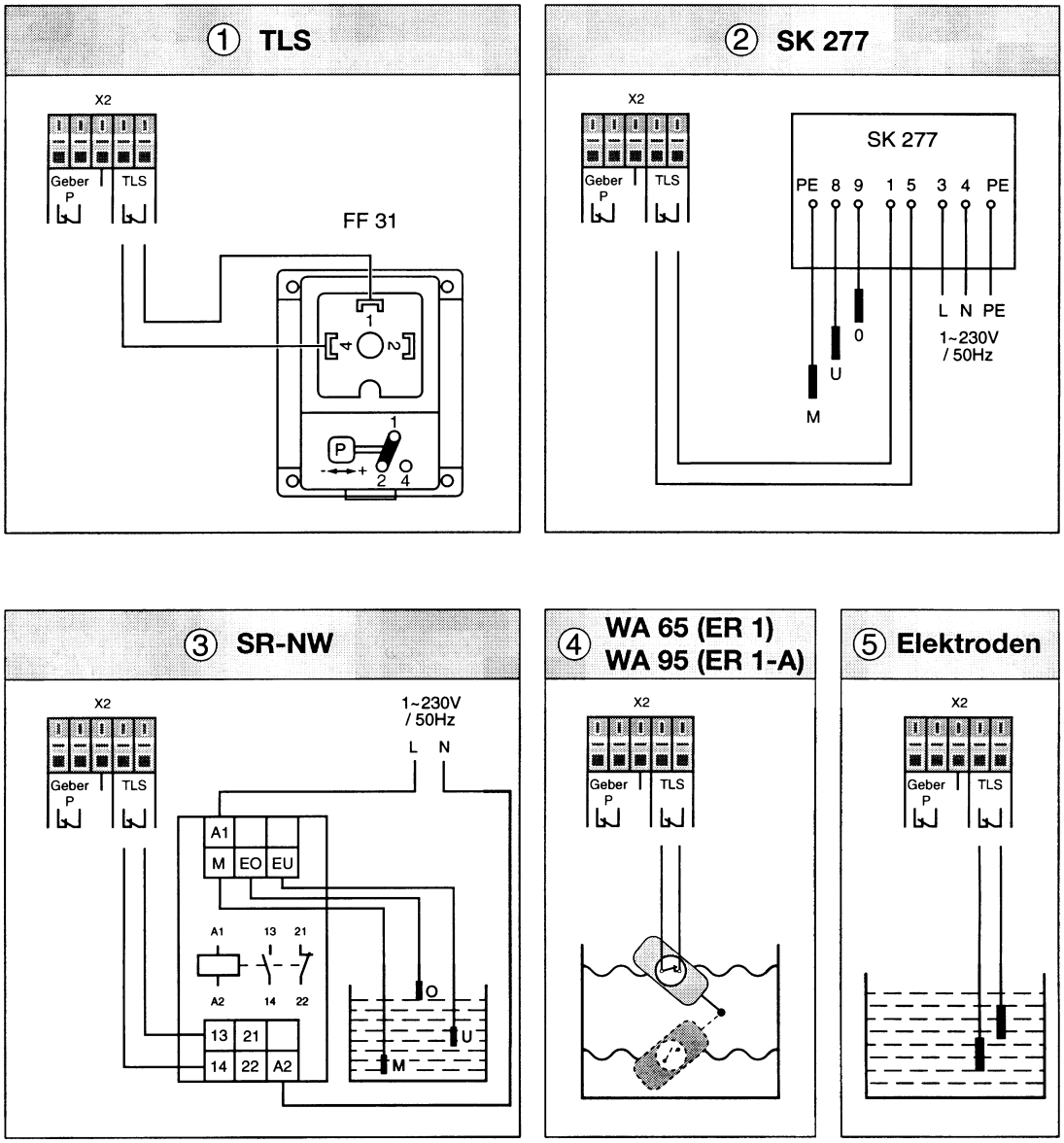

Fig. 4: Options for connecting dry-running protection to the board for controlling the well pump

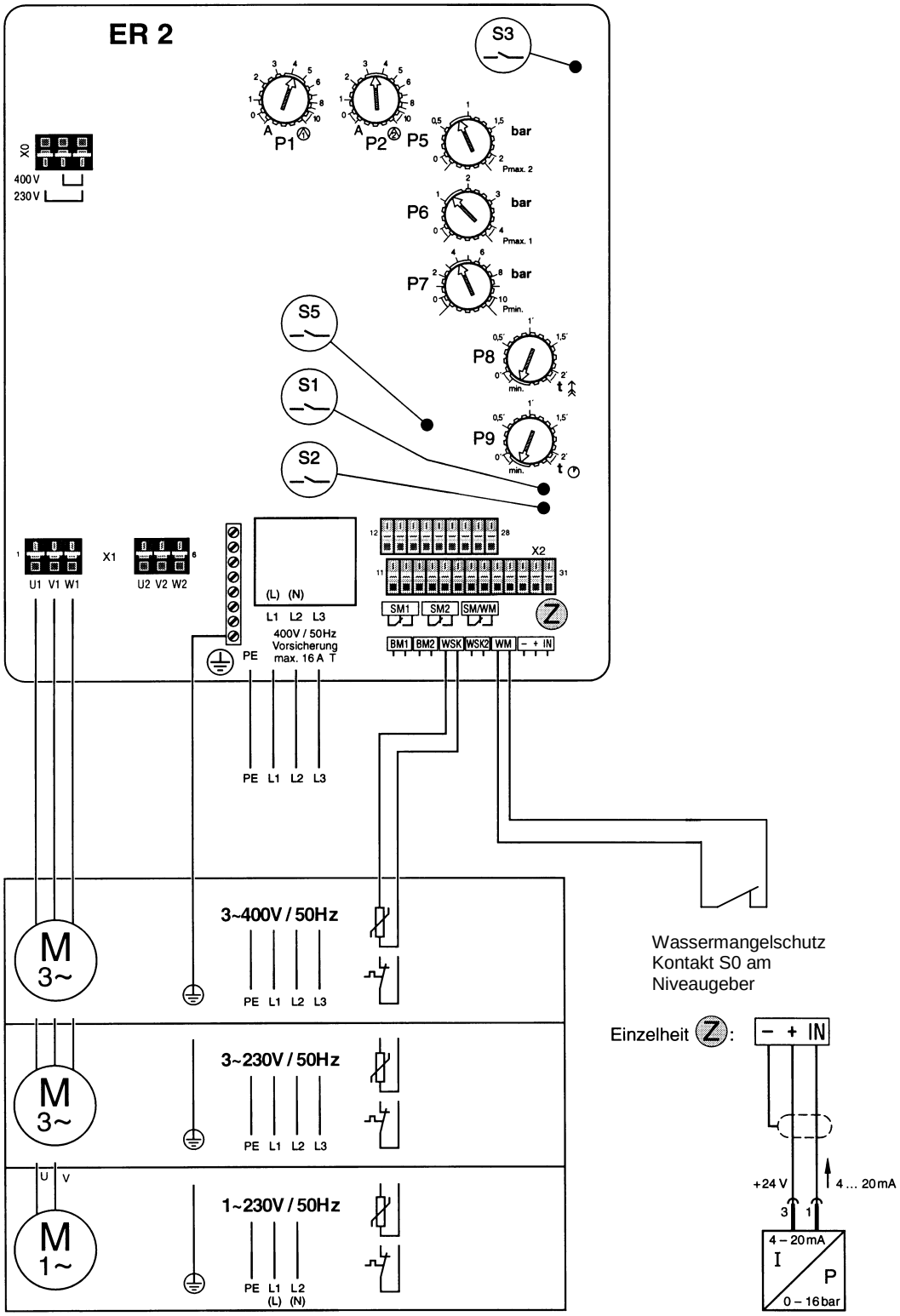

Fig. 5: Pin assignment on the board for controlling the booster pumps

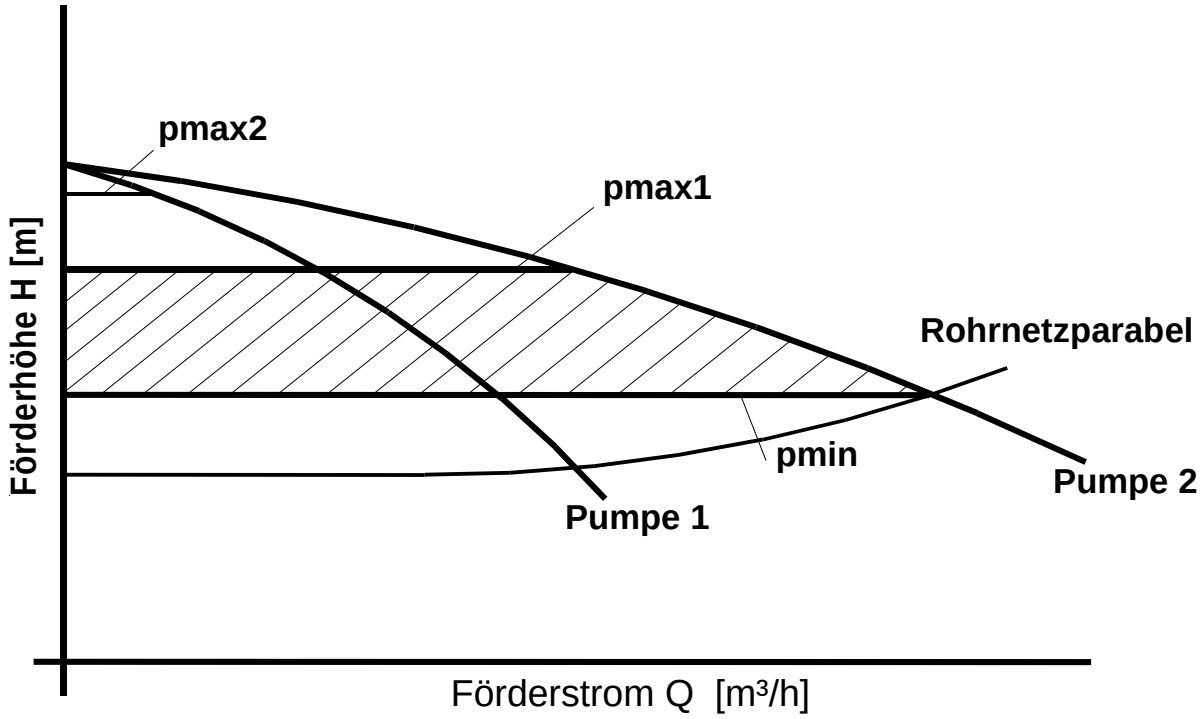

Fig. 6: Characteristic curve with booster pump switching points

NIVEAU	FUNKTION
S5	Alarm
S4	Zisternenpumpe AUS
S3	Nachspeisung AUS
S2	Zisternenpumpe EIN
S1	Nachspeisung EIN
S0	Trockenlaufschutz

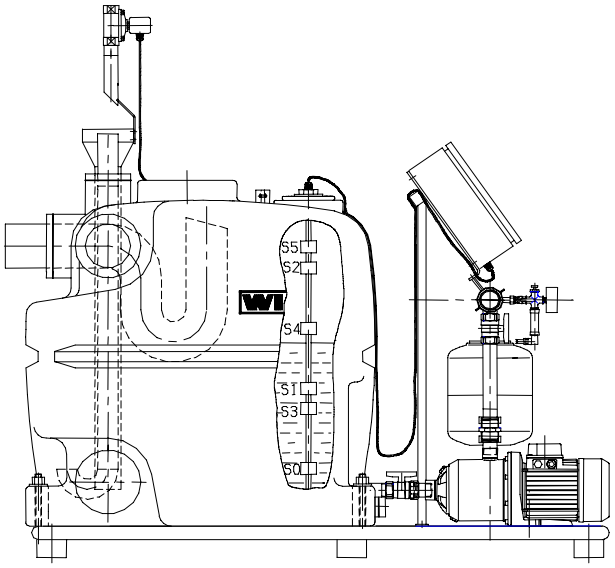

Fig. 7: Level control in the reservoir of the AF 400

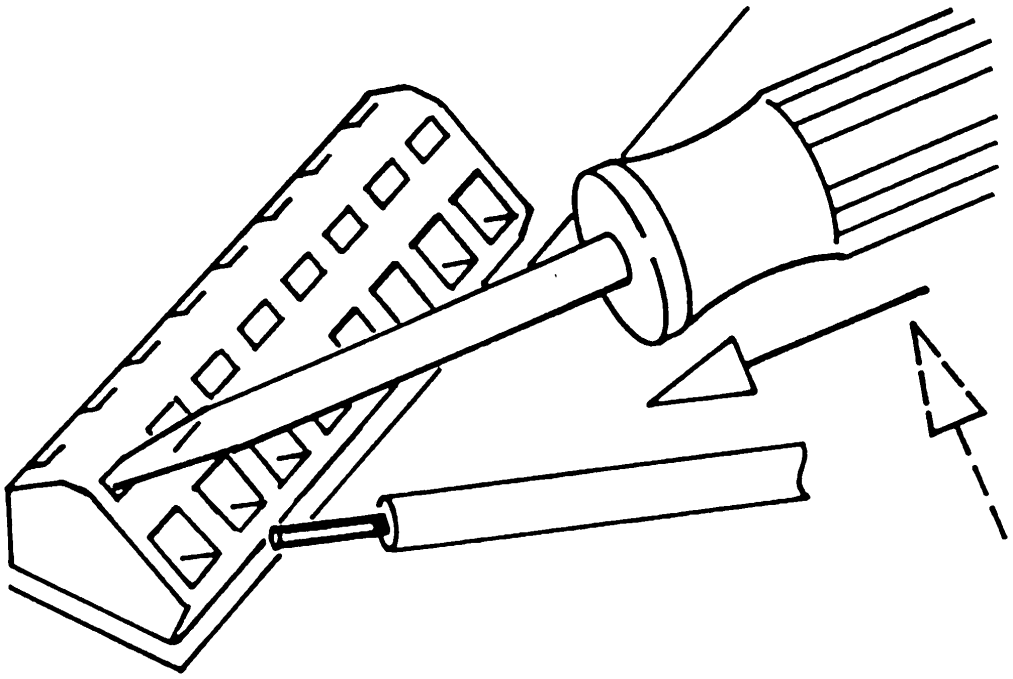

Fig. 8: Terminal confirmation