Wilo COR-MVI
Booster System

Installation and operating instructions

90-21-001-1211

Figure 1.1

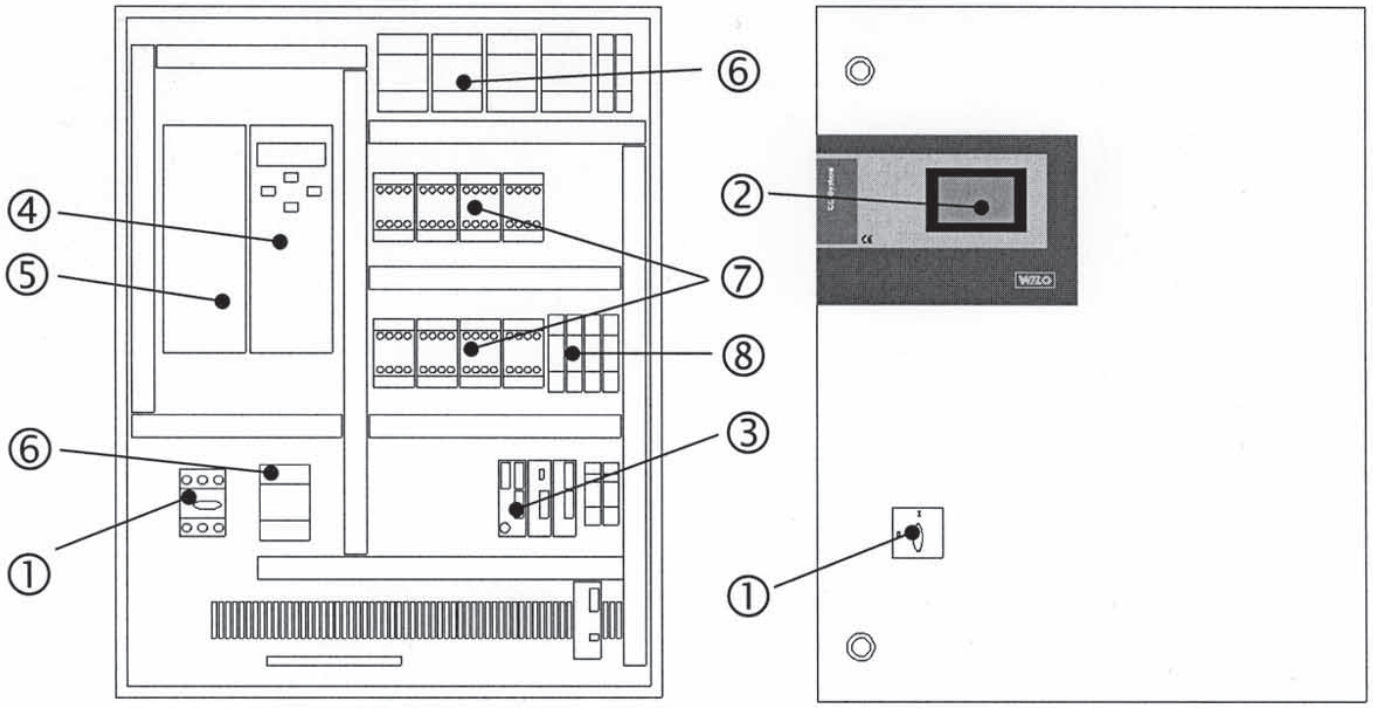


Figure 1.2

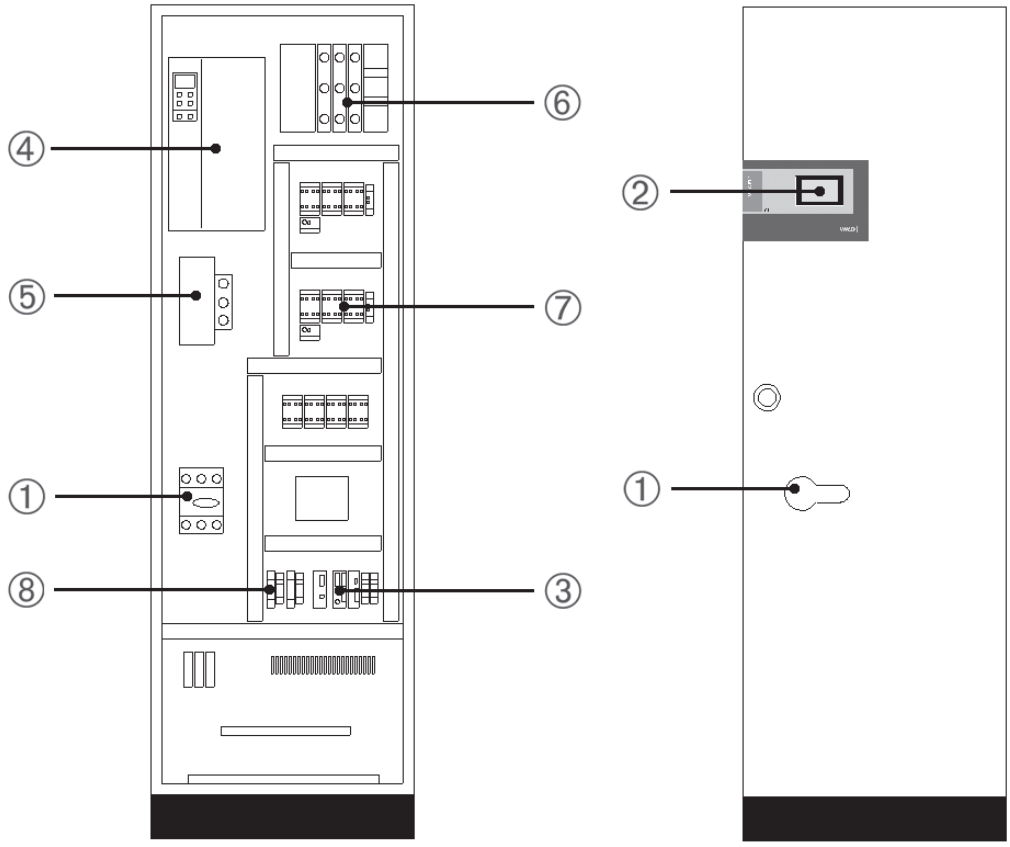


Figure 2

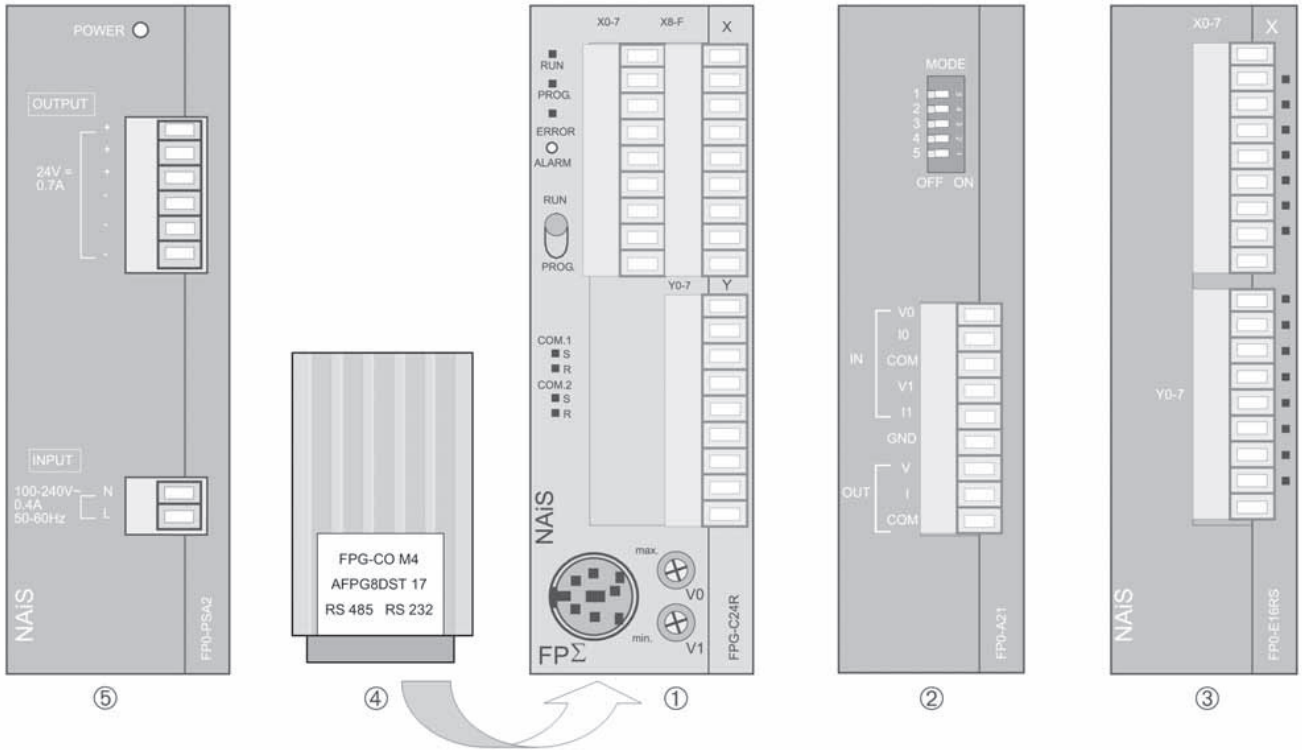


Figure 3

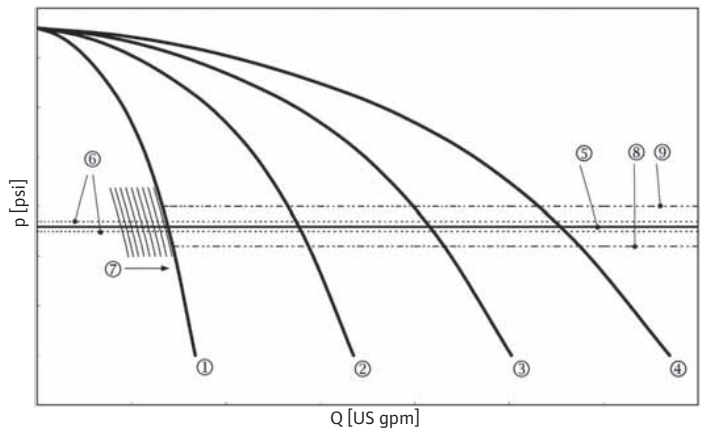
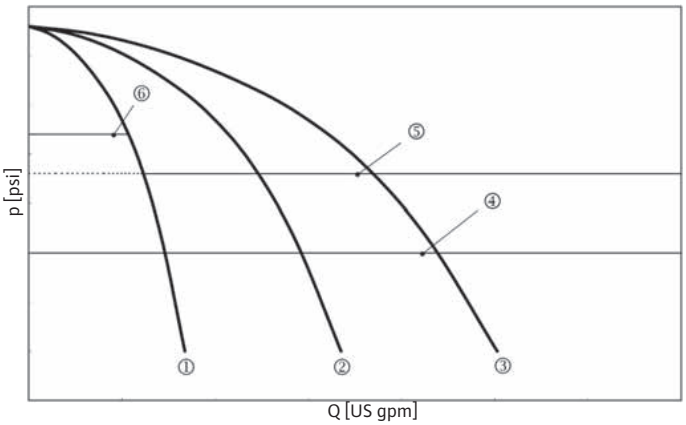


Figure 4



1 General

Installation and commissioning by trained personal only!

1.1 About this document

These Installation and Operating Instructions are an integral part of the product. They must be kept readily available at the place where the product is installed. Strict adherence to these instructions is a precondition for the proper use and correct operation of the product.
These Installation and Operating Instructions correspond to the relevant version of the product and the underlying safety standards valid at the time of going to print.

2 Safety

These instructions contain important information which must be followed when installing and operating.
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 Danger symbols used in these operating instructions

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

Warning of electrical danger

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!

2.2 Installer training

The personnel installing the booster system 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 booster system or installation. Failure to comply with the safety precautions could also invalidate any claims for damages.
In particular, lack of care may lead to problems such as:

- Failure of important pump or equipment functions,
- Personal injury due to electrical, mechanical and bacteriological causes,
- Damage to property.

2.4 Safety precautions for the operator

Existing regulations for the prevention of accidents must be followed.
National Electrical Codes, local codes and local regulations must be followed.

2.5 Safety information for inspection and assembly

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

2.6 Unauthorized 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 authorized 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 Unauthorized operating methods

The operating safety of the pump or installation supplied can only be guaranteed if it is used in accordance with section 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.

2.8 Piping Precautions

The sizing and installation of the suction piping is extremely important to the overall of the Booster System and the overall performance of the system.

Inlet side – external (system) pressurized
Maintain a minimum of 3 header (manifold) diameters of straight pipe of the same diameter as the header on the inlet of the system where ever possible. Avoid all turbulence causing fittings and rapid transitions immediately before the inlet header.

Inlet side – non-pressurized
In some situations pipe velocity may need to be further reduced to satisfy pump NPSH requirements and to control suction line losses. Pipe friction can be reduced by using pipes that are one to two sizes larger than the system inlet header size in order to maintain pipe velocities less than 5 feet [1.5m] /second.

Suction piping should be short in length, as direct as possible, and never smaller in diameter than the system inlet header size. If the suction pipe is short, the pipe diameter can be the same size as the header size. If longer suction pipe is required, pipes should be one or two sizes larger than the header size depending on piping length.

Discharge Side
Maintain a minimum of 8 header pipe diameters of straight pipe of the same diameter of the header on the outlet side of the system whenever possible. Where the building piping is smaller than the header piping, take care to insure a gradual reduction of one pipe size smaller than the header size. Consult factory if the system pips size is more than one pipe size smaller than the header size for piping recommendations

3 Transport and intermediate storage

ATTENTION! The control panel is to be protected against moisture and mechanical damage caused jolts/impacts. It should not be exposed to temperatures outside the range 14°F to 122°F [-10°C to 50°C].

4 Application

Water supply and pressure boosting in residential, commercial and public buildings, high rise buildings, hotels, hospitals, department stores, sports arenas, golf courses, irrigation and industrial systems.
For delivering potable water, process water, cooling water or other applications which do not chemically or mechanically attack the pump system components and do not contain abrasive or materials.

5 Description of product

5.1 Model designation

5.1.1 Designation of control panel

e.g.: CC 4 x 3,0 FC	
CC	Comfort-Controller
4 x	Number of pumps 1-6
3,0	Maximum motor power P_2 [HP]
FC	Including **F**requency **C**onverter

5.1.2 Designation of booster system

e.g.: COR-4 MVI 80-04/CC	
CO	Compact Booster System
R	Auto speed control of the base-load pump (fixed or rotating) via frequency converter
4	Number of pumps
MVI	Pump series
80	Rated flow (USGPM) of single pump
04	No. of stages of each pump
CC ... FC	Automatic control unit code CC = Comfort Controller (FC = with Frequency Converter)

5.2 Supply and rating data

Operating voltage [V]:	208/230/460/575 volt, 3 phase, 60 Hz
Nominal current [A]:	see nameplate
Protection class:	NEMA 12
Max. ambient temperature:	104°F [40°C]
Overload protection:	see wiring diagram

6 Product and accessory description

6.1 Description of control units

6.1.1 Functional description

The PLC-(Programmable Logic Control) controlled Comfort Controller system is used to control and regulate pressure booster systems with up to four pumps. At the same time the pressure of a system is regulated according to a load with appropriate sensors. The controller acts on the frequency converter, which influences the speed of a pump (base load pump). The delivery rate and therefore the output of the single pumps changes with the speed. Only the base load pump is speed controlled, according to the required load, peak load pumps are switched on and off automatically.

6.1.2 Construction of the control panel

The construction of the control panel varies with the power consumption of the pumps (Direct on line: fig. 1.1 or Star/Delta start fig. 1.2). It consists of the main components as follows:

- **Main switch:** Isolates the power supply and connects to power supply (Pos. 1)
- **Touch-Display:** Display of the operation data's (see menus) and operation mode by changing color of the background lighting. Abilities for choosing menus and setting parameters via touch screen (Pos. 2).
- **PLC (programmable logic controller):** The hardware configuration depends on the system (Pos. 3).

Component (see fig. 2)	No.	1-3 Pumps	4-5 Pumps
Central Unit (CPU)	1	√	√
Analog module 2E/1A	2	√	√
Digital module 4E/4A	3	-	√
Digital module 8E/8A	3	-	-
COM-Interface	4	√	√
Power supply 24V	5	√	√

- **Frequency converter:** Frequency converter for speed variation of base load pump according to load - only in COR-type boosters (Pos. 4)
- **Protection of drives and frequency converter:** Protection of pump motors and frequency converter. Panels with $P_2 \leq 5$ HP: motor protection switch (Pos. 6)
- **Contactors/-combinations:** Contactors for switching pumps. Panels with $P_2 \geq 7\ ½$ HP including thermal overload relays for over-current protection (Setting: 0,58 * IN) and time-relays for Star-/Delta switching (Pos. 7)
- **Hand-0-Automatic switch:** Selector switch for the selection of the pump operation modes "Hand" (Emergency-/Testrun on line; with motor protection), "0" (Pump switched off - no switching on enabled via PLC) and "Auto" (Pump released for automatic operation with the PLC) (Pos. 8)

6.1.3 System operating modes

Normal operation (see fig. 3)
An electronic pressure sensor (Adjustment of measure range in menu 3.3.2.4) provides the actual system pressure value as a 4 – 20 mA current signal. The controller then keeps the system pressure constant by comparing the desired (adjustment of setpoint 5: see menu 3.3.2.1) and actual values. If there is no "External Off" message and no fault, the speed controlled base load pump will start up if required. The speed of this pump depends on flow demand.
If the system flow demand cannot be met with the VFD controlled base load pump, a second (peak load) constant speed pump is automatically switched on.
Additional peak load pumps are turned on as required when the system flow increases. The peak load pump(s) operate at constant (max) speed while the base load pump provides finite pressure control in reference to the pressure setpoint (value 7). As the system flow demand decreases the peak load pumps shut off in sequence until the flow demand is met by the base load (VFD) pump. When zero flow is detected by the system, the base load pump shuts off. If the setpoint pressure drops while the system is off, the base load comes on when the system pressure drops below the setpoint pressure.
Relevant on/off pressure setpoints for the peak load pump(s) is adjustable (Switching levels 8/9; Time delays) in menu 3.3.3.2.
To avoid high and low pressure surges the speed of the base load pump is adjusted during switchover of the peak load pump(s). This "peak filter" adjustment can be performed in menu 3.3.5. – page 2.

Zero amount disconnection
If just one pump is operating, a check is made every 60 s to see whether the pressure is still decreasing. Initially, the set pressure value is increased slightly for a brief time of 5 s and then returned to its previous value. If the system's actual pressure remains at the higher level, a zero flow is determined. The pump is then switched off after a variable delay time (menu 3.3.3.1). If the pressure falls below the desired value, the system starts up again.

Pump alternation
Balanced cycle and/or run times can be programmed in menu 3.3.4.2.
For **time dependant pump alternation**, the control system will preselect the base load pump based on running hours and system diagnostics (fault/reset) (run time optimization). The adjustable time is the maximum run time difference.
The **cyclic pump change** leads to a pump change after a fix adjusted time regardless of the actual running hours of a single pump.
Changing pumps by **impulse** every restart changes the base load pump regardless of the actual running hours of a single pump.
With **Preselection Pump** a pump can be permanently designated as base load pump.
Independent from the changing mechanism of the base load pump, the peak load pumps are continuously changed run time optimized. This means that the pump with the lowest run time is started first and switched off as last one when requirement decreases.

Reserve pump
Parameterization of the installation via menu 3.3.4.1 allows one of the pumps to be designated as reserve pump. In reserve mode, one of the pumps does not participate in the standard operating cycle. This pump is only activated when another pumps fails to allow the demand to be met. The run time optimization ensures that each pump will once serve as reserve pump. The reserve pump is triggered by the pumpkick function, also.

Pumpkick (Test run)
To avoid stopping of pumps for long durations a cyclic test run is activated. In the menu 3.3.4.3 the time between two test-runs and the duration of a test-run can be adjusted. A test-run will only be executed during the stopping of the system (after zero flow shut off)

Changeover upon fault in multi-pump system
If the base load pump generates an error, it will be switched off immediately and a peak load pump is connected to the converter. If the frequency converter fails, the system is switched into the operation mode "automatic without frequency converter."

Lack of water
Triggered from a NC contact of a suction pressure switch, reserve tank float switch or an optional relay the pumps can be switched off with an adjustable time delay (menu 3.3.2.1). If the contact closes again during the delay time, no action takes place. Otherwise the automatic re-start of the system after a shut down caused by a lack of water signal follows 10 s after closing the signal contact.

Supervision of minimum and maximum
In menu 3.3.2.3 the limits for a safe and proper system operation and are adjustable. System pressures exceeding the maximum pressure setpoint will result in the immediate shutdown of all pumps. When the system pressure deceases to the normal system cut-in pressure, normal system operation occurs. If there are three maximum pressure shutdowns in a 24 hour period, the collective fault signal "SSM" will be activated.
If the minimum inlet pressure drops below the set limit the collective fault signal "SSM" will be immediately activated (the pumps will not be switched off). The pressure sensitivity and time delay is adjustable during setup and programming, reducing overload condition occurrence during short pressure fluctuations at or close to the limit values.

External off
The control system can be deactivated by an external NC contact. This function has priority! In this mode the pump kick is activated.

Emergency run
In the case that the controller itself fails, every pump can be switched via the Hand-0-Automatic switch (fig. 1.1/1.2; Pos. 8). This function has priority over the automatic pump switching by the controller.

6.1.4 Motor Protection

Over-current protection

Motors connected to controllers up to 5 HP are protected by motor protection with thermal and electromagnetic tripping. The trip current must be adjusted directly on the overloads.

Motors connected to controllers from 7 ½ HP and above are protected by thermal overload relays. These relays are directly mounted on the motor contractors. The trip current must be adjusted directly on these relays and is in star/delta start 0,58 * I_N.

All motor protection functions protect the motor in operation with the frequency converter and constant power. Pump failures leads directly to the switching off command for the pump and generates a collective fault signal. After a correction of the fault signal an acknowledgement is requested before restarting the pump.

All motor protection functions are active in the emergency mode.

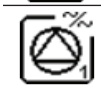
6.2 Operation of control system

6.2.1 Operating panel functions

- Main switch On/Off
- The Touch display (graphic operation, 128x64 Pixel) displays the operation modes of pumps, controller and frequency converter. Furthermore, all parameters are adjusted directly on the display. The panel's backlight changes color according to the operating state: GREEN – System o.k.; RED – Fault; ORANGE – Fault acknowledged but not rectified.

The operating panel functions are displayed referring to symbols on the touch panel:

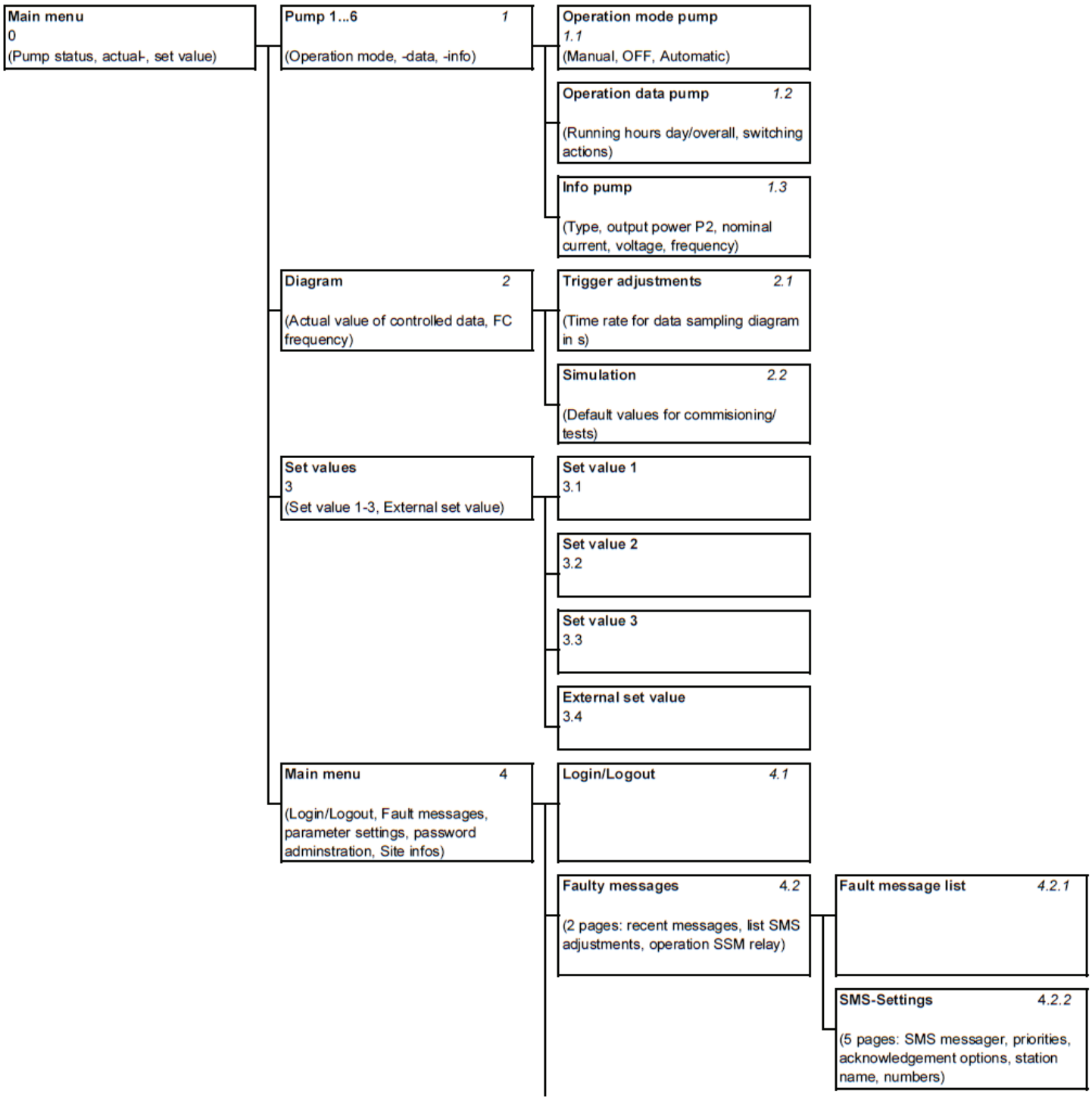
Symbol	Function/Application
	Scrolling within one menu level
	Jump back to previous menu level
	Jump back to main screen
	Main menu call up
	Operating handling: Call of the login window Displayed status: Operator is logged out
	Operating handling: Logging of Displayed status: Operator is logged in
	Call of parameter
	Call of information
	Call of operating menu
	Automatic mode e.g. of a pump
	Manual mode e.g. of a pump

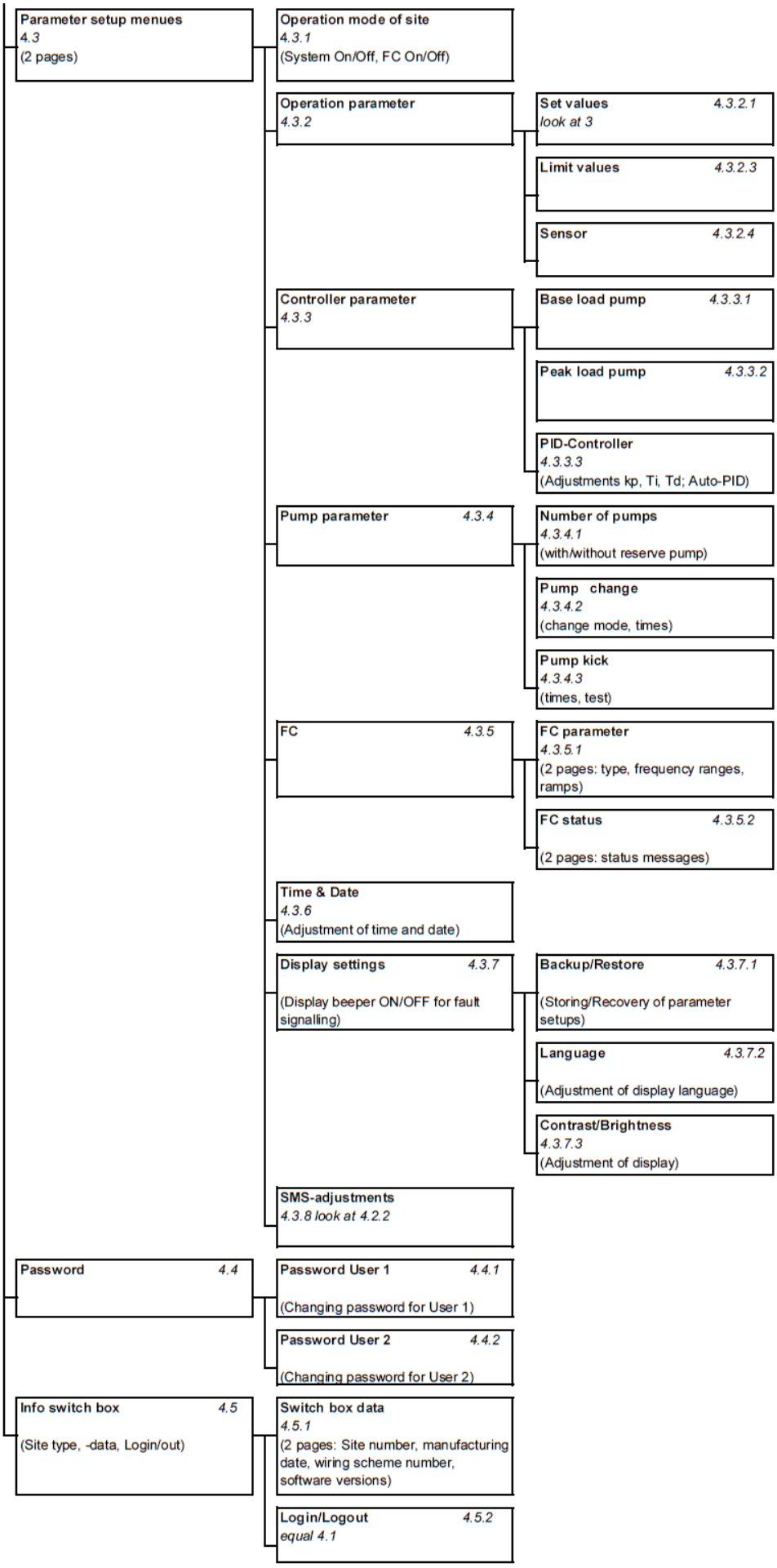
Symbol	Function/Application
	Switch a function on
	Switch a function off
	Browsing down e.g. error message history list
	Browsing up e.g. error message history list
	System deactivated by "External Off"
	Installation is in external manual control mode
	Installation is in disrupted operation (FC fault; pumps running in cascade activation)
	Installation is in disrupted operation (sensor fault; actual value absent)
	The pump is selected for mains operation and is not running
	The pump is selected for mains operation and is running
	The pump is selected for FC operation and is not running
	The pump is selected for FC operation and is running
	The pump is selected for manual mode and is not running
	The pump is selected for manual mode and is running
	Switch on time e.g. set point 2
	Switch off time e.g. set point 2
	Dry running protection delay time
	Normally closed (NC) signal
	Normally opened (NO) signal

6.2.2 Menu structure

The system's menu is structured as follows:

Menu structure CC System




Parameter setup menues
4.3
(2 pages)
Operation mode of site
4.3.1
(System On/Off, FC On/Off)
Operation parameter
4.3.2
Set values 4.3.2.1
look at 3
Limit values 4.3.2.3
Sensor 4.3.2.4
Controller parameter
4.3.3
Base load pump 4.3.3.1
Peak load pump 4.3.3.2
PID-Controller
4.3.3.3
(Adjustments kp, Ti, Td; Auto-PID)
Pump parameter 4.3.4
Number of pumps
4.3.4.1
(with/without reserve pump)
Pump change
4.3.4.2
(change mode, times)
Pump kick
4.3.4.3
(times, test)
FC 4.3.5
FC parameter
4.3.5.1
(2 pages: type, frequency ranges, ramps)
FC status 4.3.5.2
(2 pages: status messages)
Time & Date
4.3.6
(Adjustment of time and date)
Display settings 4.3.7
(Display beeper ON/OFF for fault signalling)
Backup/Restore 4.3.7.1
(Storing/Recovery of parameter setups)
Language 4.3.7.2
(Adjustment of display language)
Contrast/Brightness
4.3.7.3
(Adjustment of display)
SMS-adjustments
4.3.8 look at 4.2.2
Password 4.4
Password User 1 4.4.1
(Changing password for User 1)
Password User 2 4.4.2
(Changing password for User 2)
Info switch box 4.5
(Site type, -data, Login/out)
Switch box data
4.5.1
(2 pages: Site number, manufacturing date, wiring scheme number, software versions)
Login/Logout 4.5.2
equal 4.1

The operation and adjustment is protected by a 3 step safety system. After entering the password (Menu 3.1 and 3.5.2) the system is released for the user on the specific level (Displayed by the indicators shown beneath the level names). Pushing of the Login-Button allows the programming of the system based on the user level.

User 1:
On this level (typical: local user, e.g. janitor) the display of all menus is enabled. Inputs of parameters are only in limited scale enabled.
The password (4 digits; numerical) for this level can be defined in menu 3.4.1 (factory setting: **1111**).

User 2:
On this level (typical: operator) the display of all menus, except of the simulation mode, is enabled. Inputs of parameters are nearly unlimited.
The password (4 digits; numerical) for this level can be defined in menu 3.4.2 (factory setting : **2222**).

The user level **Service** is reserved for the Wilo-service only.

6.3 Scope of supply

- Controller WILO CC
- Wiring diagram
- Installation and operation manual

6.4 Options

The CC-System can optionally be equipped with the units as shown in the table. Please take notice that this modules must be ordered separately.

Option	Description
Uninterruptable Power Supply	PLC – Power supply remains in case of mains fault
PTC-relays	Over temperature protection of pumps with PTC-Resistors
Remote setpoint adjusting or actuator operation	Setpoint can be adjusted via external analog signal or panel works in actuator operation via external analog signal
Single run and fault signals	Potential free contacts for signalling of the pump states
Lack of water signal	Potential free contact for signalling dry run
Setpoint switching	Switching between setpoints 1 and 2 by external signal
Bus-connection	Modules for the connection to a variety of bus systems (e.g. CANBus, Profibus, Modbus RTU, Ethernet, LON)
Communication module	Modules for remote diagnosis/-maintenance (Analogmodem, ISDNTerminal, GSM-Modem, Web-Server)

7 Installation /Fitting

7.1 Electrical connections

Electrical connection must be carried out by an electrical installer authorized by the local power supply company in accordance with the applicable local regulations.

Power supply lines:
Installation and operation manuals of the complete booster system must be observed!

Pump power supply lines:

ATTENTION! **Installation and operation manuals of pumps must be observed!**

The pumps are connected to the terminal blocks in accordance with the wiring diagram.

Pressure sensor:
Properly connect the sensor to the terminals in accordance with the installation and operating instructions.
Use a shielded cable, connect one side of the shield in the control panel.

ATTENTION! **Do not apply external voltages to the terminals!**

External on/off:
Via the terminals a remote switch off/on device can be connected via a potential-free contact, after removing the jumper (factory mounted).
The system can then be switched on or off.

External On-/Off	
Contact closed	Automatic ON
Contact opened	Automatic OFF, Signaling via symbol in the display
Contact load	24 V DC / 10 mA

ATTENTION! **Do not apply external voltages to the terminals!**

Dry run protection:
A low-water protection function can be connected via the terminals designated in the wiring diagram once the jumper has been removed (pre-installed in the factory) using the floating contact (closed contact). It is therefore possible to switch the system on and off.

Dry run protection	
Contact closed	No water shortage
Contact opened	Water shortage (dry run)
Contact load	24 V DC / 10 mA

ATTENTION! **Do not apply external voltages to the terminals!**

Collective run/ failure signalling "SBM / SSM":
The terminals for collective failure signal and collective run signal (see wiring scheme) provide potential-free changeover contacts for external signals. Potential-free contacts, max. contact load 250 V ~ / 2 A

Optional signaling of single run, single failure of pumps and dry run:
The terminals for single failure signal, single run signal and dry run signal (see wiring scheme) provide potential-free changeover contacts for external signals. Potential-free contacts, max. contact load 250 V ~ / 2 A

Actual pressure display:
A 0...10 V voltage signal is available via the designated terminals (see wiring scheme), making it possible to measure/display the current actual pressure. Here 0 ... 10 V correspond to the pressure sensor signal 0 ... pressure sensor final value. For example:

Sensor	Display range	Voltage/Pressure
16 bar	0 ... 16 bar	1 V = 1,6 bar

ATTENTION! **Do not apply external voltages to the terminals!**

Actual frequency display:
Panels including a frequency converter provides, via the designated terminals, (see wiring scheme) a 0...10 V – signal for external measurement / displaying of the actual output frequency. 0...10 V correspond a frequency range of 0...60 Hz.

ATTENTION! **Do not apply external voltages to the terminals!**

8 Commissioning

Wilo recommends having the unit put into operation by a Wilo Service Representative. The customer's wiring is to be checked to make sure it is correct before switching the unit on for the first time.
The pumps and pipework must be fully cleaned and flushed, filled and if necessary bled before being put into operation for the first time.
All steps for Installation, commissioning and operation are described in the booster-system's (IOM) manual.

8.1 Factory setting

The controller is factory programmed. This factory presetting can be restored again by a Wilo Service Representative.

8.2 Confirming correct motor rotation

Check whether the direction of rotation of the pump corresponds with the arrow on the pump housing by briefly switching on each pump in the "Manual" operating mode (menu 1.1). In the case of the wet-rotor pumps the incorrect or correct direction of rotation is indicated by a control light on the terminal box (see Fitting and Operating Instructions for pump).

- If **all** pumps show the incorrect direction of rotation in mains operation reverse 2 random phases of the main power supply.
- Frequency converter operation: Set each pump individually in the operation mode >>Automatic with Frequency Converter<< in menu 1.1 to "Automatic". The direction of rotation in frequency converter operation is then to be checked by briefly switching each pump on. If **all** pumps show an incorrect direction of rotation 2 random phases at the frequency converter output are to be reversed.

8.3 Adjustment of motor-protection

- **WSK(wiring protection contact) / PTC:** No adjustment requested.
- **Over-current:** see section 6.1.4

8.4 Sensors and optional modules

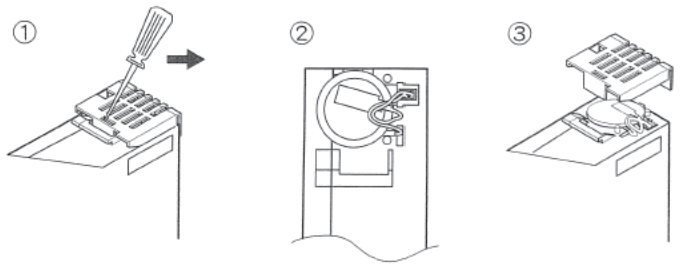
For any sensor installation please note the sensor's installation and operation manuals
Optional modules are factory installed.

9 Maintenance

Prior to maintenance or repair work switch off the unit and secure against unauthorized switching.

The control cabinet must be kept clean. Control cabinet and fan are to be cleaned if dirty. The filter mats of the fans must be inspected, cleaned or replaced if dirty or clogged.

The real-time clock backup battery is supervised by the system and, if necessary, signaled. Replacing it every 12 months is recommended. Replace the battery in the CPU as shown below.



10 Faults, causes and remedies

10.1 Fault displaying and acknowledgement

If any fault occurs, the background light of the display changes it's color to red, the collective failure signal is activated and in the menu 3.2 the fault is displayed with code-number and alarm-text. Systems with optional remote diagnosis send a message to the designated receiver(s).
The acknowledgement can be done in menu 3.2 with the softkey "RESET" or remote.
If the fault causal was corrected, the backlight of the display changes into green. If the fault causal was not rectified, the backlight of the display changes into orange.
A faulty pump is displayed on the screen with a flashing pump symbol.

10.2 Error memory for faults

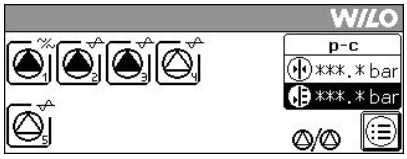
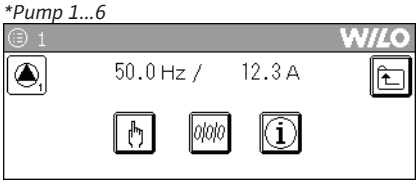
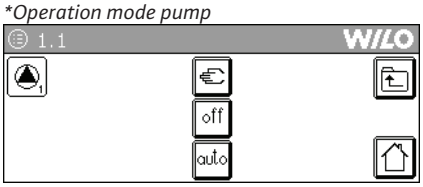
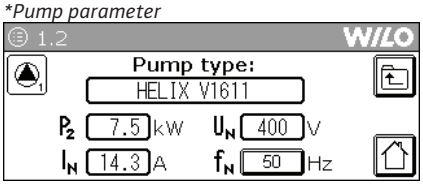
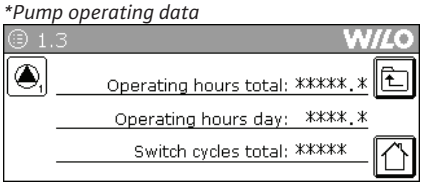
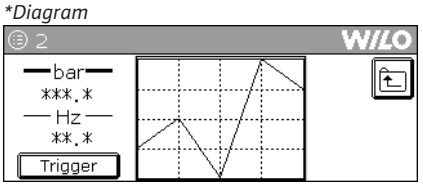
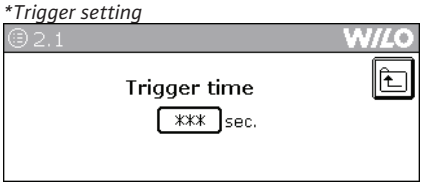
The panel provides a fault memory working with the FIFO-principle (First In First OUT). Each fault is stored with a time-stamp (Date / Time). In maximum, 35 faults can be stored.
The alarm list can be reviewed in menu 3.2 via the softkey »List«. With the softkeys »+« and »-« browsing is enabled.
Table 1 shows a list of all fault signals.

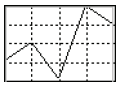
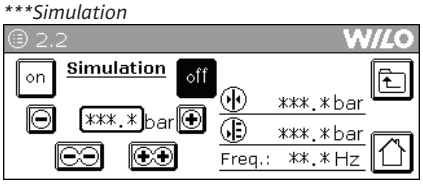
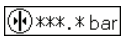
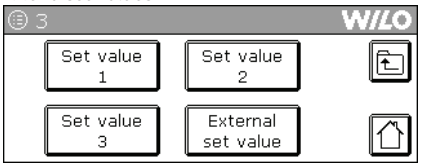
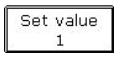
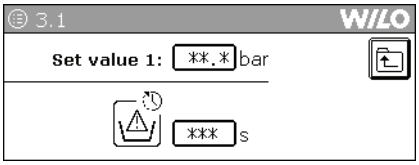
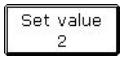
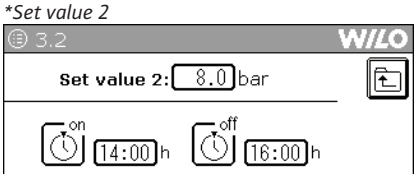
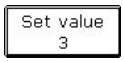
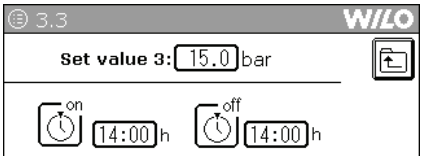
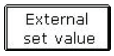
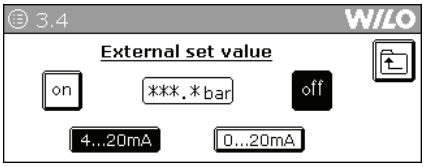
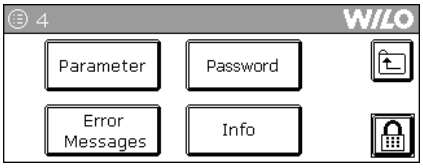
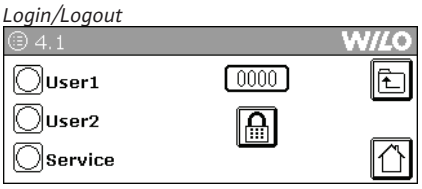
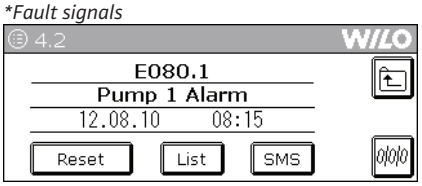
Table 1, Fault signals

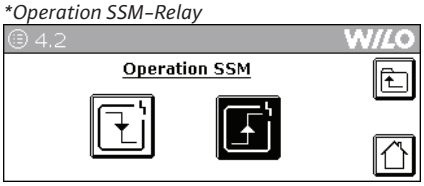
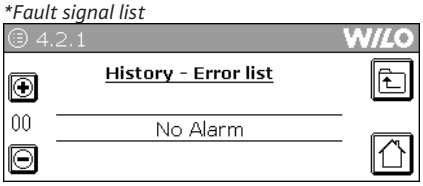
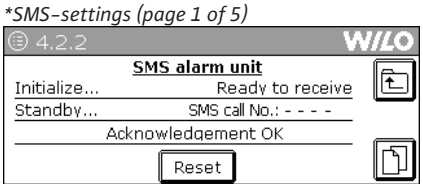
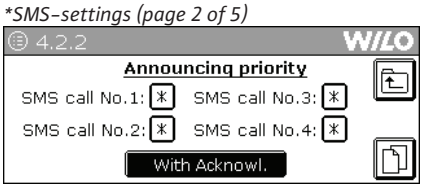
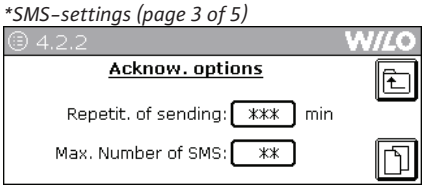
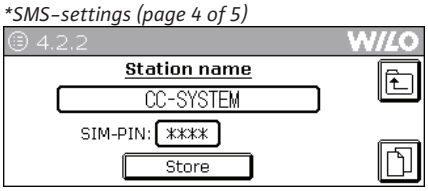
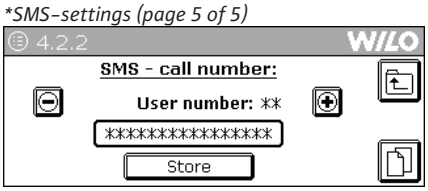
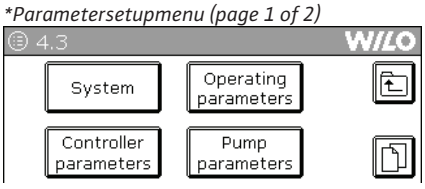
Code	Alarm-text	Causes	Remedies
E082	Frequency Converter Error	Frequency converter signals failure	Check failure display in menu 3.3.6 or on the Frequency Converter-display, rectification according to installation and operation manual of Frequency Converter
		Electrical connection defective	Check and, if required, maintain electrical connections of Frequency Converter
		Motor protection of Frequency Converter tripped (e.g. short circuit of Frequency Converter-mains; Overload of pump)	Check and, if required, maintain electrical supply line of Frequency Converter (see installation and operation manual of pump)
E040	Sensor fault	Pressure sensor defective	Replace sensor
		No electrical connection to sensor	Maintain electrical connections
E062	Pre-pressure min	Dry run protection tripped	Check inlet and storage tank; System restarts automatically
E061	Output pressure min	The output pressure of the system has fallen below the value set in menu 3.3.2.3 (e.g. because of burst pipe)	Check if adjustments meet requirements of local installation
			Check and, if required, repair pipework
E060	Output pressure max	Output pressure of system exceeds value adjusted (e.g. caused by controller failure) in menu 3.3.2.3	Check controller function
			Check installation
E080.1	Pump1 Alarm	Winding over-temperature (WPC/PTC)	Clean cooling fins; Motors are designed for ambient temperatures up to 104°F [+40°C] (see installation and Alarm operation manual of pump)
E080.2	Pump2 Alarm		
E080.3	Pump3 Alarm		
E080.4	Pump4 Alarm	Motor-protection tripped (Over-current or short circuit in supply line)	Checking pump (see installation and operation manual of pump) and supply line connection
E080.5	Pump5 Alarm		
E080.6	Pump6 Alarm		
E100	Battery discharged	The battery is discharged down to minimum level, the further buffering of real time clock is no longer assured	Replace battery (see section 7)

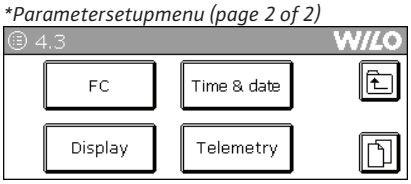
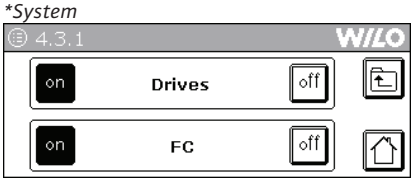
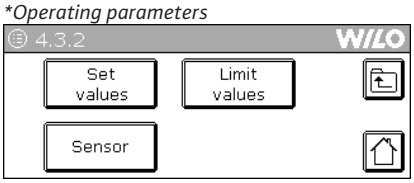
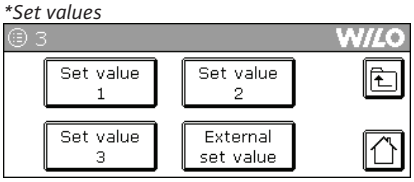
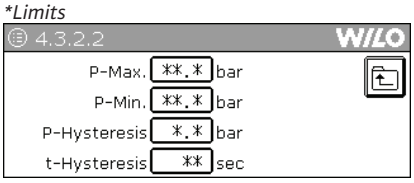
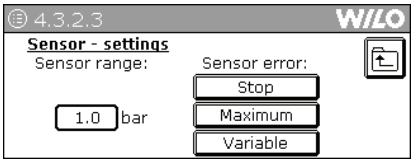
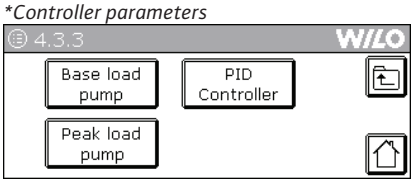
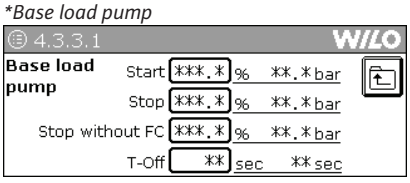
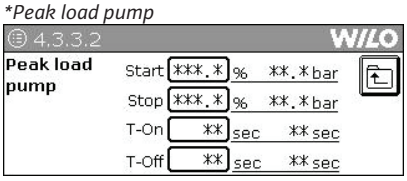
If the problem cannot be corrected, contact your sanitation and heating dealer or Wilo Customer Service Representative.

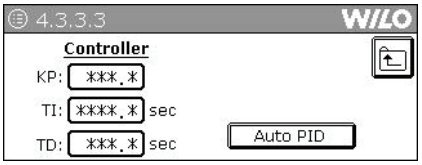
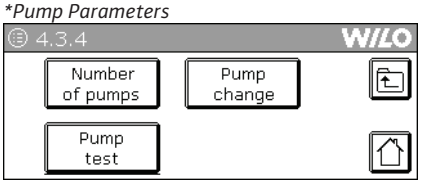
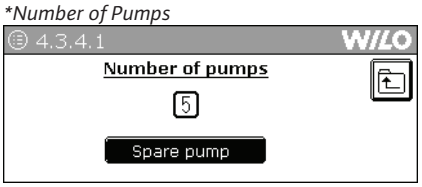
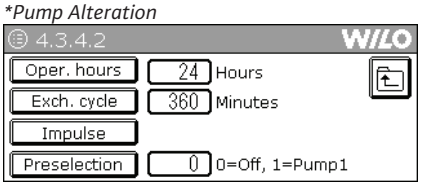
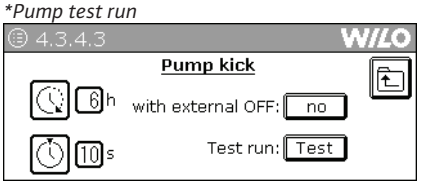
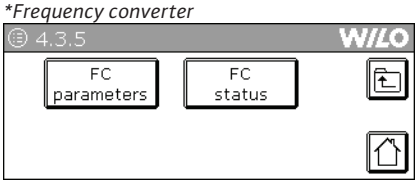
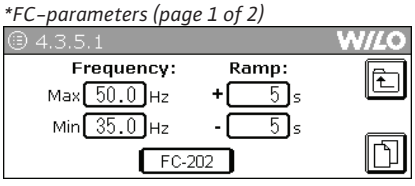
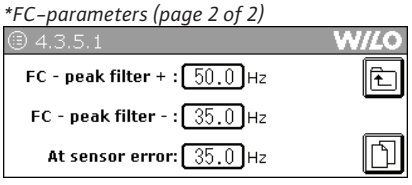
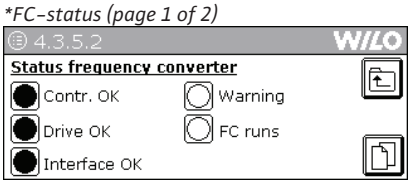
Table 2, Menu Description

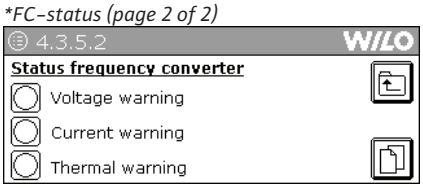
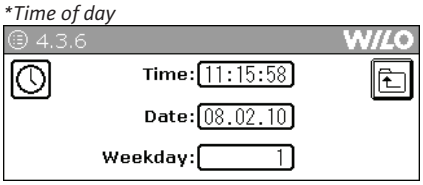
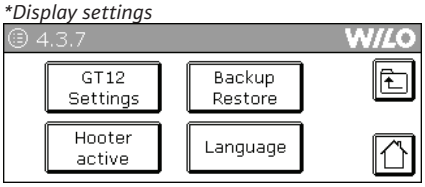
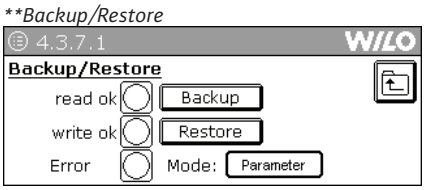
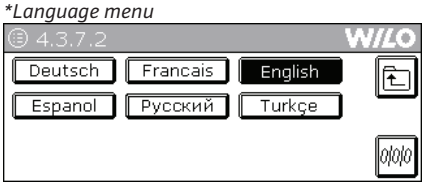
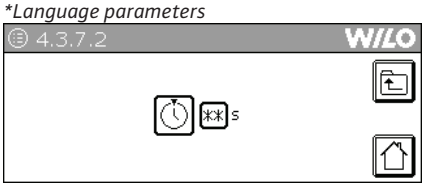
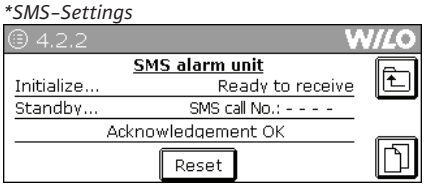
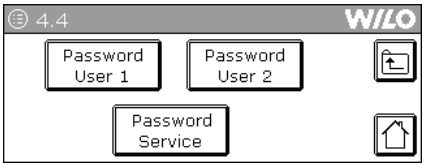
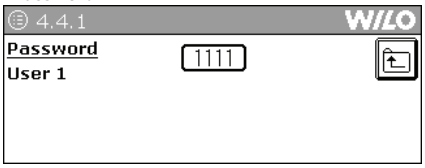
Menu-No. / Call-up by:	Display Visible to: *User 1 and above **User 2 and above ***Service	Description	Setting parameters / function Adjustable by *User 1 and above **User 2 and above ***Service	Factory setting
0	*Main Menu* 	Display of the operating states of the pumps, the control mode, nominal and actual value of the controlled variable and of the standby pump (if selected). Call-up of the pump settings, the set value adjustment, the diagram display and the main menu.	None	–
1 	**Pump 1...6* 	Call-up of the operating mode setting, the parameters and the operating data information for the pumps 1...6 (quantity: installation-specific). The actual current and the actual frequency are displayed for the pump running on the frequency converter.	None	–
1.1 	**Operation mode pump* 	Pump operating mode setting: Manual mode (on the mains), Off (no pump start via control) or automatic mode (on the mains or FC controller-dependent).	**Operating mode	auto
1.2 	**Pump parameter* 	Display of the pump information concerning type, shaft power P_2, nominal current I_N, nominal voltage UN and adjustment of motor frequency f_N (50/60Hz). Pump information input at the time of commissioning, data are applied from pump 1 to pump 2...6.	**Pump type **Shaft power P_2 [kW] **Nominal current I_N [A] **Motor frequency f_N [Hz]	Installation specific Installation specific Installation specific 60
1.3 	**Pump operating data* 	3 Display of total operating hours (since commissioning) and of operating hours on the current day and of the switching cycles (number of activations).	None	–
2 ***.* bar	**Diagram* 	Measured value diagram for time-staggered presentation of actual pressure and frequency of FC. Call-up of trigger setting and Simulation mode.	None	–
2.1 Trigger	**Trigger setting* 	Setting of the time basis (triggering time) of the measured value diagram.	*Trigger time [s]	0

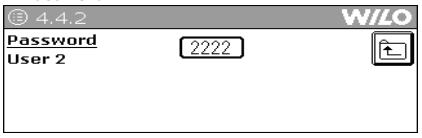
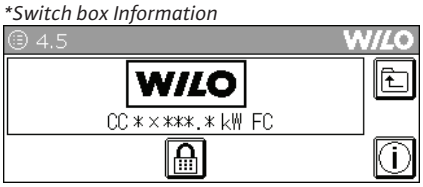
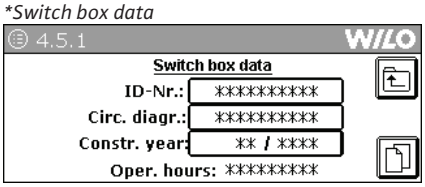
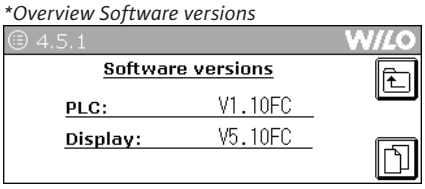
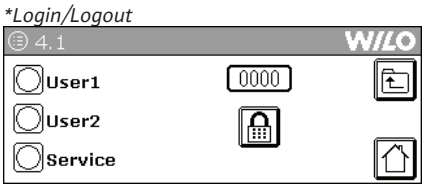
2.2 	****Simulation* 	On/Off switching of the simulation mode (testing operation of the switch-gear without signal transmitter). Using keys to modify the simulated pressure value:	***Simulation on/off ***Simulation value	Off 11.0
3 	**Menu set values* 	Call-up of the set values 1-3 and of the external set value	none	–
3.1 	*Set value 1* 	Setting of the 1. Set value (reference set value) Adjustment of the run-on time for dry-running protection system	**Set value 1 [bar] **tTLS [s]	4.0 180
3.2 	**Set value 2* 	Setting of the 2. set value as well as of the switching times to the set value 2	**Set value 2 [bar] **On [h:min] **Off [h:min]	4.0 00:00 00:00
3.3 	**Set value 3* 	Setting of the 3. set value as well as of the switching times to the set value 3	**Set value 3 **On [h:min] **Off [h:min]	4.0 00:00 00:00
3.4 	**External set value* 	Activation of the external set value and selection of the signal type (0 ... 20 mA or 4 ... 20 mA). Display of the external set value (NOTE: the external set value is in reference to the measurement range of the selected sensor).	**External Set value on/off **Signal type	off 4...20mA
4	**Main menu* 	Call-up of fault signals, parameter settings, password setting, installation information and login/logout.	None	–
4.1	*Login/Logout* 	Entry of the password for login (User1, User2, Service), display of the login status. Login Logout	Password entry	–
4.2	**Fault signals* 	Display of the current fault signal (in the event of several signals, these will be switched through cyclically). Local reset of the faults, call-up of the fault signal list and SMS settings.	*Reset	–

4.2 *(New function!)*	**Operation SSM-Relay* 	Choose operation mode normally close (nc) or normally open (no) for the relay of main faults normally open normally closed	*NC/NO	NC
4.2.1 Liste	**Fault signal list* 	Display of the fault signal history (35 disc spaces) with date/time stamp; Switching between the messages by using keys Up Down	*Reviewing the fault Signal	–
4.2.2 SMS	**SMS-settings (page 1 of 5)* 	Display of the SMS status and settings Reset Local reset of the fault 4.2s	**Reset	–
4.2.2 	**SMS-settings (page 2 of 5)* 	Establishment of priority (0...4) for the 4 possible call numbers. Establishment of acknowledgement obligation.	**Priority SMS call No. 1 **Priority SMS call No. 2 **Priority SMS call No. 3 **Priority SMS call No. 4	1 0 0 0
4.2.2 	**SMS-settings (page 3 of 5)* 	Setting of the time for repeating the transmission And the maximum number of SMS for each event and call number. (**NOTE:** This page is displayed only if "With acknowledgement" has been established on page 2)	**Repeat of sending [min] **Max. No. of SMS	15 min 3
4.2.2 	**SMS-settings (page 4 of 5)* 	Input of the name of the station name for the telemetry and of the PIN for the SIM card.	**Station name [text, 16 characters] PIN [num., 4 digits]	"CC System" Installation specific
4.2.2 	**SMS-settings (page 5 of 5)* 	Input of 4 possible call numbers (user number 1-4) for the receivers and the number (user number 5) of the SMS centre of the provider. Switching between the call numbers use: Up Down	**Call number 1-5 [num., 16 digits]	Installation specific
4.3 Parameter	**Parametersetupmenu (page 1 of 2)* 	Call-up of the system, operating parameters, controller parameters and pump parameters menus (Telemetry).	None	–

4.3	**Parametersetupmenu (page 2 of 2)* 	Call-up of the FC, Time and date, display settings and SMS settings/telemetry menus	None	–
4.3.1 System	**System* 	Switching all drives On or Off Switching FC On or Off	**Drives **FC	Off Off
4.3.2 Operating parameters	**Operating parameters* 	Call-up of the menus for set values, limit values, sensor and frost protection	None	–
4.3.2.1 Set values	**Set values* 	Corresponds to menu 3		
4.3.2.2 Limit values	**Limits* 	**Only with p-c control mode:** Input of permitted limit values of the controlled Variable. A time delay before triggering the alarm Can be entered for these limit values.	**P-Max. [bar] **P-Min. [bar] **P-Hysteresis [bar] **t-Hysteresis [sec]	10.0 0.0 0.0 5
4.3.2.3 Sensor	**Sensor* 	Selection of the sensor measurement range and of the installation behavior in the event of sensor fault (shutdown of all pumps, operation of all pumps with max. speed or operation of one pump with preset speed – **see Menu 4.3.5.1 page 2**)	**Sensor [bar] **Behavior in the event of sensor fault:	16.0 Stop
4.3.3 Controller parameters	**Controller parameters* 	Call-up of the menu for setting the base load pump, peak load pump and operation control parameters for the PID controller	None	–
4.3.3.1 Base load pump	**Base load pump* 	Base load pump >> Display/setting of: – Switching ON and OFF pressure for normal operation – Switching OFF pressure for operation without FC – Zero flow run down time (All pressure values in % of 1. set value)	**Start [%] **Stop [%] **Stop without FC[%] **T-Off [s]	90 105 110 10
4.3.3.2 Peak load pump	**Peak load pump* 	Display/adjustment of the start-up and switch-off pressures and of the start-up and switch-off delay times for the peak load pumps (input of all values in % of 1. set value of the controlled variable)	**Start [%] **Stop [%] **T-On [s] **T-Off [s]	90 110 3 3

4.3.3.3 PID Controller	**PID-Controller* 	Adjustment of proportional value KP, times for turning clocks backward TI and forward TD of the PID 	**KP: **TI [s] **TD [s] ***AutoPID	25 5 1
4.3.4 Pump parameters	**Pump Parameters* 	Call-up of the menu for setting the number of pumps and the parameters of the pump alteration or test run	None	–
4.3.4.1 Number of pumps	**Number of Pumps* 	Setting the number of pumps for the installation (1...6) and establishment of operation with/without spare pump	**Number of pumps **With/without spare pump	3 Without spare pump
4.3.4.2 Pump change	**Pump Alteration* 	Establishment of the type of pump alteration (in accordance with operating hours, at the time of switch-on pulse, cyclical) and replacement times. It is also possible to specify a permanent base-load pump. The number of this pump must be entered for the purpose.	**Operating hours [h] **Alteration cycle [min] **No. of the permanently set pump	24 360 0
4.3.4.3 Pump test	**Pump test run* 	Setting of the pump test run interval and of the switch-on duration for the pump test run. Selection as to whether the test run should also take place with External Off. Possibility of the pump test by means of: "TEST." One pump is started for the switch-on duration selected above at pressing a Key. Each further pressing of the key starts the other pumps in sequence.	**Test turn interval [h] **Test on switch on duration [s] **With external off *Test	6 10 no –
4.3.5 FC	**Frequency converter* 	Call-up of the menu for setting the FC parameters and for displaying the FC status	None	–
4.3.5.1 FC parameters	**FC-parameters (page 1 of 2)* 	Setting of the maximum and minimum output frequency and of the ramp times of the frequency converter. Establishment of the frequency converter type (the drives must be switched off for this purpose)	**fmax [Hz] **fmin [Hz] **tRamp+ [s] **tRamp- [s] ***FU-Type 50	50 35 5 5 FC202
4.3.5.1	**FC-parameters (page 2 of 2)* 	Setting the FC frequencies for the purpose of avoiding controlled variable jumps with peak load cut-ins and switch-offs. Setting of the FC frequency with which the controlled pump is to run in the event of sensor failure	**fPeak+ [Hz] **fPeak- [Hz] *fNot [Hz]	50 35 40
4.3.5.2 FC status	**FC-status (page 1 of 2)* 	Display of the status signals of the bus connection and of the frequency converter	None	–

4.3.5.2	**FC-status (page 2 of 2)* 	Display of the frequency converter warning signals (voltage, current, temperature)	None	–
4.3.6	**Time of day* 	Setting of the real time clock (time, date) and of the day of the week (1 = Monday; 2 = Tuesday ... 0 = Sunday)	Time of day [hh:mm:ss] Date: [dd.mm.yy] Weekday	– – –
4.3.7	**Display settings* 	On/Off switching of the horn [hooter] (with fault signals). Call-up of the submenu for adjusting the display (brightness and contrast – these are system monitors – no illustration is provided), to backup/restore recipes and language setting	**Horn on/off	Off
4.3.7.1	***Backup/Restore* 	Possibility of saving (Backup) or reloading recipes (parameter sets of the SPS) into the/ from the memory of the display. 2 recipes are defined. Recipe 1 "Parameters" contains all adjustable variables. Recipe 2 "Type" contains the installations and pump data.	**Backup ***Restore	– –
4.3.7.2	**Language menu* 	Establishment of the active language for the display texts	*Language	English
4.3.7.2	**Language parameters* 	Setting of duration for displaying language parameter page after a system start	**Duration [s]	10s
4.3.8	**SMS-Settings* 	Corresponds to menu 4.2.2		
4.4	**Password menu* 	Call-up of the submenu for establishing the passwords 1 and 2	None	–
4.4.1	**Password 1* 	Input of the password for USER1	*Password User1 [Numerical, 4 digits]	1111

4.4.2 Password User 2	***Password 2* 	Input of the password for USER2	**Password User2 [numerical, 4 digits]	2222
4.5 Info	**Switch box Information* 	Display of the switchgear designation. Call-up of the switchgear data and software versions and of login/logout	None	–
4.5.1	**Switch box data* 	Input/display of ID number, circuit diagram number and year of manufacture of the switchgear Display of the operating hours of the switchgear	***ID-No. [txt, 10 digits] ***Wiring diagram No. [txt , 10 digits] ***Year of manufacture [month : year]	Installation specific
4.5.1	**Overview Software versions* 	Display of the software versions of the PLC program and of the touch screen program	None	–
4.5.2	**Login/Logout* 	Corresponds to menu 4.1		

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