



Wilo CO-Helix Pressure Boosting Systems

Installation and operating instructions

Installation and commissioning by qualified personnel only!

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 publication.

2 Safety

These operating instructions contain basic information concerning the installation and commissioning of the system and should be read by the service technician and responsible operator prior to proceeding. Observe the special safety instructions and understand the danger symbols throughout this document.

2.1 Indication of instructions

Symbols:



General danger symbol



Danger due to electrical voltage



Danger due to explosion risk



Information on handling the product or draw attention to possible problems.

Signal Words:

DANGER!

Acutely dangerous situation. Non-observance could result in death or the most serious of injuries.

WARNING!

The user can suffer (serious) injuries. 'Warning' implies that (serious) injury to persons is probable if this information is disregarded.

CAUTION!

There is a risk of damaging the pump/unit. 'Caution' implies that damage to the product is likely if this information is disregarded.

2.2 Personnel qualifications

The installation personnel must have the appropriate qualifications for this work.

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

Non-observance of the safety instructions can result in risk of injury to persons and damage to pump/unit. Non-observance of the safety instructions can result in the loss of any claims to damages. In detail, non-observance can, for example, result in the following risks:

- Failure of important pump/unit functions
- Failure of required maintenance and repair procedures
- Danger to persons from electrical, mechanical and bacteriological influences
- Property damage

2.4 Safety instructions for the operator

The existing directives for accident prevention must be observed. Danger from electrical current must be eliminated. Local directives [e.g. NEMA, IEC etc.] and local power supply directives companies must be followed.

2.5 Safety instructions for inspection and installation work

The operator must ensure that all inspection and installation work is carried out by authorized and qualified personnel, who are sufficiently informed from their own detailed study of the operating instructions. Work on the pump/unit should only be carried out when the unit is powered down, and lock-out/tag-out procedures are followed.

2.6 Unauthorized modification and manufacture of spare parts

Modifications to the pump/unit are only permissible after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of unauthorized parts violates warranty and absolves the manufacturer of responsibility for consequences stemming from their use.

2.7 Improper use

The operating safety of the supplied pump/unit is only guaranteed for conventional use in accordance with Section 4 of the operating instructions. The limit values must never fall below or exceed those specified.



CAUTION!

If placing the unit outside, a NEMA 3R panel must be used in order to avoid defaulting on the factory warranty.

3 Transport and interim storage

The Wilo CO-Helix is supplied on a pallet, on transport boards or in a crate and is film-wrapped to protect it against moisture and dust. Transport and storage instructions marked on the packing must be observed. The transport dimensions, weights and necessary passageways or transport space of the unit are given in the attached installation plan or other documentation.



CAUTION!

Risk of damage!

The equipment must be transported by means of authorized load carriers. Stability of the load must be ensured, since the pumps have been constructed in a way that shifts their center of gravity to the top. Transport straps or ropes must be secured to the existing transport lugs or placed around the base frame. The pipes are not designed to withstand loads and should not be used to secure loads in transit.



CAUTION!

Risk of damage! The system must be protected against moisture, frost and heat and also mechanical damage by means of suitable measures!

Unpack. Carefully inspect the Wilo CO-Helix booster or the accessory parts for possible damage and notify the delivery company (forwarder) or Wilo after-sales service. After removing the packing, store or install the unit according to the installation conditions described (see section entitled Installation). Concealed damage will not be revealed until after start-up, at which time notify Wilo after-sales service.



DANGER!

Risk of bodily harm or death! A storage tank, if used, must be vented to atmosphere and unpressurized! Over-pressurizing a storage tank can cause an explosion!

4 Product Information

4.1 Applications

Pressure boosting systems are designed for boosting and maintaining the pressure of water supply systems. They are used as:

- Potable water supply systems
- High-rise apartments
- Hospitals
- Offices
- Industrial buildings

The pressure boosting system's structure, function and requirements comply with the following guidelines and directives:

- Drinking Water Ordinance – NSF-61 (pending at the time of this publishing)
- DOE regulations

The Wilo CO-Helix pressure boosting system must be connected directly to a water main, or indirectly to a storage tank. These storage tanks are open to atmospheric pressure and should never be pressurized.

4.2 Type Key (description)

Example: Wilo CO-2 Helix V190-02/2-1/208-230~3/5/VCe

Wilo	Brand Name
CO	Product Family: Pressure Booster Systems (1 VFD Per Pump)
2	Number of Pumps
Helix	Series designation of pumps
V	Pump Design (Vertical Multistage)
190	Nominal Flow Rate in US Gallons per Minute
-02	Number of Stages (Impellers in Series)
/2	Number of Trimmed Impellers
-1	304 Stainless Steel Wetted Parts
208-230~3	Voltage and Phase
5	Horsepower
VCe	Vision Controller

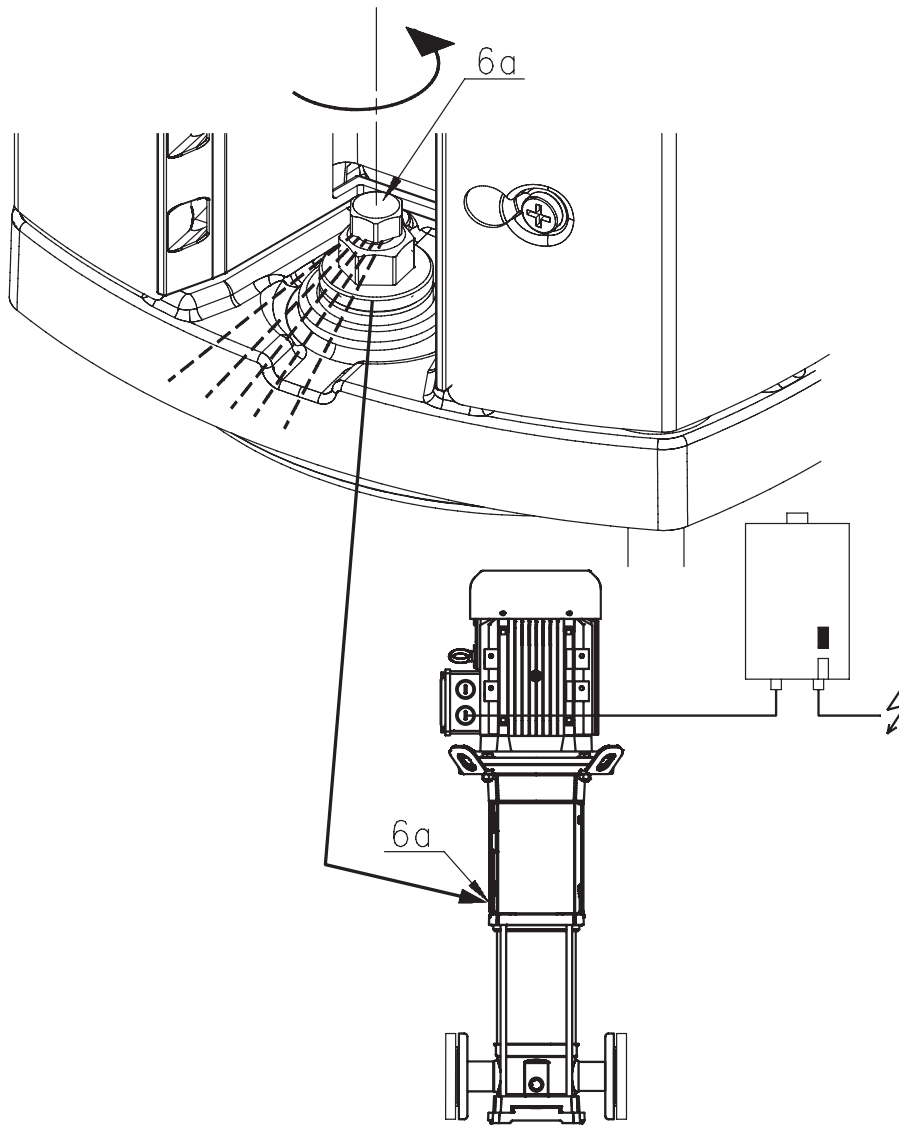
5 Description of the product and accessories

5.1 General description

The Wilo CO-Helix booster is a compact system that is supplied completely piped and ready to connect. The only connections that have to be made are for the inlet and pressure pipes and the main power connection. It may also be necessary to install accessories ordered separately but included in the delivery.

The Wilo CO-Helix booster is supplied with 2-4 non-self-priming pumps that can be connected indirectly (non-pressurized water storage tank) or directly to the water supply main from the city. **Vent** any air out of the Helix pumps before start-up to prevent seal failure or unexpected high pressure thrusts that can damage system components (See Fig. 5a).

Figure 5a



The systems must be operated and maintained in accordance with the relevant regulations so that the operational security of the water supply is permanently ensured and neither the public water supply nor other consumption installations are disrupted.

Mechanical and hydraulic system components (Figures 5b & 5c).

1	Base frame with vibration damper
2	2 to 4 High-pressure multistage centrifugal pumps
3	Suction manifold pipe
4	Discharge manifold pipe
5	Check valve
6	Isolation valves
7	(OPTIONAL) 2.1 Gallon / 232 PSI Hydropneumatic Tank
8	¾" NPT shutoff valve used for tank isolation during service
9	Pressure transducer
10	Pressure gauge
11	¼" shutoff valves so that the pressure gauge and transducer can be isolated without disrupting the system
12	Control panel that contains one variable frequency drive per pump supplied

Figure 5b

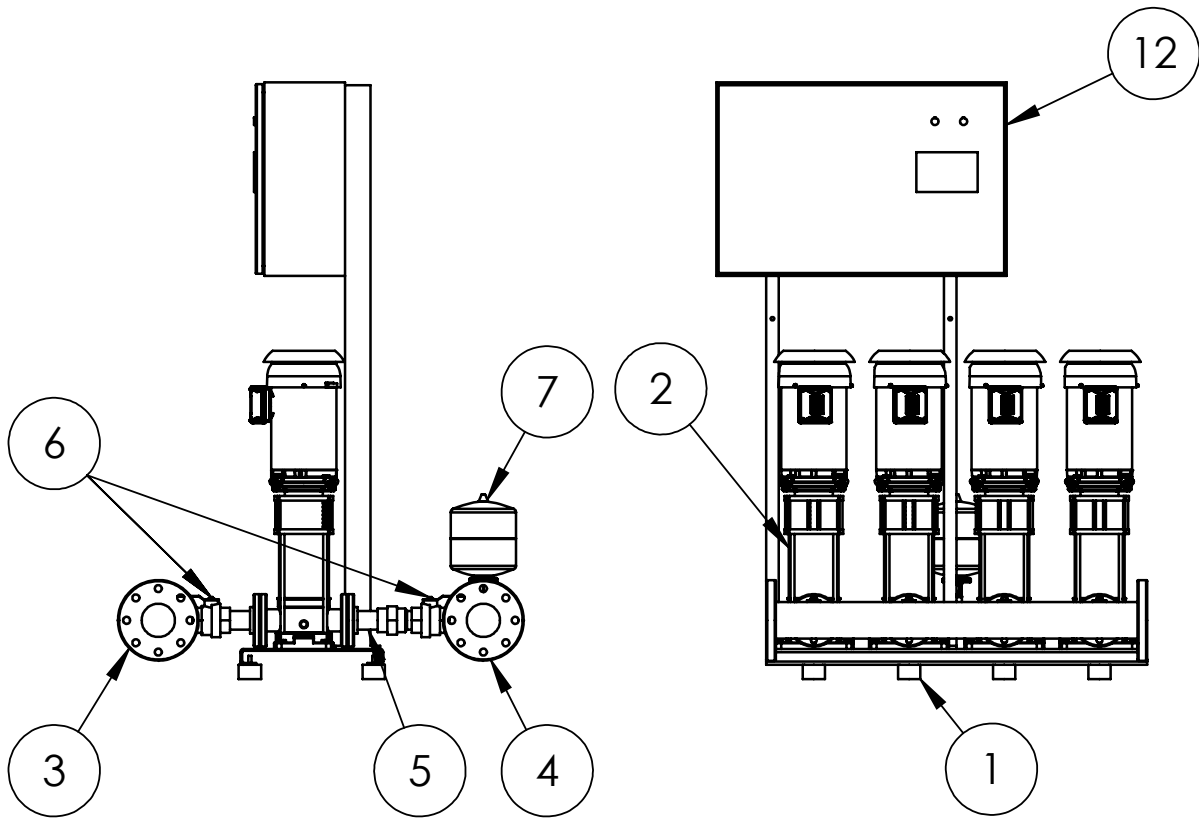


Figure 5c

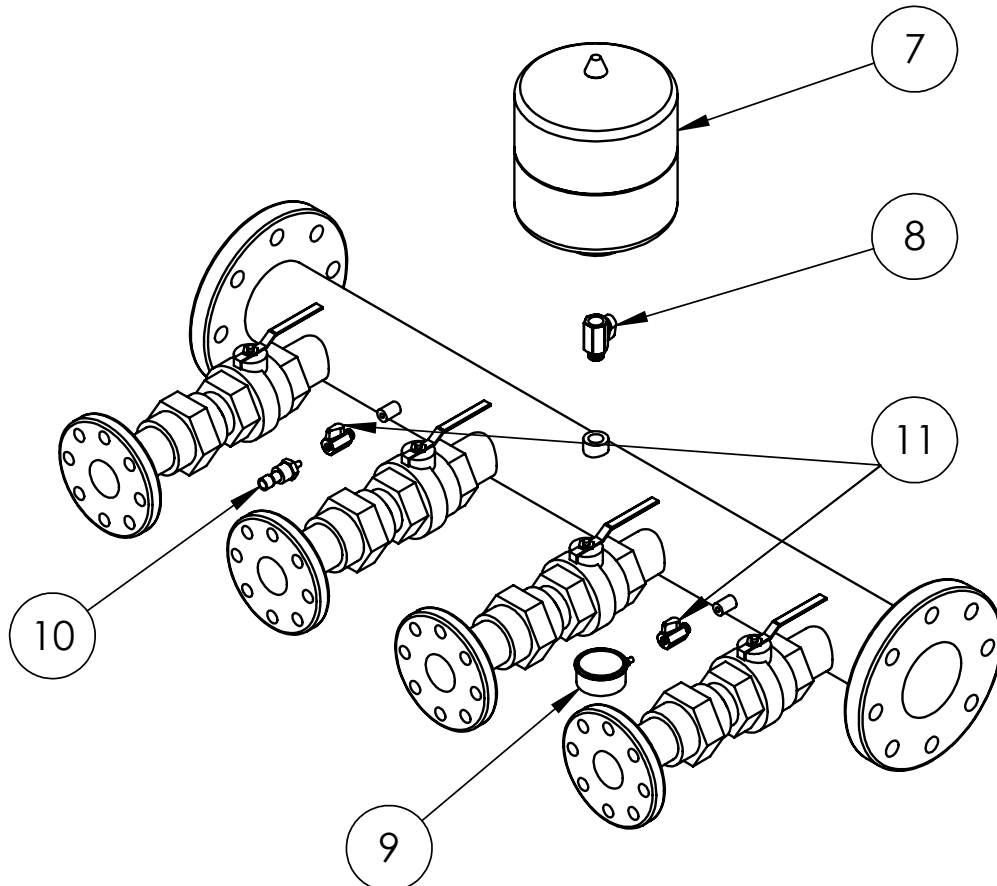
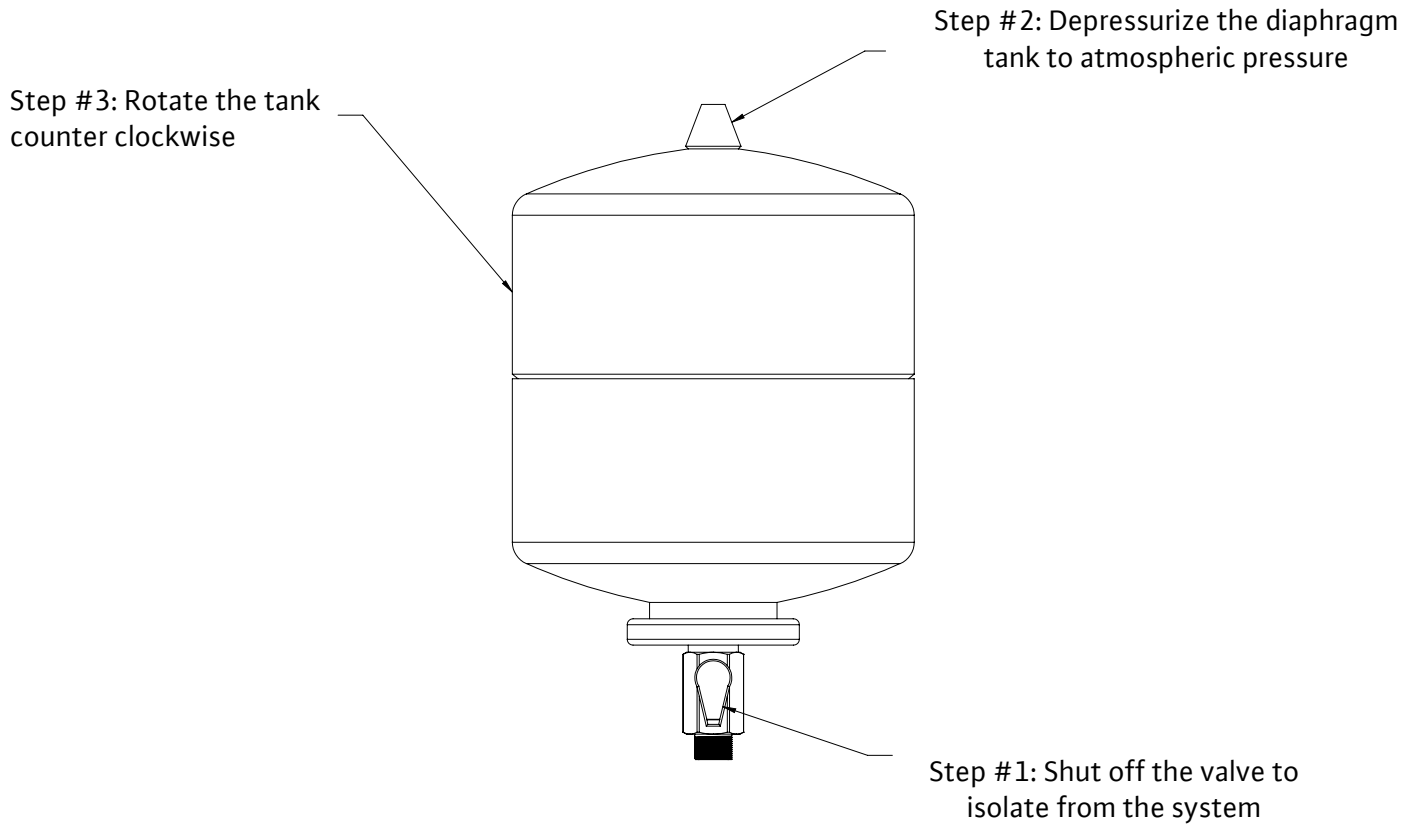


Figure 5d

Warning:

To safely uninstall the diaphragm tank,
please follow these steps



WARNING!

Risk of damage or bodily injury!

Please follow the above instructions (figure 5d) in order to safely remove the hydropneumatic tank from the discharge manifold for service! Note: The bladder may be ruptured; please proceed with caution!

5.3 Function of Wilo CO–Helix pressure boosting system

Wilo CO–Helix pressure boosting systems are equipped with non–self–priming, high–pressure, multistage centrifugal pumps as standard. These are supplied with water via the suction manifold pipe. The pumps increase the pressure and pump the water to the consumer via the discharge manifold pipe. To do this, they are switched on, off, or speed–controlled depending on the demand of the system. Depending on demand, the control unit switches the pumps on or off, or changes the speed of the pumps, until the set control parameters are reached. (A more precise description of the control mode and the control process is given later in this document).

The total delivery volume of the system is distributed over several pumps (cascading). The system output is adapted very precisely to the actual demand and the pumps are operated in the most favorable power range in each case. This design delivers a high level of efficiency and an economical energy consumption for the system. The first pump that starts up is called the base load pump. The remaining pumps needed to reach the system operating point are called peak load pumps. If the system is configured to supply potable water, one (or two in the case of a Quadraplex) pump(s) can be designated as a standby pump. To ensure that all the pumps are used equally, the control unit exchanges the pumps continuously based on least amount of hours used (e.g. the order of switching on and off the base load/peak load or duty–standby pump functions change regularly).

The optional hydropneumatic pressure vessel performs a buffer function for the pressure sensor and prevents unnecessary control system oscillation of on/off starts. It also mitigates and reduces the frequency of starts and switching of the base load pump as a result of minor pressure drops in the consumer’s piping system. **The optional 2.1 gallon tank is strongly recommended for the booster set** – in addition to your system–sized storage tank – as it helps to prevent water hammer. System–sized tanks are also available from Wilo USA.



CAUTION!

To protect the axial face seal or slide bearing, do not allow the pumps to run dry. Dry run may cause the pump seal to fail and leak!

Protection against low water level/suction pressure is monitored by a suction pressure transducer mounted on the side of the suction manifold. The suction transducer monitors the supply pressure that is being provided from the water main. Its analog signal is processed by the PLC to make sure it does not fall below the suction pressure set point. In the case of an indirect connection (system separation through non–pressurized storage tank), the suction transducer should be sufficient for the application. If low pressure issues occur (not common), a level–dependent switch can be used in lieu of the supplied pressure transducer (provided by others). It should be inserted in the storage tank as a dry run protection device and wired to the control panel accordingly (please refer to the wiring diagram located in the panel door). In addition, a change from the PLC input will have to take place in order to change the analog input to digital.



WARNING!

Use only materials approved for use in potable water systems!

5.4 Noise

The Wilo CO–Helix Booster is supplied with different stages of pumps and a variable number of pumps. Consequently, the overall noise level variants cannot be listed here. However, it is possible to approximate the overall noise level using the noise value for an individual pump of the type supplied. To do this, use the individual pump noise value from the Installation and Operating Instructions for the pumps.

Calculation	
Individual pump =	... dB(A)
2 pumps, total	+3 dB(A)
3 pumps, total	+4.5 dB(A)
4 pumps, total	+6 dB(A)

5.5 Scope of delivery

- Wilo CO–Helix Pressure boosting system.
- Installation and operating instructions of the Wilo CO–Helix booster.
- Electrical circuit diagram as required.
- Additional sheet with the frequency converter factory settings as required.

5.6 Optional Accessories

Accessories must be ordered separately if needed. The optional accessories included in the Wilo range are:

- Optional, 2.1 gallon, non–ASME, 232 PSI WP tank.
- Larger diaphragm pressure vessels available (both non–ASME rated and ASME rated).

Control panel options must be ordered separately if needed and placed at the time of the initial order. The control panel options included in the Wilo range are:

- Dome light – Red (Failure)
- Dome light – Green (Running)/Red (Failure)
- Dome light – Green (Running)/Amber (Yellow)/Red (Failure)
- Dome light – Green (Running)/Amber (Yellow)/Red (Failure)/ White (Running)
- Run/Fault lights
- 3 Phase surge protection – 208v–230v 3 phase, Delta, 3–wire with ground
- 3 Phase surge protection – 460v 3 phase, Delta, 3–wire with ground
- 3 Phase surge protection – 208v–230v, 3 phase, Wye, 3–wire with ground
- 3 Phase surge protection – 277v–480v, 3 phase, Wye, 3–wire with ground
- 3 Phase surge protection – 347v –600v, 3 phase, Wye, 3–wire with ground
- BACnet gateway (MS/TP and IP)
- LONworks gateway
- CANopen gateway Card
- Interior panel light
- NEMA 3R adder in lieu of NEMA 12 panel

575VAC to 460VAC Transformers, Type 1:

- Aluminum Coiled Transformers
 - 15 kVA vented transformer – 3 phase – 600v delta – 480Y/277 150C RISE
 - 30 kVA vented transformer – 3 phase – 480v delta – 480Y /277 150C RISE
 - 45 kVA vented transformer – 3 phase – 600v delta – 480Y /277 150C RISE
- Copper Coiled Transformers
 - 15 vented transformer – 3 phase – 600v delta – 480Y/277 150C RISE
 - 30 vented transformer – 3 phase – 600v delta – 480Y/277, 150C RISE
 - 45 vented transformer – 3 phase – 600v delta – 480Y/277 150C RISE
- 3R weather shield for transformers

6 Installation

6.1 Installation location

- Adequately dimensioned floor drainage must be provided in the installation room.
- Location must be free from harmful or combustible vapors.
- Adequate space must be provided for maintenance work and the installation should be freely accessible from at least two sides.
- The installation surface must be horizontal and flat.
- The system is designed for an ambient temperature range of 32°F to 104°F with a relative atmospheric humidity of 50%.
- Installation and operation should be in a secure space, away from living and sleeping quarters

6.2 Foundation/bearing surface

The Wilo CO-Helix booster is constructed for installation on flat concrete floors. The base frame is mounted on height-adjustable vibration dampers to prevent structure-borne noise.



NOTE!

The vibration dampers will not be fitted when the equipment is delivered for transport reasons. Before installing the Wilo CO-Helix booster, check whether all the vibration dampers are fitted and locked by the threaded nut. If additional onsite adjustment is required, measures must be taken to avoid structure-borne noise.

6.2.2 Hydraulic connection and pipes

- When connecting to the public potable water main, the requirements of the local water supply company must be met.
- Perform all the welding or soldering work and then flush the system. If necessary, disinfect the piping system and the boosting system before connecting the system.
- The system pipework must be free of pipe strain. Flexible connector lines are recommended to avoid stress on the pipe connections and to minimize the transmission of system vibration to the building installation. In order to prevent the transmission of structure-borne noise to the building, do not secure the pipe clamps to the Wilo CO-Helix manifolds.
- The connection is made either on the right or left of the system, depending on the site conditions. It may be necessary to move blind flanges or thread caps that are already fitted.
- The flow resistance of the suction pipe must be minimized through ample diameter and straight, short, pipe runs, in order to prevent low suction pressure faults during high-volume pumping. **Observe NPSH requirements of the system.**

6.2.3 Hygiene

When used for potable water applications, the complete potable water supply system has to be transferred to the operator in a perfectly hygienic condition, flushing if necessary and also disinfecting under some circumstances.



WARNING!

Contaminated potable water is a health hazard! Flushing the pipes and the system reduces the risk of adversely affecting the potable water quality. The water must be completely replaced after a long period of system standstill.



DANGER!

The Wilo CO-Helix must be de-energized during the flushing process!

For the simple flushing of the system prior to start-up, Wilo recommends removing the 3/4" NPT plug on the top of the discharge manifold of the Wilo-CO Helix booster (if no diaphragm pressure vessel on the discharge side is present) and connecting a garden hose connection (3/4" MNPT x 3/4" male garden hose adaptor), to drain the water to the nearest floor drain or waste water system during the flushing process. If an optional, diaphragm pressure vessel is present on the discharge manifold, you will have to follow the procedure noted in diagram 6a and proceed with attaching the hose adaptor and hose prior to opening the 3/4" shutoff valve.



NOTE!

Isolation of the discharge manifold from the downstream piping system will be needed in order to properly flush the Wilo CO-Helix correctly before start-up for potable water applications. Wilo recommends that either a ball valve or butterfly valve (depending on manifold connection size) be placed directly between the discharge manifold and upstream piping system.

6.2.4 Dry-running protection system and protection against low water

- Every Wilo-CO Helix booster system is supplied with a suction transducer that has a .4% accuracy across its full span (0-150 PSI) which equates to a +/- 0.6 PSI deviation.
- To fit an alternate, dry-running, switch protection system (**not common** and provided by others):
 - It is very rare for a problem to arise using the Wilo CO-Helix supplied suction transducer when a storage tank is used. Regardless of this rarity, issues with low water conditions when utilizing a storage tank can occur and a digital switch can be used in lieu of the transducer in the form of a tank float or low water probe.
 - Please refer to the PLC operation, described later in this document for detailed instructions to use a digital switch in lieu of the Wilo-supplied suction transducer.

6.2.5 Diaphragm pressure vessel (optional accessory)

For transport reasons, if the diaphragm pressure vessel (2.1 gallon/232 PSI non-ASME) has been purchased as an accessory for the Wilo CO-Helix, it will not be attached upon delivery; it will be separately packed. Before commissioning, this must be mounted on the ¾" shutoff valve (see Fig. 6c) and charged to the appropriate pressure at the jobsite with nitrogen (See below – 6.2.5.1)

6.2.5.1 Diaphragm pressure vessel recommended charge

The diaphragm pressure vessel should be installed on the discharge manifold, adjacent to the pressure transducer, and it should be charged with pressure to equal 70% of the system constant pressure setpoint. For example, if the constant pressure setpoint is 80 PSI, the tank should be charged to 56 PSI (80 x 70%).

6.3 Electrical connection



DANGER!

Risk of fatal injury! The electrical connection must be made in accordance with the local and national electrical code regulations by a qualified electrician!

The Wilo CO-Helix can be equipped with different variances of current and voltage. To make the electrical connection, the corresponding installation and operating instructions and attached electrical circuit diagrams must be observed. General points to be considered are listed below:

- Every Wilo CO-Helix control panel is supplied with a current overload sized for each pump motor amperage (circuit breakers).
- The type of current and voltage of the main connection must comply with the details on the wiring diagram of the control panel.
- The electrical connection line must be adequately sized according to the total power of the Wilo CO-Helix.
- External protection must be provided according to local and national electrical codes.
- As a protective measure, the Wilo CO-Helix must be wired to ground in accordance to local and national electrical codes. The connections intended for this purpose are identified accordingly (see wiring diagram).
- Further measures are referenced in the wiring diagram of the control panel.

7 Commissioning/decommissioning

We recommend that Wilo's after-sales service commission the system. Contact your dealer, the nearest Wilo representative or our service department directly for details.

7.1 General preparations and checking



WARNING!

Make sure the system is de-energized and wait 5 minutes to allow any capacitance voltage to discharge.

Before energizing the system for the first time:

- Check that onsite wiring and grounding of the electrical panel is correct.
- Check that the pipe joints are stress-free.
- Fill the system and check visually for leakage.
- Open the pump vent screws and slowly fill the pumps with water so that the air can escape.



CAUTION!

Risk of damage! Do not allow the pump to run dry. Dry-running destroys the axial face seal of the Helix V.

In suction mode (e.g. negative level difference between storage tank and pumps), the pump and the suction line must be filled via the opening in the vent screw (use a funnel as required).

7.2 Electrical layout, sequence of operations, and start-up procedure



DANGER!

Risk of fatal injury! Always refer to the wiring diagram of the onsite CO-Helix ONLY! References and examples of wiring diagrams in this document are not official wiring diagrams for the onsite unit!

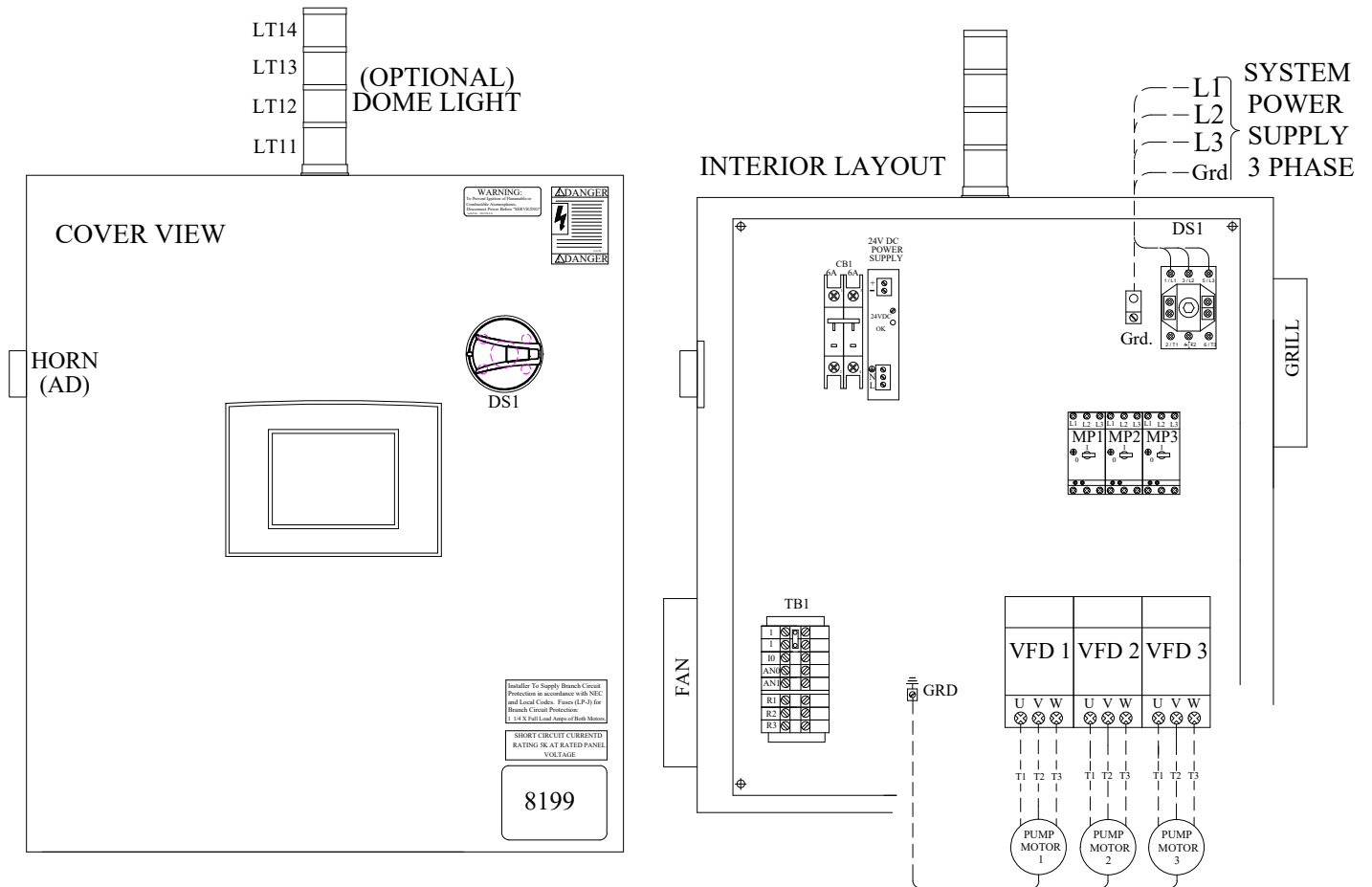
7.2.1 Electrical layout – panel overview

Every CO-Helix panel shall meet the requirements of UL508A standards for Industrial Control equipment. Standard panel shall be rated as a NEMA 12 enclosure with a fan; CFM rated for heat sink requirements of the variable frequency drives (VFDs). Three phase, 208-230/460 voltage panels shall either be equipped and mounted with Danfoss FC-51 micro VFDs (1-10 horse power) or Danfoss FC-101 VFDs (10-20 horse power) – no keypad per pump. Three Phase, 575 voltage panels shall be equipped and mounted with Danfoss FC-101 drives – no keypad per pump. VFD's shall be programmed to the CO-Helix needed parameters prior to shipment. The Danfoss variable speed drives will be mounted inside the panel enclosure and supplied with a NEMA 1 enclosure rating. The VFD will utilize the MODbus protocol to report faults and energy usage in kWh to the programmable logic controller. The VFD shall provide visual indication that requires no external control devices. The panel shall have labeled wires and terminal block for easy reference to the wiring diagram. The panel shall contain motor protector circuits, for each pump supplied, sized for motor amperage. Through-the-door-disconnect with selector handle and lockout will be provided with the panel. The panel will also be provided with alarm with silencing button.

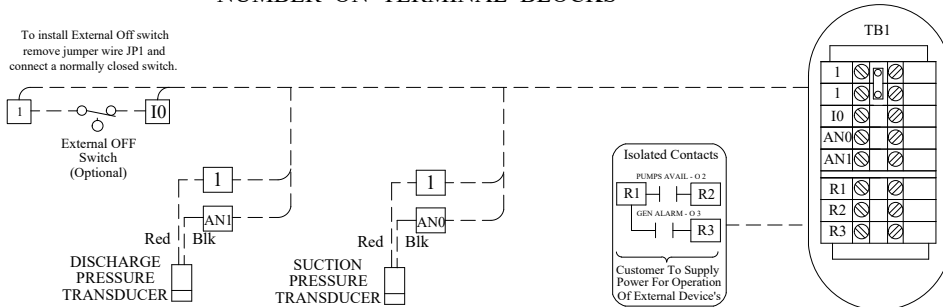
Optional panel items include

- NEMA 3R panel suitable for outdoor applications.
- Run/fault lights per pump
- Surge protection
- Interior panel light
- Transformer
- NEMA 3R transformer cover
- BACnet gateway
- LONworks gateway
- CANopen gateway card

EXAMPLE of CO-Helix triplex electrical layout and wiring diagram:



FIELD CONNECTIONS
CONNECT EACH WIRE TO MATCHING NUMBER ON TERMINAL BLOCKS



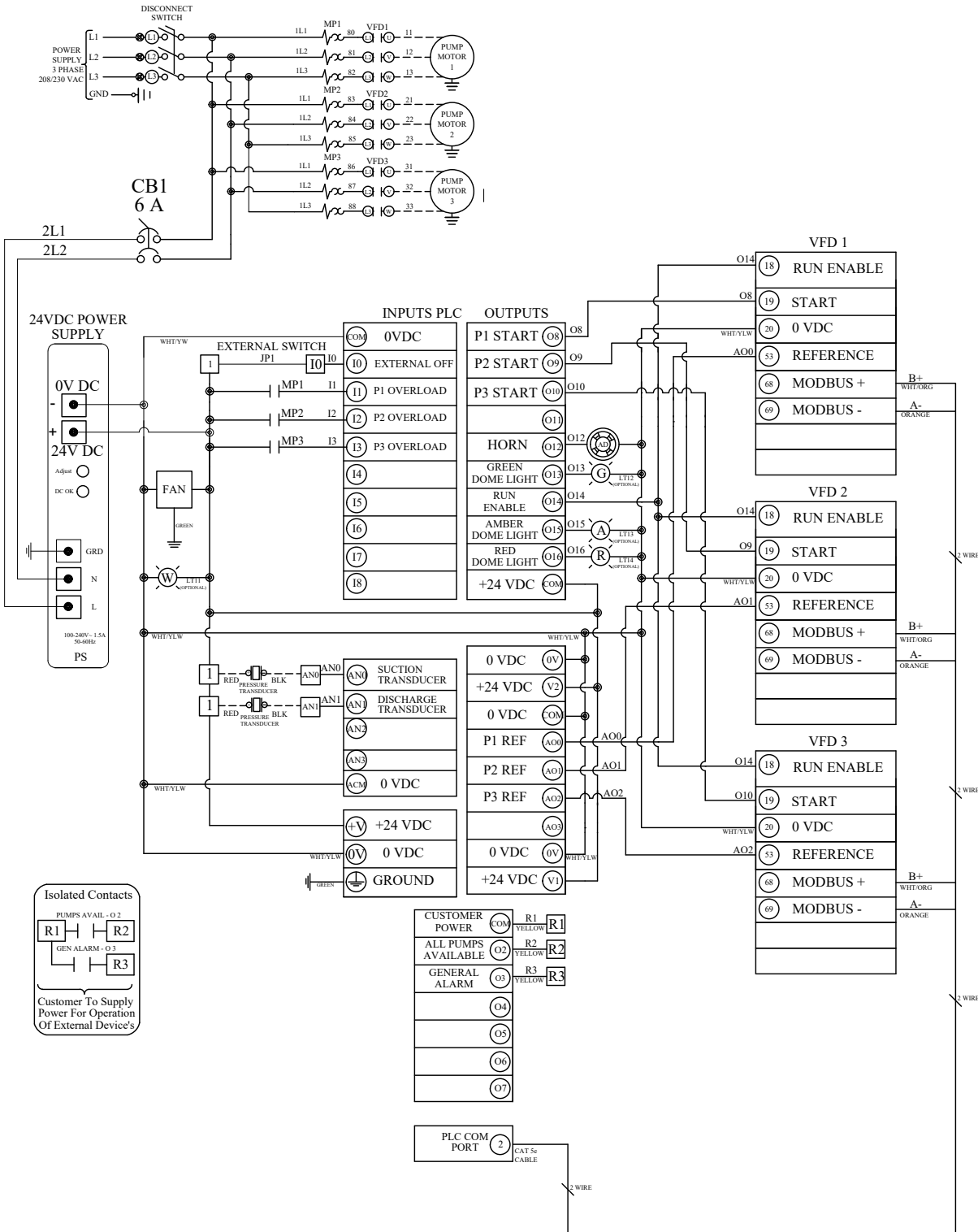
7.2.2 Electrical layout - programmable logic controller (PLC)



DANGER!

Risk of fatal injury! Always refer to the wiring diagram of the onsite CO-Helix ONLY! References and examples of wiring diagrams in this document are not official wiring diagrams for the onsite unit!

EXAMPLE of a wiring diagram for CO-Helix triplex:



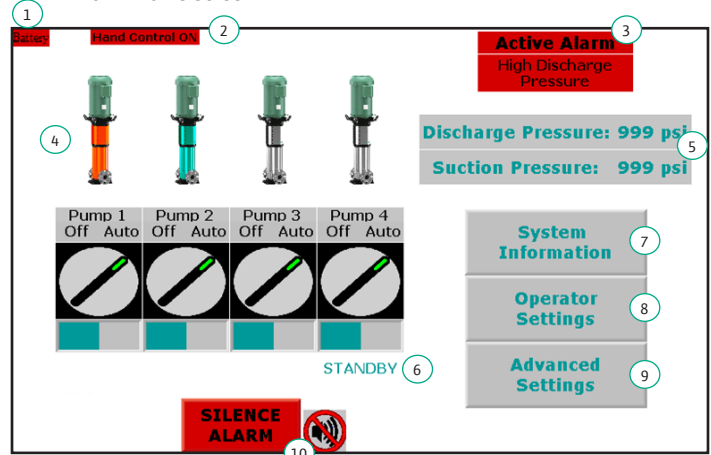
The Wilo CO-Helix boosting system technology is the current state of the art functionality and factory-checked to ensure it performs at start-up. The programmable logic controller shall have the following attributes:

- 7" LED color touchscreen with a display resolution of 800 x 480 pixels.
- The PLC shall indicate on the display, per the pump icon, the individual pump status in real-time. (green=running, red=faulted, no color=off).
- The PLC shall be factory set for either base load/peak load or duty/standby operation.
- The PLC shall provide off/hand/auto function. Hand operation shall be password protected.
- The PLC shall display pump hours, suction PSI, discharge PSI, pump frequencies, total kWh for system, and current kWh per pump.
- The PLC shall be able to modify the discharge pressure setting through password protected screen.
- The PLC shall have a low pressure cut out function.
- The PLC shall have pipe burst protection.
- The PLC shall be able to be able to flash the PLC program by means of a Micro-SD card via Micro-SD port or remotely flashed by the factory (note: internet access need in order to be flashed remotely).
- The PLC shall have a RJ45 Ethernet port capable of transmitting data 10/100Mbps using a Cat 5 cable.
- The PLC shall have a 2.0 USB port available for communication.
- The PLC shall have onboard Modbus Protocol. Two serial ports available; one for communication to the VFD and one open for the building management system.
- The PLC shall have the following I/O:
 - Number of digital inputs: 18
 - Number of digital outputs: 17
 - Number of analog inputs: 4
 - Number of analog outputs: 4

7.2.3 Sequence of Operations

1. When pressure drops low of the pressure band, first pump will turn on.
2. The pump will adjust speed to maintain pressure at the set point.
3. Additional pumps will turn on to maintain pressure if demand cannot be met with one pump. In systems with more than 2 pumps, there will be a delay between each additional pump turning on.
4. When additional pumps turn on, they will adjust in speed so that all pumps run at the same speed.
5. When multiple pumps are running, one will turn off if either:
 - a. Pressure is high out of band for a programmable amount of time.
 - b. System will periodically check whether fewer pumps can maintain pressure efficiently and if so, a pump will turn off.
6. If only 1 pump is running, the pump will turn off if either:
 - a. Pressure is high out of band for a programmable amount of time.
 - b. System will periodically boost pressure a programmable amount above the set point. If pressure does not drop after returning the set point to normal, the pump will turn off.

01 Home Screen



1. Battery indicator
 - a. Not visible until battery level is low. Battery is supposed to last for around 7 years. If battery fails, PLC time/date information as well as any saved data will be lost if power is lost. Battery can be replaced while power is running to maintain data, although battery warning will not clear until power is cycled.
2. Hand Control indicator
 - a. Displays a warning that PLC is currently in hand control mode. PLC will not respond automatically to pressure changes when in this mode. Pumps can be turned off from the main screen during hand control, unless the hand control alarm override is active. In that case, pumps can only be controlled from the hand control screen.
3. Active Alarms
 - a. Will cycle through all currently active alarms every few seconds.
 - b. Only visible if at least one alarm is active.
 - c. Can be clicked to view active alarms.
4. Pump information (Icon for pump will change based on booster model)
 - a. The pump icons display whether pumps are on, off, or faulted
 - i. Cyan indicates the pump is running
 - ii. Grey indicates that the pump is off
 - iii. Orange indicates the pump has faulted
 - b. The switch below the pump icons will take the pumps from auto to off.
 - c. The bar below the auto/off switch show pump speed. A fully green bar is full speed while an empty bar is off. Indication is based on full 0-60Hz, so a pump running at a minimum speed of 30Hz will show the bar half green. If max frequency is changed to 50Hz, bar will be scaled from 0-50Hz.
5. Suction and discharge pressure
 - a. Show current suction and discharge pressures
 - b. Suction pressure will not display if suction pressure transducer is not used
6. Standby pump indicator
 - a. A standby pump can be set in the options menu. If using one standby pump, the pump with the highest runtime will be the standby pump until all pumps are off, then a new pump is evaluated for standby if the highest runtime pump has changed. With 2 standby pumps, the highest 2 runtime pumps are set to standby.
 - b. Standby pump will not run unless a pump has faulted or is taken to off.
7. System information button
 - a. Goes to system information screen. No password required
8. Operator settings button
 - a. Goes to operator settings screen. Password 1111
9. Advanced settings button
 - a. Goes to advanced settings screen. Password 2222
10. Silence Button
 - a. Not used. Touch screen to silence alarms.

02 System Information

System Information					
	Run Time	Frequency	Start/Stop Cycles	Total Energy Usage	
Pump 1:	999999.9 Hrs	99.9 Hz	999999	999999 kWh	Power Usage Details
Pump 2:	999999.9 Hrs	99.9 Hz	999999	999999 kWh	
Pump 3:	999999.9 Hrs	99.9 Hz	999999	999999 kWh	
Pump 4:	999999.9 Hrs	99.9 Hz	999999	999999 kWh	
Total:	999999.9 Hrs		999999	999999 kWh	
Discharge Pressure Setpoint :			999.9 psi	Main Screen	

The System Information screen displays discharge pressure set point, pump run time, pump frequency, pump cycles, and total energy usage of the system. Run time and pump cycles cannot currently be reset. Energy usage can be reset in the VFD through the use of a keypad.

Pressing the Power Usage Details button will jump to another screen with motor voltage, current, and power.

Pressing the main screen button will return to the main screen.

03 Operator Settings

Operator Settings		
Pumps	Alarms	Communications
Pump Test Run Configuration	View Alarm History	IP Configuration
Hand Control	View Active Alarms	Email Configuration
Discharge Pressure Setpoint : 999.9 psi		Main Screen

The operator settings page links to multiple screens for controlling user level settings.

1. Pump test run configures the pump test option. This allows users to run a pump for a short period of time to test it if all pumps are off. Additionally, it will allow the pumps to run periodically during a long off period.
2. Hand control allows the user to manually run pumps
3. View Alarm History will display the last 256 Alarms. The alarm history cannot be reset.
4. View Active Alarms will view all of the active alarms, including alarms that have not been acknowledged. This is similar to the active alarms button on the main screen, but additionally allows for acknowledging of alarms that have cleared. The button on the main screen will disappear if an alarm came in and cleared without acknowledgement.
5. IP configuration sets up the PLC network settings
6. Email configuration sets up the PLC email settings
7. Discharge Pressure set point sets the desired output pressure of the system.

04 Pump Test Run

Pump Test Run				
	Test Pump 1	Test Pump 2	Test Pump 3	Test Pump 4
Test Run Interval:	99 Hours	3	1 Pump Test Enabled	
Test Run Activation Period:	99 Seconds	4		
Test Run Frequency:	99.9 Hz	5		
			Previous Screen	Main Screen

The Pump Test Run page allows for pumps to be run for a short duration.

1. Enables and disables the pump test option. When enabled pumps will run after a set period of inactivity.
2. Pump indicator and test pushbuttons. With no pumps running, pressing a test button will run the pump for the set activation period at the set test frequency. Only one pump may be tested at a time.
3. Sets the time between pump test runs. Test run will occur when this time has elapsed with no pumps running. 1 pump will be run per test run. The pumps test cyclically so that all 4 pumps will be tested after 4-time intervals have elapsed (in the case of a quad). Default value is 6 hours. Input range of 1-99 hours.
4. Sets how long pumps will run during a test. Default value is 10 seconds. Input range of 1-30 seconds.
5. Sets the speed of the pump during a test run. Default value is 45.0 Hz. Input range of 25.0-60.0 Hz. Speed will clamp to the minimum or maximum allowed frequency if entered value exceeds those limits.

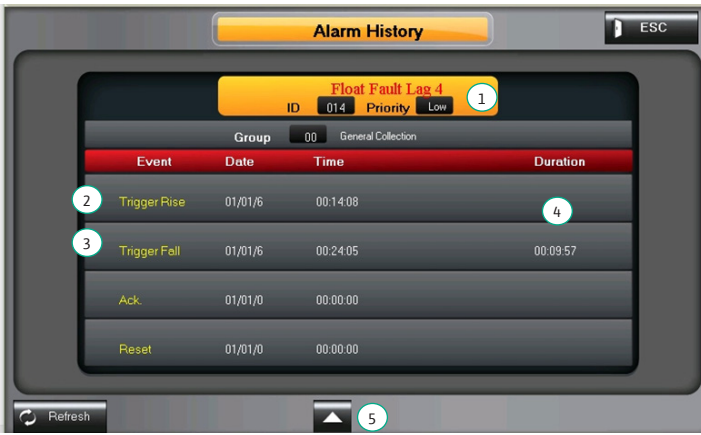
05 Alarms

Alarm Details			ESC
OLR-Trip Pump 1			
ID	001	Priority	Med
Group	00	General Collection	
Date	Time	Count	
07/08/16	06:23:36	1	
Details			
Active	Open Enclosure & Reset Motor Protector. If recurring check Settings/Motor		Ack

1. Alarm description
 - a. A one line description of the cause of the alarm.
2. Time stamp
 - a. The date and time of the initiation of the alarm
3. Corrective action
 - a. A short list of corrective actions and causes of the alarm.
4. Next icon
 - a. This takes you to a screen with expanded details and suggested actions to correct the alarm.

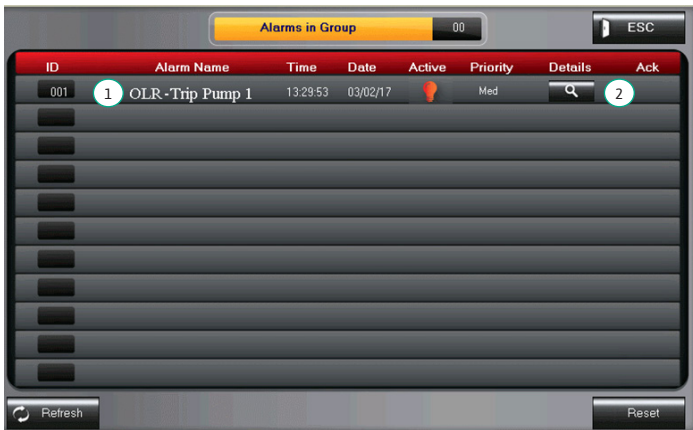
Press the "ESC" button on the top right corner of the "Alarm Details" screen. This will take you to the "alarm in groups" page. This page is not utilized. Press the "ESC" button. The "Groups with Pending Alarm" screen will appear. This screen is not utilized. Press the "ESC" button.


06 Alarm History



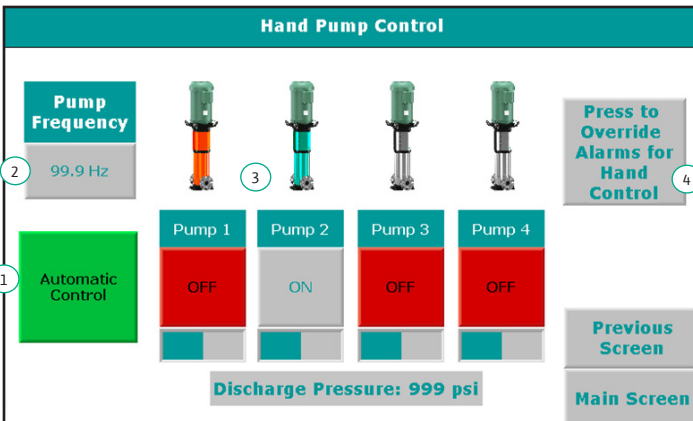
1. Alarm description
 - a. A one line description of the cause of the alarm.
2. Time stamp start of alarm
 - a. The date and time of the initiation of the alarm.
3. Time stamp end of alarm
 - a. The date and time when the alarm ended.
4. Duration of alarm.
 - e. Hours:Minutes:Seconds
5. Scroll
 - a. Press forward or back to scroll through the alarm history.
 - b. Note – the default system will store 256 alarm entries.

07 Active Alarms Page



1. Alarm description
 - a. All active alarms will be listed.
2. Alarm Details
 - a. Takes you to the alarm details page. On the alarms detail page press the "next" icon  To take you to the detailed troubleshooting screen.

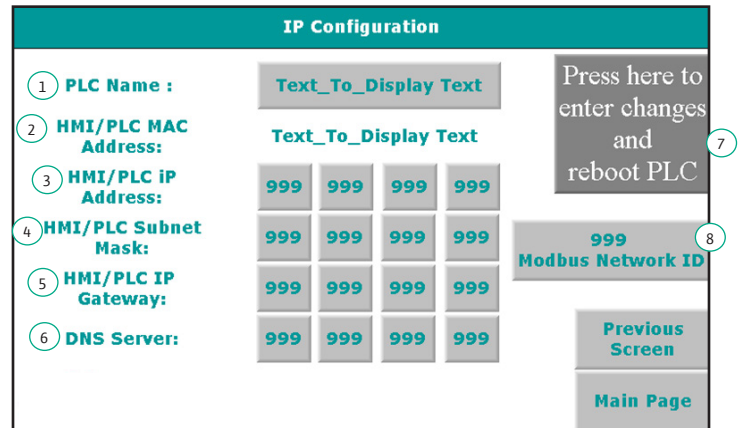
08 Hand Control



Hand Control allows for manual operation of the pumps.

1. Hand Control toggle button. Switches between manual and automatic pump control. Pumps will not operate on based on system pressure automatically when in hand control.
2. Sets the hand control pump speed. All pumps will run at this speed when on and in hand control.
3. Turns pumps on and off when in hand mode. Has no effect when in automatic control mode.
4. Pressing the alarm override button will take the user to a confirmation page to verify they wish to run the pumps with alarm conditions in. Activating this mode will allow the user to run the pumps unless regardless of conditions, unless the pump failure is due to a physical failure of the pump or drive. This option is automatically turned off every time the system returns to automatic control. Using this option will set a flag in the system indicating that it was used at least once.

09 IP Configuration



This page configures the PLC to allow for remote access and use of the remote app, as well as email.

1. Sets the PLC name. This is effectively the password for logging into the PLC remotely. Default is V700-1
2. Displays the PLC MAC address. This can be used to identify which device is the PLC on a network. Cannot be changed.
3. IP address. This is the desired IP address of the PLC. It must have a static IP address, and does not support DHCP. Default is 192.168.1.8.
4. Subnet Mask. Obtain these settings from a Network administrator to connect PLC to a network. Default value 255.255.255.0
5. IP Gateway. Obtain these settings from a Network administrator to connect PLC to a network. Default value 192.168.1.1
6. DNS Server. Obtain these settings from a Network administrator to connect PLC to a network. Default value 8.8.8.8
7. Reboot PLC. Changing the settings on this page requires a reboot of the PLC to take effect. Press the reboot button after updating any network settings.
8. Modbus ID. This is the Slave ID of the PLC for Modbus communication.

10 Email Configuration

Email Configuration			
1	Mail Server Name 50 Char. Max	Text_To_Display Text_To_Display Text_To_Display Te	Port # 99999 2
3	E-mail User Name 50 Char. Max	Text_To_Display Text_To_Display Text_To_Display Te	
4	E-mail Password 20 Char. Max	Text_To_Display Text	E- Mail Test Hold for 1 sec 9
5	From Email	From Email: From Email: From Email: From Email: Fr	
6	To Email	Text_To_Display Text_To_Display Text_To_Display Te	
7	CC Email	Text_To_Display Text_To_Display Text_To_Display Te	
For Text Message use this scheme. AT&T - (10 digit phone #)@txt.att.net Google "SMS via Email" for other carriers. T-Mobile - (10 digit phone #)@tmomail.net US Cellular - (10 digit phone #)@email.uscc. Verizon - (10 digit phone #)@vtext.com		Previous Screen	
8	Location	Text_To_Display Text_To_Display Text_To_Display Te	Main Screen

Configures email settings to allow email notifications. Currently there are only 3 emails that can be sent out: Test email, General Alarm, and General Alarm Clear. Email notifications require that the PLC be connected to the internet. Email does not support SSL encryption, only email accounts which support unencrypted email can be used as the sending email account. All email addresses will receive email sent through the PLC. Sets the PLC name. This is effectively the password for logging into the PLC remotely. Default is V700-1

1. Name of the mail server. No default. Due to the requirement of using an unencrypted mail server, typical free email accounts like gmail or outlook will not work. Accounts with <https://www.smtp2go.com/> have been verified to work
2. Port number associated with mail server. Default 587.
3. Email user name. This is the applicable user name for the mail server
4. Email password. This is the password associated with the user name.
5. From email. The email address that the notification will appear to come from.
6. To email. The email address that will be the destination of the email.
7. CC email. Allows email to be sent to an additional address.
8. Location. This is the message that will appear in the body of the email. The subject of the email is either "Test Email". "General Alarm" or "General Alarm Clear"
9. Send Test email by pressing this button. PLC requires a second or two between sending emails. If two events occur that would both send an email at the same time, one of the emails may be lost.

11 Communication

BACnet Communication Protocol

Binary Values

Alarm# (Read Only)	Object ID
1	P1_Overload 56
2	P2_Overload 57
3	P3_Overload 58
4	P4_Overload 59
5	SuctionSensorFault 60
6	DischargeSensorFault 61
7	OverMaxPressure 62
8	BelowMinPressure 63
9	LowSuctionPressure 64
10	LowBattery 65
11	
12	
13	
14	
15	
16	

Pump Status (Read Only)	Object ID
1	P1_Available 72
2	P2_Available 73
3	P3_Available 74
4	P4_Available 75
5	P1_ON 76
6	P2_ON 77
7	P3_ON 78
8	P4_ON 79
9	
10	
11	
12	
13	
14	
15	
16	

Analog Values

Pump/Motor Information (Read Only)	Units	Decimal Places	bits	Object ID
P1_Current	A	2	16	0
P2_Current	A	2	16	1
P3_Current	A	2	16	2
P4_Current	A	2	16	3
P1_Voltage	V	0	16	4
P2_Voltage	V	0	16	5
P3_Voltage	V	0	16	6
P4_Voltage	V	0	16	7
P1_Frequency	Hz	1	16	8
P2_Frequency	Hz	1	16	9
P3_Frequency	Hz	1	16	10
P4_Frequency	Hz	1	16	11
P1_RunTime	Hr	1	32	28
P2_RunTime	Hr	1	32	29
P3_RunTime	Hr	1	32	30
P4_RunTime	Hr	1	32	31
P1_Cycles		0	32	32
P2_Cycles		0	32	33
P3_Cycles		0	32	34
P4_Cycles		0	32	35
P1_TotalKWhr	kWhr	0	32	36
P2_TotalKWhr	kWhr	0	32	37
P3_TotalKWhr	kWhr	0	32	38
P4_TotalKWhr	kWhr	0	32	39
P1_CurrentPower	kW	3	32	40
P2_CurrentPower	kW	3	32	41
P3_CurrentPower	kW	3	32	42
P4_CurrentPower	kW	3	32	43

Control (Read/Write)	Object ID
1	P1_Auto 88
2	P2_Auto 89
3	P3_Auto 90
4	P4_Auto 91
5	Hand_Mode_ON 92
6	P1_Hand_ON 93
7	P2_Hand_ON 94
8	P3_Hand_ON 95
9	P4_Hand_ON 96
10	Silence_Alarm 97
11	
12	
13	
14	
15	
16	

Control (Read/Write)	Units	Decimal Places	bits	Modbus Address (Dec)
Hand_Frequency	Hz	1	16	12
Pressure_Setpoint	psi	1	16	13

Bacnet MS/TP Default Settings:
Com Port 1
RS485
Bacnet MAC Address: 1
Baud Rate: 19,200
Data Bits: 8
Parity: None
Stop Bits: 1

Bacnet IP Default Settings:
IP Address: 192.168.1.24
Bacnet MAC Address: 1
Port: 47808

Bacnet settings must be requested at time of order.

Modbus Communication Protocol

Coils

Alarm# (Read Only)	Modbus Address (Dec)
1	Pump 1 Overload 1600
2	Pump 2 Overload 1601
3	Pump 3 Overload 1602
4	Pump 4 Overload 1603
5	Suction Pressure Sensor Fault 1604
6	Discharge Pressure Sensor Fault 1605
7	Exceeded Maximum Pressure 1606
8	Minimum Pressure Fault 1607
9	Low Suction Pressure 1608
10	Low PLC Battery Power 1609
11	1610
12	1611
13	1612
14	1613
15	1614
16	1615

Pump Status (Read Only)	Modbus Address (Dec)
1	Pump 1 Available 1616
2	Pump 2 Available 1617
3	Pump 3 Available 1618
4	Pump 4 Available 1619
5	Pump 1 On 1620
6	Pump 2 On 1621
7	Pump 3 On 1622
8	Pump 4 On 1623
9	1624
10	1625
11	1626
12	1627
13	1628
14	1629
15	1630
16	1631

Control (Read/Write)	Modbus Address (Dec)
1	Pump 1 Auto/Off 1632
2	Pump 2 Auto/Off 1633
3	Pump 3 Auto/Off 1634
4	Pump 4 Auto/Off 1635
5	Hand Mode Enable 1636
6	Pump 1 Hand ON 1637
7	Pump 2 Hand ON 1638
8	Pump 3 Hand ON 1639
9	Pump 4 Hand ON 1640
10	Silence Alarm 1641
11	1642
12	1643
13	1644
14	1645
15	1646
16	1647

Holding Registers

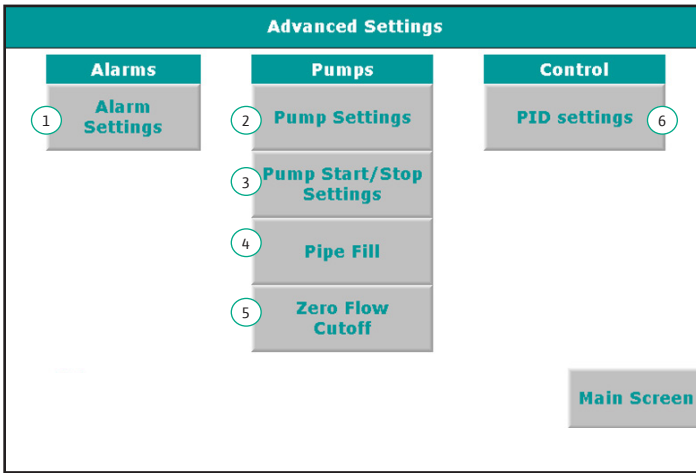
Pump/Motor Information (Read Only)	Decimal Places	bits	Modbus Address (Dec)
Pump 1 Motor Current (A)	2	16	2000
Pump 2 Motor Current (A)	2	16	2001
Pump 3 Motor Current (A)	2	16	2002
Pump 4 Motor Current (A)	2	16	2003
Pump 1 Motor Voltage (V)	0	16	2004
Pump 2 Motor Voltage (V)	0	16	2005
Pump 3 Motor Voltage (V)	0	16	2006
Pump 4 Motor Voltage (V)	0	16	2007
Pump 1 Frequency (Hz)	1	16	2008
Pump 2 Frequency (Hz)	1	16	2009
Pump 3 Frequency (Hz)	1	16	2010
Pump 4 Frequency (Hz)	1	16	2011
Pump 1 Runtime (Hours)	1	32	29072
Pump 2 Runtime (Hours)	1	32	29073
Pump 3 Runtime (Hours)	1	32	29074
Pump 4 Runtime (Hours)	1	32	29075
Pump 1 Run Cycles	0	32	29076
Pump 2 Run Cycles	0	32	29077
Pump 3 Run Cycles	0	32	29078
Pump 4 Run Cycles	0	32	29079
Pump 1 Energy Used (kWhr)	0	32	29080
Pump 2 Energy Used (kWhr)	0	32	29081
Pump 3 Energy Used (kWhr)	0	32	29082
Pump 4 Energy Used (kWhr)	0	32	29083
Pump 1 Current Power (kW)	3	32	29084
Pump 2 Current Power (kW)	3	32	29085
Pump 3 Current Power (kW)	3	32	29086
Pump 4 Current Power (kW)	3	32	29087

Control (Read/Write)	Decimal Places	bits	Modbus Address (Dec)
Hand Control Pump Frequency	1	16	2012
Pressure Setpoint	1	16	2013

Modbus RTU Default Settings:
Com Port 1
RS485
Network ID: 21
Baud Rate: 19,200
Data Bits: 8
Parity: None
Stop Bits: 1

Modbus IP Default Settings:
IP Address: 192.168.1.8
Network ID: 21

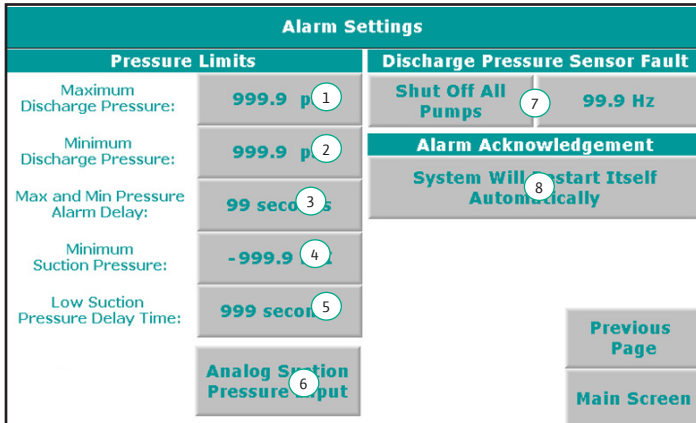
12 1. Advanced Settings



Used for advanced settings. This page is reached from the main page using password 2222.

PID settings page is used to control how fast and accurately the system responds to pressure changes. Generally speaking, raising P value will slow the system down and lowering P value will speed up reaction time. I value works similar but in a stronger way per unit change. At some point, lowering P too much will make the system unstable, or create a large overshoot. Default values P:1250 I:1 D:0

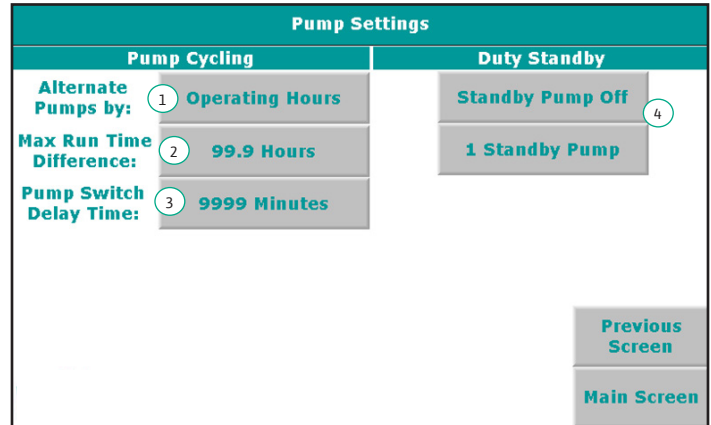
13 Alarm Settings



1. Maximum Discharge Pressure. If this pressure is reached for the time period set in (3) all pumps will be shut off for 1 minute. Default value 200.0 psi. Input range 0.0–232.0 psi
2. Minimum discharge pressure. If pressure falls below this value with all pumps running at full speed, all pumps will be shut off. This alarm is cleared when all pumps are off and the alarm has been acknowledged. (this is the alarm for pipe burst). Default value 20 psi. Input range 0.0–232.0 psi
3. Max and min pressure alarm delay. This is the delay before the alarms in (1) or (2) activate. Default value 2 seconds. Input range 0–10 seconds
4. Minimum suction pressure. This is the minimum value for suction pressure. Pumps will turn off if suction pressure is below the set point for the time duration set in (5). Alarm will clear after 10 seconds with suction pressure above the set point. Default value 1.0 psi. Input range –10.0–200.0 psi.
5. Low suction pressure delay time. Time with suction pressure below set point before alarm activates. Default value 3 seconds. Input range 0–180 seconds.
6. Suction pressure input toggle. Changes between using the analog suction pressure transducer and a digital switch input for suction pressure. Default value: analog input

7. Pressure transducer fault options: Toggles between turning off all pumps in the event of a pressure transducer fault, or running one pump at a specified frequency. Sensor faults activate immediately upon an invalid value. A failed low sensor fault will show a negative value of pressure. A failed high sensor fault will show the max value of pressure. A failed high sensor value often indicates an issue with the PLC I/O card, while a failed low value could be a problem with the sensor connection. Default value is turn off all pumps. Alarm will clear when a valid sensor value is sent.
8. Alarm acknowledgement. Toggles between requiring acknowledgement for alarms to clear, or alarms resetting automatically. Acknowledgement occurs on the alarm screen. Acknowledgement password is 1111.

14 Pump Settings

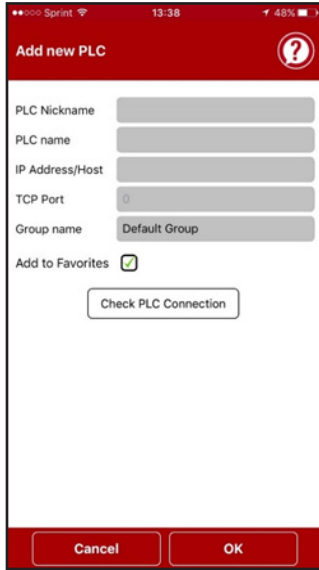


1. Toggles between pumps alternating by operating hours and cyclically. In operating hours mode, the pump with the lowest operating hours will start first, and highest operating hours will start last. If there is ever a time difference between a running pump and an off pump greater than the value set in (2), the highest runtime pump will shut off and the lowest off pump will start. If pumps are operated cyclically, pump 1 will start first, followed by the lowest runtime pump available and will continue by operating hours. After all pumps stop, pump 2 will be the first pump to start. After the duration in (3) has elapsed, a pump will stop and the next pump in the cycle will start. Default value: operating hours.
2. Default value 24 hours. Input range 1–99 hours
3. Default value 360 minutes. Input range 1–1440 minutes.
4. Toggles standby mode on and off. When in standby mode, 1 pump will never start unless another pump has failed. When in 2 pump standby mode, 2 pumps won't start unless 2 other pumps have failed. Default value: off

15 Remote Operation

1. Smart Phone Configuration
 - a. Download and run the “Unitronics Remote Operator” by Unitronics using the App/Play Store application.
 - b. Enter a password to use for the Remote Operator application. This is used to prevent others with access to the device from using the Remote Operator application. This password will only be created the first time running the program.
 - c. Click the “+” symbol at the top of the screen. This will take you to the “Add new PLC” screen.

- i. Enter any nickname for the PLC.
- ii. Enter PLC Name –V700–1 is the default name. See section 08 User Config to change PLC name.
- iii. Enter applicable IP address (Note 1).
- iv. Enter 20256 as the TCP port.
- v. Click on “Check PLC Connection” to verify the connection settings and then click “OK”.



- d. The nickname that was entered should appear on the screen. Click on it to begin connection with the PLC panel.
- e. After connection the phone screen will function the same way as the screen of the PLC panel. To disconnect from the PLC, click on the red arrow pointing left located in the bottom right of the screen.
 - i. Local operation of the touchscreen is still possible while a remote connection is in progress. Only one remote connection is allowed at a time.

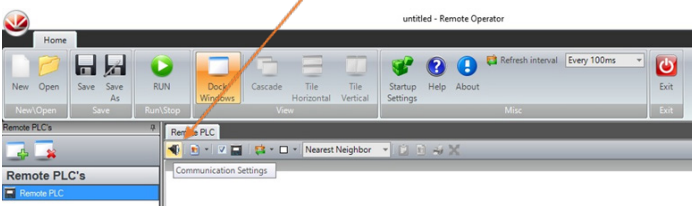
1. Note

If connecting to the PLC from the same network, enter the internal IP address which can be found on the PLC by clicking Menu Page->IP Configuration from the main page.

If connecting to the PLC from outside the network, enter the WAN address of your network as the IP address. This can be obtained from a network administrator. In addition, the network administrator will need to enable port forwarding of port 20256 to the local IP address of the PLC panel. The local IP address can be found on the PLC by clicking Menu Page->IP Configuration.

2. PC Configuration

- a. Download the Remote Operator application from the Unitronics website and install the program. <http://www.unitronics.com/support/downloads>
- b. Open Remote Operator.
- c. Click on “Communication Settings”



- i. Enter Connection Type: Ethernet(Call)

ii. IP Address

1. If connecting to the PLC from the same network, enter the internal IP address which can be found on the PLC by clicking Menu Page->IP Configuration from the main page.
2. If connecting to the PLC from outside the network, enter the WAN address of your network as the IP address. This can be obtained from a network administrator. In addition, the network administrator will need to enable port forwarding of port 20256 to the local IP address of the PLC panel. The local IP address can be found on the PLC by clicking Menu Page->IP Configuration.
3. If connecting to the PLC directly with an Ethernet cable, enter the internal IP address which can be found on the PLC by clicking Menu Page->IP Configuration from the main page. Then, adjust your computers IP settings by going to Windows Control Panel – Networks setup – Connection Properties – TCP/IPv4 Properties – Fixed IP address. IP: 192.168.1.XXX, (XXX can be any number from 2–254 but not 8. [192.168.1.8 is the default PLC IP address. If the default is changed, do not give the computer the same IP address]), Subnet: 255.255.255.0 Gateway: 192.168.1.1 You may need to refresh.

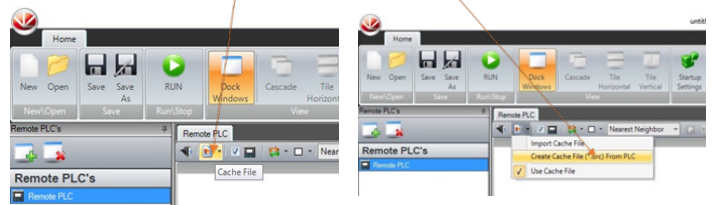
iii. Enter 20256 as the Port Number.

- iv. Enter PLC Name –V700–1 is the default name, (case sensitive). See section 08 User Config to change PLC name.

- v. Left click “Check Connection” If connections are correct, PLC Model etc. will appear. Click OK.

d. Click on Cache File.

- i. Create Cache file from PLC



- ii. Enter a file name and click Next twice.

- iii. After the cache is done loading, click Finish

- e. Go to Save As and enter a file name.
- f. Click Run to operate the panel remotely. Only one remote connection can be made at a time. Local operation of the panel is possible while remotely connected.
- g. To discontinue remote operation, click on the Stop button.
- h. When you run Remote Operator in the future click, first click Open and then choose the appropriate file. After the file is loaded, click Run to make the remote connection.

16 Pump Start/Stop Settings

Pump Start/Stop Settings			
Base Load Pump		Frequency	
Start %:	999.9 %	Minimum Frequency:	99.9 Hz
Base Load Pump Off Delay:	99 seconds	Maximum Frequency:	99.9 Hz
Peak Load Pumps			
Peak Load Pump On Delay:	99.9 seconds		
Peak Load Pump Off Delay:	99.9 seconds		
		Previous Screen	
		Main Screen	

- Base Load Pump settings.
 - Start % is the percentage of the pressure set point at which pumps will start to turn on if no pumps are running. Default value 90%. Input range 75–100%.
 - Base load pump off delay. If pressure is greater the setpoint for this time period with one pump running, the pump will shut off. Default value 10 seconds. Input range 1–60 seconds.
- Peak Load Pump settings.
 - Peak load pump on delay. Time with pump frequency greater than 5% less than max frequency before the next pump will start. Default value 0.5 seconds. Input range 0–60.0 seconds.
 - Off delay. If pressure is 20psi greater than the setpoint for this duration, the next pump will shut off. Default value 0.5 seconds. Input range 0–60 seconds.
- Frequency settings. Sets the min and max frequencies
 - a. Min frequency. Default value 30 Hz. Input range 25–50Hz.
 - b. Max frequency. Default value 60 Hz. Input range 25–60 Hz.

18 Zero Flow Cut-Off

Zero Flow Pump Cut-off	
Delay Time:	9 Minutes
Setpoint Increase:	99.9 PSI
Duration:	999 Seconds
Check Frequency:	99.9 Hz
	Previous Screen
	Main Screen

- Time with one pump running until system checks for no flow. If the system detects no flow, the pump will shut off. Default value: 1 minute. Input range: 1–3 minutes
- Amount that pressure will be raised when the zero flow check is performed. Default value: 5.0 psi. Input range 1.5–15.0 psi
- Duration that the zero flow check will be performed. Default value 10 seconds. Input range 1–180 seconds.
- Check frequency is the pressure below which the zero flow checks will be performed. Default value: 40 Hz. Input range 25.0–60 Hz

17 Pipe Fill Settings

Pipe Fill	
Pipe Fill Enable % :	99.9 %
Pipe Fill Duration :	99 sec
	Pipe Fill OFF
	Previous Screen
	Main Screen

Pipe Fill Mode will only allow one pump to run until either the pressure or time requirement is met.

- Enables and disables pipe fill. Default Off
- Only one pump will run when initially starting until this percentage of the pressure setpoint is reached. Default value 50%. Input range 0–99.9%
- Will only run one pump when starting until this much time has elapse, or the pressure setting is reached, whichever comes first. Default value: 10 seconds. Input range 0–60 seconds.

7.3 CO-Helix PLC levels of access

The PLC includes three levels of control access: monitoring, operator settings and advanced settings. These levels of access prevent unauthorized individuals from accessing parameters that are critical to proper function of the Wilo CO-Helix. If the "Operator Settings" or "Advanced Settings" buttons are pressed from the main screen a keyboard will appear to allow a password to be entered for the requested level of access.

7.3.1 Troubleshooting Guide

FAULT	CAUSE	REMEDIES
Pump(s) do not start	No mains voltage	Inspect fusts, cables and connections
	Main switch "OFF"	Switch on main switch
	Water level in break tank too low, i.e. low-water level reached	Check break tank inlet valve/inlet pipe
	Low-water level switch has triggered	Check intake pressure
	Low-water level switch defective	Check, if necessary replace the lowwater level switch
	Electrodes incorrectly connected or supply pressure switch incorrectly set	Check installation or setting and correct
	Intake pressure exceeds start-up pressure	Check settings and correct if necessary
	Check valve closed at pressure sensor	Inspect, open check valve if necessary
	Start-up pressure set too high	Check setting and correct if necessary
	Fuse defective	Check fuses and replace if necessary
	Motor protection has triggered	Check set values against the pump or motor data, measure current values and correct setting if necessary. Check motor for defects and replace if necessary
	Contactors defective	Check and replace if necessary
	Turn-to-turn fault in motor	Check, if necessary replace motor or have repaired
Pump does (pumps do) not switch off	Intake pressure fluctuates severely	Check intake pressure, if necessary take measures to stabilise supply pressure (e.g. pressure reducer)
	Intake pipe blocked or shut off	Check inlet pipe, if necessary remove blockage or open check valve
	Nominal diameter of inlet pipe too small	Check the inlet pipe, increase the crosssection for the inlet pipe if necessary
	Inlet pipe incorrectly installed	Check inlet pipe, if necessary change pipe guide
	Air in inlet	Check, if necessary seal pipe. Vent pumps
	Impellers blocked	Check pump, if necessary replace or have repaired
	Non-return valve leaking	Check, if necessary replace seal or replace non-return valve
	Non-return valve blocked	Check, if necessary remove blockage or replace non-return valve
	Gate valve in system closed or not sufficiently open	Check, open the check valve completely if necessary
	Volume flow too large	Check pump data and default values and correct if necessary
	Check valve closed at pressure sensor	Inspect, open check valve if necessary
	Switch-off pressure set too high	Check setting and correct if necessary
	Direction of motor rotation false	Check the direction of rotation and correct by changing over the phases if necessary

FAULT	CAUSE	REMEDIES
Switching frequency too high or fluttering	Intake pressure fluctuates severely	Check intake pressure, if necessary take measures to stabilise supply pressure (e.g. pressure reducer)
	Intake pipe blocked or shut off	Check inlet pipe, if necessary remove blockage or open check valve
	Nominal diameter of inlet pipe too small	Check the inlet pipe, increase the crosssection for the inlet pipe if necessary
	Inlet pipe incorrectly installed	Check inlet pipe, if necessary change pipe guide
	Check valve closed at pressure sensor	Inspect, open check valve if necessary
	No diaphragm pressure vessel present (optional or accessory)	Retrofit a diaphragm pressure vessel
	Supply pressure at existing diaphragm pressure vessel incorrect	Check supply pressure and correct if necessary
	Valve on existing diaphragm pressure vessel closed	Check valve and open if necessary
	Existing diaphragm pressure vessel defective	Check the diaphragm pressure vessel and replace if necessary
	Set switching difference too small	Check setting and correct if necessary
Pump(s) produces no or too little pressure	Major fluctuations in Intake pressure	Check intake pressure, if necessary take measures to stabilise supply pressure (e.g. pressure reducer)
	Intake pipe blocked or shut off	Check inlet pipe, if necessary remove blockage or open check valve
	Nominal diameter of inlet pipe too small	Check the inlet pipe, increase the crosssection for the inlet pipe if necessary
	Inlet pipe incorrectly installed	Check inlet pipe, if necessary change pipe routing
	Air in inlet	Check, if necessary seal pipe. Vent pumps
	Impellers blocked	Check pump, if necessary replace or have repaired
	Non-return valve leaking	Check, if necessary replace seal or replace non-return valve
	Non-return valve blocked	Check, if necessary remove blockage or replace non-return valve
	Gate valve in system closed or not sufficiently open	Check, open the check valve completely if necessary
	Low-water level switch has triggered	Check intake pressure
	Direction of motor rotation false	Check direction of rotation and correct by changing over phases if necessary
Turn-to-turn fault in motor	Check, if necessary replace motor or have repaired	
Dry-running protection system switches off, although water is present	Major fluctuations in Intake pressure	Check intake pressure, if necessary take measures to stabilise supply pressure (e.g. pressure reducer)
	Nominal diameter of inlet pipe too small	Check the inlet pipe, increase the crosssection for the inlet pipe if necessary
	Inlet pipe incorrectly installed	Check inlet pipe, if necessary change pipe guide
	Volume flow too large	Check pump data and default values and correct if necessary
	Electrodes incorrectly connected or supply pressure switch incorrectly set	Check installation or setting and correct
	Low-water level switch defective	Check, if necessary replace the lowwater level switch
Dry-running protection does not switch off, although water low	Electrodes incorrectly connected or supply pressure switch incorrectly set	Check installation or setting and correct
	Low-water level switch defective	Check, if necessary replace the lowwater level switch

7.4 CO-Helix PLC commissioning

We recommend that Wilo USA's after-sales service commissions the system. Contact your dealer, nearest Wilo USA representative, or the Wilo USA service department directly.

8 Commissioning/decommissioning

To guarantee maximum operational reliability at the lowest possible operating cost, we recommend inspecting and maintaining the Wilo CO-Helix regularly. It is advisable to have a maintenance agreement with a specialist company or with our after-sales service department. The following inspections should be made regularly:

- Check that the Wilo CO-Helix is ready to operate.
- Check the mechanical seal of the pump. The mechanical seal needs water for lubrication and small quantities of it can leak out of the seal. If the volume increases, change the mechanical seal.

Check the **diaphragm pressure vessel** (every 3 months is recommended) to make sure that the **supply pressure** is set correctly, please refer to the diaphragm pressure vessel recommended charge section in this document for guidance (Section 6.2.5.1).



CAUTION! Risk of damage!

The function of the diaphragm vessel is compromised and can lead to system faults.

Set the tank pressure to the correct level. Isolate (see step 1 of figure 5d) the pumps and system from the discharge side and upstream piping of the manifold. Drain the water from the discharge manifold. Check the gas pressure at the valve (see step 2 figure 5d) of the diaphragm pressure vessel. Use an air pressure gauge and correct the pressure as required.

To assure proper air flow to the control panel, inlet and outlet air filters for the panel fan must be cleaned periodically. If the system is out of service for a long period drain all the pumps by opening the drainage plug on the bottom of the pump base.

9 Faults, causes and remedies

Faults, particularly those affecting the pumps or control system, should only be remedied by Wilo USA's after-sales service or a specialist company.



NOTE!

The general safety instructions must be observed when doing any maintenance or repair work. Also reference the Installation and Operating Instructions for the Wilo Helix pumps.

10 Spare parts

Spare parts or repairs may be ordered from local service technicians or the Wilo USA aftersales service department. To avoid incorrect orders, all data on the name plate should be submitted with each order.

Subject to change without prior notice!

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