Pioneering for You

Wilo DDI-I

en Installation and operating instructions

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1 General information

1.1 About these instructions

These instructions form part of the product. Compliance with the instructions is essential for correct handling and use:

- Read the instructions carefully before all activities.
- Keep the instructions in an accessible place at all times.
- Observe all product specifications.
- Observe the markings on the product.

The language of the original operating instructions is German. All other languages of these instructions are translations of the original operating instructions.

1.2 Copyright

Copyright for these instructions and the Digital Data Interface software remains with Wilo. Content of any kind must not be reproduced, distributed or used by unauthorised persons for purposes of competition and shared with others.

The name Wilo, Wilo logo and Nexos name are registered brands of Wilo. Any other names and designations may be brands or registered brands of their corresponding owners. The Digital Data Interface user interface provides an overview of licences used ("License" menu).

1.3 Network connection (LAN)

Integrate the product into a local Ethernet network (LAN) to enable correct functionality (configuration and operation). There is a risk of unauthorised network access to Ethernet networks. This may enable product manipulations. For this reason, the statutory stipulations or other internal regulations as well as the following specifications must be adhered to:

- Deactivate unused communication channels.
- Assign secure access passwords.
- Immediately change default passwords.
- Install an additional security appliance upstream.
- Adhere to protective measures specified in the current IT security requirements and applicable standards (e.g. setting up VPN for remote access).

Wilo shall not be liable for damage to the product or damage caused by the product provided this comes as a result of the network connection or access to said network.

1.4 Scope of software functions

These instructions describe the complete functional scope of the Digital Data Interface software. However, customers are exclusively entitled to the Digital Data Interface software scope specified in the order confirmation. Customers are welcome to retrospectively purchase any other available Digital Data Interface software functions.

1.5 Personal data

Personal data is not processed in connection with the use of the product. **NOTICE! Do not enter any personal data (e.g. e-mail address, phone number, etc.) in the fields for the installation and maintenance logbook to prevent conflicts with data protection specifications!**

1.6 Subject to change

Wilo shall reserve the right to change the listed data without notice and shall not be liable for technical inaccuracies and/or omissions. The illustrations used may differ from the original and are intended as an exemplary representation of the product.

1.7 Exclusion from warranty and liability

Wilo shall specifically not assume any warranty or liability in the following cases:

- Network on site not available or unstable
- Damage (directly or indirectly) as a result of technical issues, e.g. server failure, transfer errors
- Damage caused by third-party suppliers' external software
- Damage caused by third parties, e.g. hacking, virus
- Unauthorised modifications to the Digital Data Interface software
- Non-compliance with these instructions
- Improper use
- Incorrect storage or transport
- Incorrect installation or dismantling

2 Safety

2.1 Personnel qualifications

Electrical connection

- Electrical work: qualified electrician

Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.

- Network knowledge
  Assemble network cables

Operation

- Safe handling of web-based user interfaces
- Specialist language skills in English, for the following specialist areas
  - Electrical engineering, specialising in frequency converters
  - Pump technology, specialising in operating pump systems
  - Network technology, configuring network components

2.2 Electrical work

- Electrical work must be carried out by a qualified electrician.
- Before commencing work, disconnect the product from the mains and safeguard it from being switched on again.
- Observe applicable local regulations when connecting to the mains power supply.
- Adhere to the requirements of the local energy supply company.
- Earth the product.
- Observe technical information.
- Replace a defective connection cable immediately.

2.3 Functional safety

Note the following if the pump is operated within explosive environments:

- Install dry-running protection and connect using an Ex-i evaluation relay.
- Connect level sensor via a Zener barrier.
- Connect thermal motor monitoring using Ex-certified evaluation relay. It is possible to retrofit the "MCB 112" PTC thermistor card in the frequency converter for a connection to the Wilo-EFC!
- In connection with a frequency converter, connect dry-running protection and thermal motor monitoring to the Safe Torque Off (STO).

SIL level

Provide safety equipment with SIL-Level 1 and hardware fault tolerance 0 (according to DIN EN 50495, category 2). Consider all components within the safety circuit for system assessment. Refer to the individual components' manufacturer's instructions for the required information.

Ex rating sensor CLP01

- The built-in capacitive sensor CLP01 is type-tested separately according to guideline 2014/34/EU.
- The label is: II 2G Ex db IIB Gb.

- The sensor also meets the requirements according to IECEx on the basis of the prototype test.

2.4 Data security

All network requirements, in particular network security requirements, must be complied with to integrate the product into the network. For this purpose, buyers or operators must comply with all valid, national and international directives (e.g. Kritis Directive) or statutory stipulations.

2.5 Emergency operation in applications critical to safety

The pump and frequency converter are controlled by the parameters input at the corresponding device. The pump also overwrites the frequency converter's parameter set 1 in LPI and LSI mode. We recommend creating a backup of corresponding configurations and saving them in a central location to guarantee fast troubleshooting.

NOTICE! It is possible to save a further configuration in the frequency converter in applications critical to safety. In the event of a fault, the frequency converter can be operated in emergency operation using this configuration.

3 Product description

3.1 Structure

The Digital Data Interface is a communication module with integrated web server that has been integrated in the motor. It is accessed and controlled in an Internet browser using a graphical user interface. The user interface enables easy pump configuration, control and monitoring. Different sensors may have been installed in the pump for this purpose. External signal transmitters may also input additional system parameters in the control. The Digital Data Interface is capable of the following, depending on the system mode:

- Pump monitoring.
- Controlling the pump with a frequency converter.
- Controlling the complete system with up to four pumps.

3.2 System modes

The Digital Data Interface can be licensed for three different system modes:

- DDI system mode
  System mode with no control function. Only temperature and vibration sensor values are recorded, evaluated and saved. The pump and the frequency converter (if present) are controlled via the operator's primary control.
- LPI system mode
  System mode with control function for frequency converters and clogging detection. The pump/frequency converter pairing works as a unit: the frequency converter is controlled through the pump. This allows clogging detection to be carried out and, if necessary, a cleaning process to be started. Level-dependent control of the pump takes place via the operator's primary control.
- LSI system mode
  System mode for complete control of the pumping station with up to four pumps. In this process, one pump operates as the master and all other pumps are slaves. The master pump controls all other pumps depending on the system-specific parameters.

Licence keys enable system mode. System modes with less comprehensive functional scopes are included.

3.3 Functional overview depending on the system mode

Function	System mode		
	DDI	LPI	LSI
User interface			
Web server	•	•	•

Function	System mode		
	DDI	LPI	LSI
Language selection	•	•	•
User password	•	•	•
Uploading/downloading the configuration	•	•	•
Resetting to factory setting	•	•	•
Data display			
Rating plate data	•	•	•
Test protocol	o	o	o
Installation logbook	•	•	•
Maintenance logbook	•	•	•
Recording and saving data			
Internal sensors	•	•	•
Internal sensors via fieldbus	•	•	•
Frequency converter	–	•	•
Pumping station	–	–	•
Interfaces			
Support for external inputs/outputs	•	•	•
ModBus TCP	•	•	•
OPC UA	o	o	o
Controlling the frequency converter	–	•	•
Control functions			
Non-immersed operation	–	•	•
Clogging detection/cleaning process	–	•	•
External control values (analogue/digital)	–	•	•
External off	–	•	•
Pump kick	–	•	•
Dry-running protection	–	•	•
Flood control	–	•	•
Pump cycling	–	–	•
Standby pump	–	–	•
Selecting the pump operation mode	–	–	•
Level control with level sensor and float switch	–	–	•
PID control	–	–	•
Redundant master pump	–	–	•
Alternative stop levels	–	–	•
High Efficiency (HE) controller	–	–	•

Key
– = Not available, o = Optional, • = Available

3.4 Inputs

The Digital Data Interface features two integrated sensors and nine connections for external sensors.

Internal sensors (onboard)
- Temperature
  Records the current temperature of the Digital Data Interface module.
- Vibration
  Records the current vibrations at the Digital Data Interface along three axes.

Internal sensors (in motor)
- 5x Temperature (Pt100, Pt1000, PTC)
- 2x Analogue inputs 4–20 mA
- 2x Inputs for vibration sensors (at max. 2 channels)

3.5 I/O modules – additional inputs and outputs

A host of measuring data is required to control the pump/frequency converter combination (LPI system mode) or the complete system (LSI system mode). Usually the frequency converter provides a sufficient number of analogue and digital inputs and outputs. If required, inputs and outputs can be supplemented by two I/O modules:

- Wilo IO 1 (ET-7060): 6x Digital inputs and outputs
- Wilo IO 2 (ET-7002): 3x Analogue and 6x digital inputs, 3x digital outputs

NOTICE

Wilo IO 2 for LSI system mode is mandatory!

Include Wilo IO 2 (ET-7002) in system planning to record all required measured values! System control is not possible without Wilo IO 2.

4 Electrical connection

DANGER

Risk of fatal injury due to electrical current!

Improper conduct when carrying out electrical work can lead to death due to electric shock!

- Electrical work must be carried out by a qualified electrician!
- Observe local regulations!

DANGER

Risk of explosion due to incorrect connection!

If the pump is used in an explosive atmosphere, there is a risk of explosion due to incorrect connection. Observe the following points:

- Install dry-running protection.
- Connect float switch via Ex-i evaluation relay.
- Connect level sensor via Zener barrier.
- Connect thermal motor monitoring and dry-running protection to "Safe Torque Off (STO)".
- Observe information in chapter "Electrical connection in potentially explosive atmospheres"!

4.1 Personnel qualifications

- Electrical work: qualified electrician
  Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Network knowledge
  Assemble network cables

4.2 Prerequisites

Overview of required components depending on the applied system mode:

Prerequisite	System mode		
	DDI	LPI	LSI
Installation without Ex			
Pump with Digital Data Interface	•	•	•
24 VDC control voltage	•	•	•
Evaluation device for PTC sensor	•	•	•
Frequency converter Wilo-EFC with Ethernet module “MCA 122” (ModBus TCP module)	–	•	•
Primary control for setpoint or start/stop specification	–	•	o
Float switch for dry-running protection	–	o	o
Level sensor for specification of setpoint	–	–	•
Network switch (LAN switch)	•	•	•
Wilo IO 1 (ET-7060)	o	o	–
Wilo IO 2 (ET-7002)	o	o	•

Prerequisite	System mode		
	DDI	LPI	LSI
Additional requirements for installations with Ex			
"MCB 112" Wilo-EFC PTC thermistor card enhancement or evaluation device with Ex rating for PTC sensor	•	•	•
Float switch for dry-running protection with Ex cut-off relay	•	•	•
Zener barrier for level sensor	–	–	•

Key

– = Not required, o = If required, • = Mandatory

4.3 Digital Data Interface connection cable

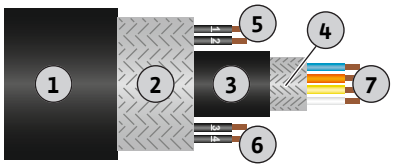


Fig. 1: Hybrid cable diagram

Description

A hybrid cable is used as the control cable. The hybrid cable merges two cables in one:

- Signal cable for control voltage and winding monitor
- Network cable

Pos.	Wire no/colour	Description
1		Outer cable sheath
2		Outer cable shielding
3		Inner cable sheath
4		Inner cable shielding
5	1 = +	Connection wires for Digital Data Interface power supply. Operating voltage: 24 VDC (12–30 V FELV, max. 4.5 W)
	2 = -	
6	3/4 = PTC	PTC sensor connection wires in the motor winding. Operating voltage: 2.5 to 7.5 VDC
7	White (wh) = RD+	Prepare the network cable and install the supplied RJ45 plug.
	Yellow (ye) = TD+	
	Orange (og) = TD-	
	Blue (bu) = RD-	

NOTICE! Widely position cable shielding!

Technical data

- Type: TECWATER HYBRID DATA
- Wires, outer cable bundle: 4x0.5 ST
- Wires, inner cable bundle: 2x 2x22AWG
- Material: Special elastomer, irradiated, resistant to water and oil, dual shielding
- Diameter: approx. 13.5 mm
- Bend radius: 81 mm
- Max. water temperature: 40 °C
- Ambient temperature: -25 °C to 40 °C

4.4 DDI system mode

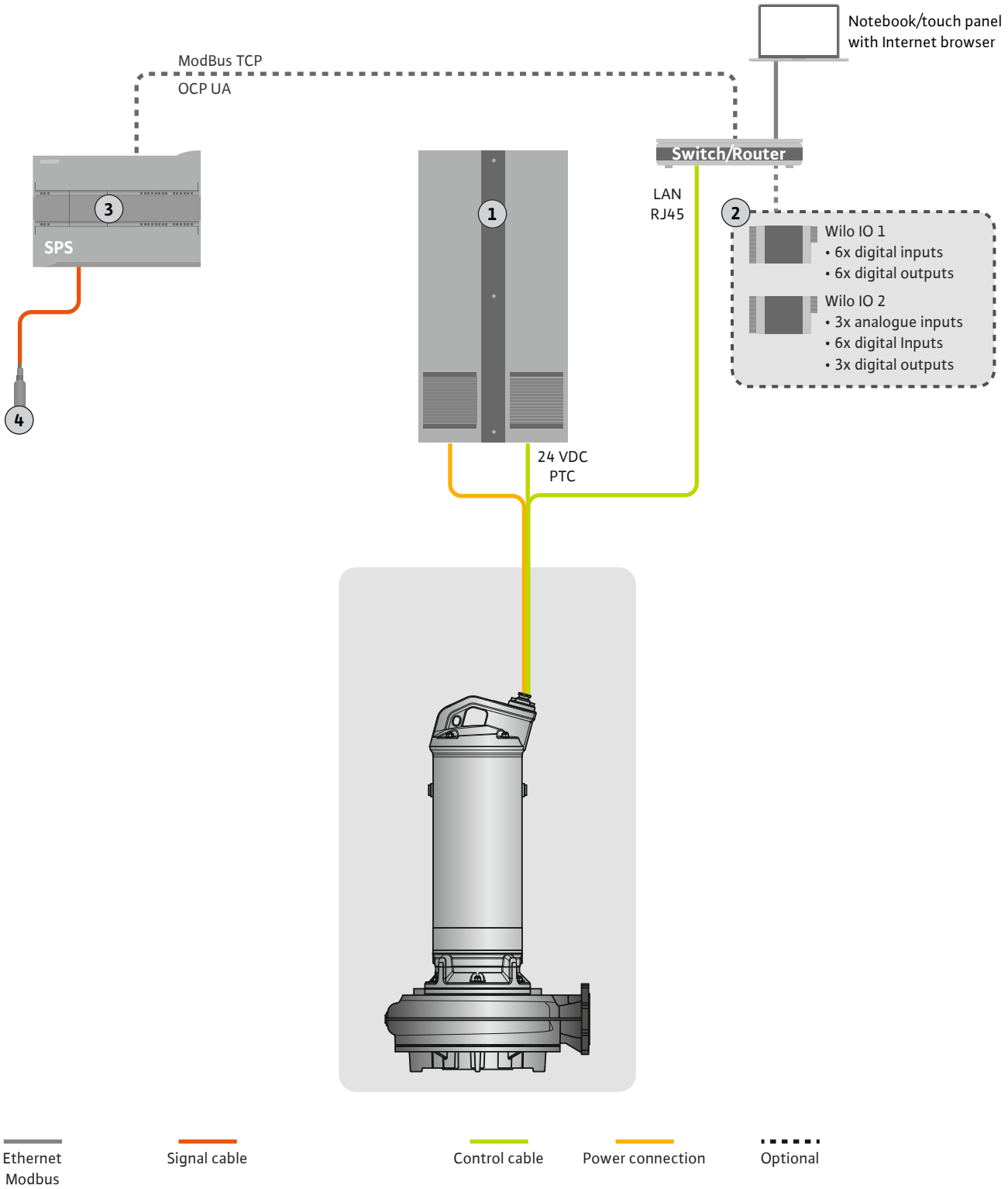


Fig. 2: Installation suggestion

1	Switch cabinet
2	I/O modules with digital and analogue inputs/outputs
3	Operator-side, primary control
4	Level sensor

4.4.1 Pump mains connection

Connect the motor to the on-site switching system. Please refer to the manufacturer's instructions for data about the activation type and motor connection!

NOTICE! Widely position cable shielding!

4.4.2 Digital Data Interface power supply connection

Connect the Digital Data Interface power supply to the on-site switching system:

- Operating voltage: 24 VDC (12–30 V FELV, max. 4.5 W)
- Wire 1: +
- Wire 2: –

4.4.3 Connecting PTC sensors to the motor winding

Pt100 or Pt1000 sensors installed in the motor winding are used for thermal motor monitoring as part of software. View and adjust current temperature values and configure limit temperatures with the user interface. PTC sensors installed in the hardware define the maximum winding temperature and switch off the motor in an emergency.

CAUTION! Perform a functional check! Check the resistance prior to connecting the PTC sensor. Use an ohmmeter to measure the temperature sensor's resistance. PTC sensors have a cold resistance between 60 and 300 ohm.

Connecting the PTC sensor to the on-site switching system:

- Operating voltage: 2.5 to 7.5 VDC
- Wires: 3 and 4
- Evaluation relay for PTC sensor, e.g. for enhancing the "MCB 112" Wilo-EFC PTC thermistor board or "CM-MSS" relay

DANGER

Risk of explosion due to incorrect connection!

There is a risk of fatal injury within potentially explosive atmosphere if thermal motor monitoring has been connected incorrectly! The connection must always be carried out by a qualified electrician. If used in potentially explosive atmospheres:

- Connect thermal motor monitoring via an evaluation relay!
- Deactivation by the temperature limiter must be conducted with reactivation lock! It must only be possible to restart the unit once the unlock key has been actuated by hand!

4.4.4 Network connection

Prepare the network control cable and install the enclosed RJ45 plug. Connect to a network socket.

4.5 LPI system mode

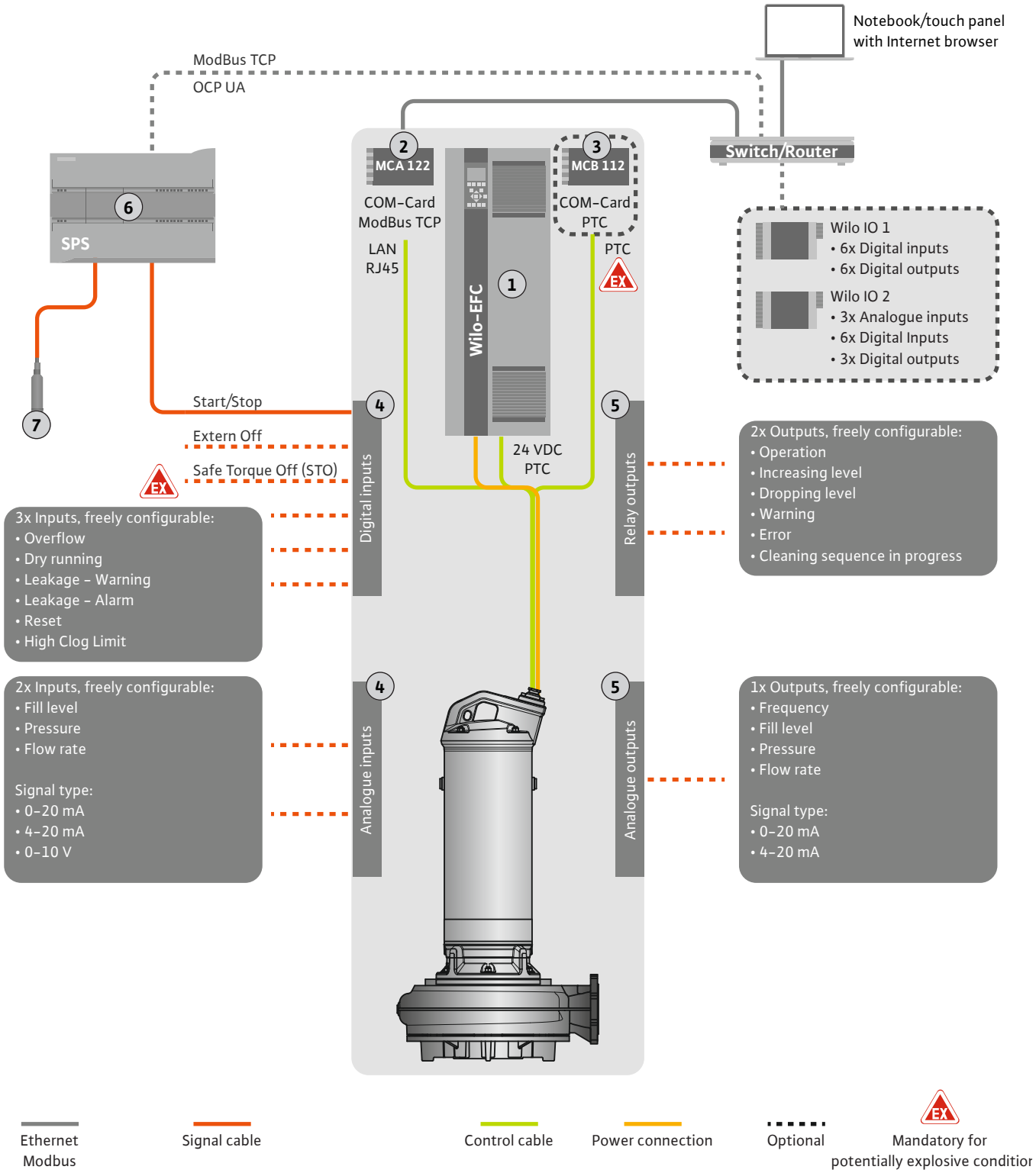


Fig. 3: Installation suggestion with start/stop

1	Frequency converter
2	"MCA 122" extension module for frequency converter (included in scope of de-livery)
3	"MCB 112" extension module for frequency converter
4	Inputs at frequency converter
5	Outputs at frequency converter
6	Operator-side, primary control
7	Level sensor

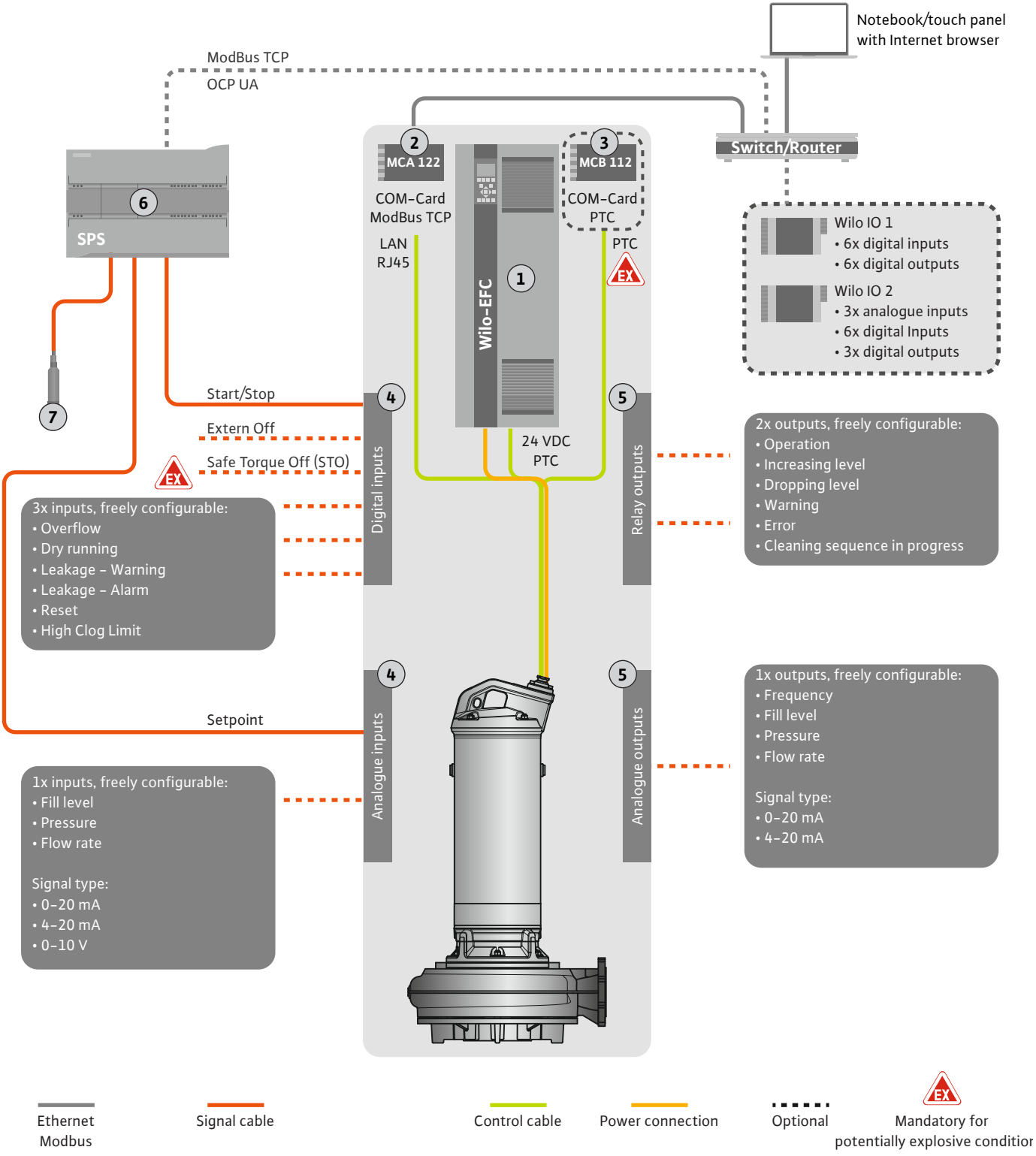


Fig. 4: Installation suggestion with analogue setpoint specifications

1	Frequency converter
2	"MCA 122" extension module for frequency converter (included in scope of de-livery)
3	"MCB 112" extension module for frequency converter
4	Inputs at frequency converter
5	Outputs at frequency converter
6	Operator-side, primary control
7	Level sensor

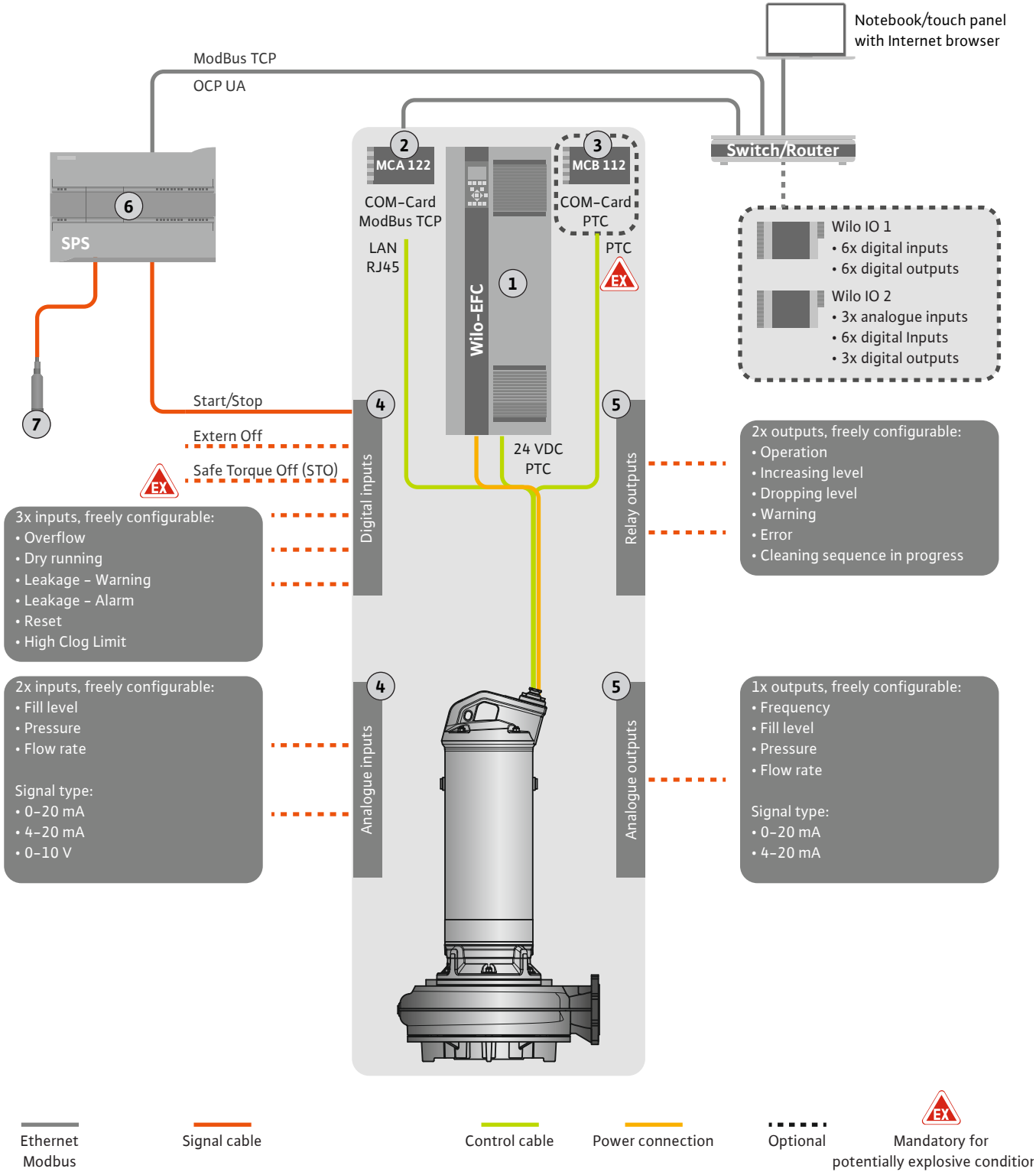


Fig. 5: Installation suggestion with ModBus

1	Frequency converter
2	"MCA 122" extension module for frequency converter (included in scope of de-livery)
3	"MCB 112" extension module for frequency converter
4	Inputs at frequency converter
5	Outputs at frequency converter
6	Operator-side, primary control
7	Level sensor

4.5.1 Mains connection, pump

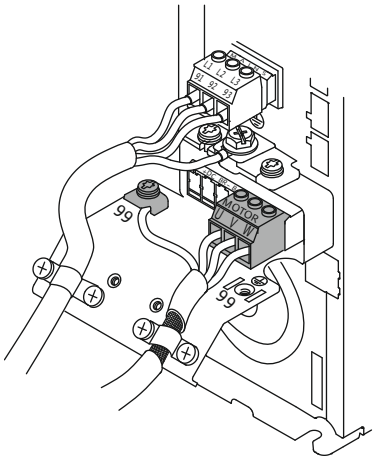


Fig. 6: Pump connection: Wilo-EFC

Wilo-EFC frequency converter

Terminal	Wiring diagram
96	U
97	V
98	W
99	Earth (PE)

Insert the motor connection cables into the frequency converter through the threaded cable gland. Connect the wires as per the connection diagram.

NOTICE! Widely position cable shielding!

4.5.2 Digital Data Interface power supply connection

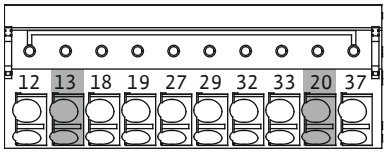


Fig. 7: Wilo-EFC terminal

Wilo-EFC frequency converter

Terminal	Control cable wire	Description
13	1	Power supply: +24 VDC
20	2	Power supply: Reference potential (0 V)

4.5.3 Connecting PTC sensors to the motor winding

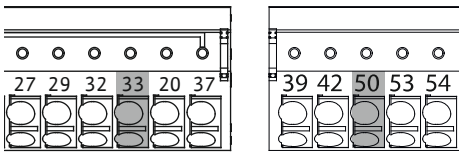


Fig. 8: Wilo-EFC terminal

Wilo-EFC frequency converter

DANGER

Risk of fatal injury due to incorrect connection!

If the pump is used in explosive atmospheres, observe chapter "Electrical connection in potentially explosive atmospheres"!

Terminal	Control cable wire	Description
50	3	+10 VDC power supply
33	4	Digital input: PTC/WSK

Pt100 or Pt1000 sensors installed in the motor winding are used for thermal motor monitoring as part of software. View and adjust current temperature values and configure limit temperatures with the user interface. PTC sensors installed in the hardware define the maximum winding temperature and switch off the motor in an emergency.

CAUTION! Perform a functional check! Check the resistance prior to connecting the PTC sensor. Use an ohmmeter to measure the temperature sensor's resistance. PTC sensors have a cold resistance between 60 and 300 ohm.

4.5.4 Network connection

Wilo-EFC frequency converter

Prepare the network control cable and install the enclosed RJ45 plug. Connect to a network socket, e.g. at the "MCA 122" Ethernet module.

4.5.5 Connecting digital inputs

Note the following when connecting digital inputs:

- Use shielded cables.
- The unit automatically configures parameters during initial commissioning. Individual digital inputs are pre-assigned as part of this process. It is not possible to modify pre-assignments!
- Assign the corresponding function in the Digital Data Interface to guarantee correct functionality of freely configurable inputs.

DANGER

Risk of fatal injury due to incorrect connection!

If the pump is used in explosive atmospheres, observe chapter "Electrical connection in potentially explosive atmospheres"!

NOTICE

Observe the manufacturer's instructions!

For more information, read and comply with the frequency converter instructions.

Frequency converter: Wilo-EFC

- Input voltage: +24 VDC, terminal 12 and 13
- Reference potential (0 V): Terminal 20

Terminal	Function	Contact type
18	Start	Normally open contact (NO)
27	External off	Normally closed contact (NC)
37	Safe Torque Off (STO)	Normally closed contact (NC)
19, 29, 32	Freely configurable	

Description of preassigned input functions:

- Start
  Input/output signal from primary control. **NOTICE! If the input is not required, install a converter bridge between terminals 12 and 18!**
- External off
  Remote deactivation using a separate switch. **NOTICE! The input directly switches over the frequency converter!**
- Safe Torque Off (STO) – safe deactivation **NOTICE! If the input is not required, install a converter bridge between terminals 12 and 27!**
  Hardware shutdown of the pump by the frequency converter, independent of the pump control. Automatic reactivation is not possible (reactivation lock). **NOTICE! If the input is not required, install a converter bridge between terminals 12 and 37!**

It is possible to assign the following functions to available inputs at the Digital Data Interface:

- High Water
  Signal for overflow level.
- Dry Run
  Signal for dry-running protection.
- Leakage Warn
  Signal for external sealing chamber monitoring. A warning message is output in the event of a fault.
- Leakage Alarm
  Signal for external sealing chamber monitoring. The pump is shut down in the event of a fault. Modify the alarm type in the configuration to define the downstream response.
- Reset
  External signal to reset error messages.
- High Clogg Limit
  Activating higher tolerance ("Power Limit – High") for clogging detection.

Contact type for the corresponding function

Function	Contact type
High Water	Normally open contact (NO)
Dry Run	Normally closed contact (NC)
Leakage Warn	Normally open contact (NO)

Function	Contact type
Leakage Alarm	Normally open contact (NO)
Reset	Normally open contact (NO)
High Clogg Limit	Normally open contact (NO)

4.5.6 Connecting analogue inputs

Note the following when connecting analogue inputs:

- Use shielded cables.
- You can freely configure the corresponding functions for analogue inputs. Assign corresponding functions in the Digital Data Interface!

NOTICE

Observe the manufacturer's instructions!

For more information, read and comply with the frequency converter instructions.

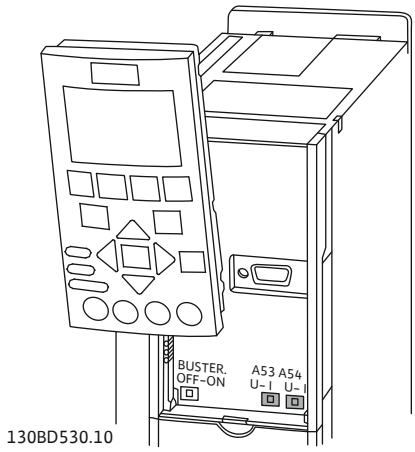


Fig. 9: Position for switches A53 and A54

Wilo-EFC frequency converter

- Supply voltage: 10 VDC, 15 mA or 24 VDC, 200 mA
- Terminals: 53, 54
  The individual connection depends on the installed sensor type. **CAUTION! Note the manufacturer's instructions on information about how to correctly connect the unit!**
- Measurement range: 0...20 mA, 4...20 mA or 0...10 V.
  Additionally adjust the signal type (voltage (U) or current (I)) using two switches at the frequency converter. The two switches (A53 and A54) are located below the frequency converter display. **NOTICE! Also adjust the measurement range in the Digital Data Interface!**

It is possible to assign the following functions to the Digital Data Interface:

- External Control Value
  Setpoint specification to control the pump speed as part of an analogue signal from primary control.
- Level
  Recording the current fill level to record data. Basis for the "Increasing" and "Dropping" level functions at the digital output.
- Pressure
  Recording the current system pressure to record data.
- Flow
  Recording the current flow rate to record data.

4.5.7 Relay output connection

Note the following when connecting relay outputs:

- Use shielded cables.
- You can freely configure the corresponding functions for relay outputs. Assign corresponding functions in the Digital Data Interface!

NOTICE

Observe the manufacturer's instructions!

For more information, read and comply with the frequency converter instructions.

Wilo-EFC frequency converter

- 2x type C relay outputs. **NOTICE! Note the manufacturer instructions for exact relay output positioning!**
- Switching capacity: 240 VAC, 2 A
  A higher switching capacity can be applied at relay output 2 on the NO contact (terminal: 4/5): max. 400 VAC, 2 A

Terminal	Contact type
Relay output 1	
1	Centre terminal (COM)

Terminal	Contact type
2	Normally open contact (NO)
3	Normally closed contact (NC)
Relay output 2	
4	Centre terminal (COM)
5	Normally open contact (NO)
6	Normally closed contact (NC)

It is possible to assign the following functions to the Digital Data Interface:

- Run
  Individual run signal of the pump
- Rising Level
  Message for increasing level.
- Falling Level
  Message for dropping level.
- Warning
  Individual fault signal of the pump: Warning.
- Error
  Individual fault signal of the pump: Alarm.
- Cleaning
  Message when the cleaning sequence of the pump is started.

4.5.8 Connecting analogue outputs

Note the following when connecting the analogue output:

- Use shielded cables.
- You can freely configure the corresponding functions for the output. Assign corresponding functions in the Digital Data Interface!

NOTICE

Observe the manufacturer's instructions!

For more information, read and comply with the frequency converter instructions.

Wilo-EFC frequency converter

- Terminal: 39/42
- Measurement range: 0...20 mA or 4...20 mA
  NOTICE! Also adjust the measurement range in the Digital Data Interface!

It is possible to assign the following functions to the Digital Data Interface:

- Frequency
  Current actual frequency output.
- Level
  Current fill level output. **NOTICE! For output, connect a corresponding signal transmitter to an input!**
- Pressure
  Current operating pressure output. **NOTICE! For output, connect a corresponding signal transmitter to an input!**
- Flow
  Display of the current flow quantity. **NOTICE! For output, connect a corresponding signal transmitter to an input!**

4.5.9 Connection input/output extensions (LPI mode)

NOTICE

Take note of additional literature!

To ensure proper use, additionally read and observe the manufacturer instructions.

	Wilo IO 1	Wilo IO 2
General		
Type	ET-7060	ET-7002
Mains connection	10 … 30 VDC	10 … 30 VDC
Operating temperature	-25 … +75 °C	-25 … +75 °C
Dimensions (WxLxH)	72x123x35 mm	72x123x35 mm
Digital inputs		
Number	6	6
Voltage level "On"	10 … 50 VDC	10 … 50 VDC
Voltage level "Off"	max. 4 VDC	max. 4 VDC
Relay outputs		
Number	6	3
Contact type	Normally open contact (NO)	Normally open contact (NO)
Switching capacity	5 A, 250 VAC/24 VDC	5 A, 250 VAC/24 VDC
Analogue inputs		
Number	–	3
Configurable measurement range	–	Yes, with jumper
Potential measurement ranges	–	0 … 10 V, 0 … 20 mA, 4 … 20 mA

Please refer to the manufacturer's instructions for all further technical data.

Installation

NOTICE! Refer to the manufacturer's instructions for any information on how to change the IP address and installation!

1. Adjust the signal type (current or voltage) for the measurement range: Install the jumper.
   NOTICE! Adjust the measurement range in the Digital Data Interface and send to the I/O module. Do not set the measurement range in I/O module.
2. Secure the module in the switch cabinet.
3. Connect inputs and outputs.
4. Connect the mains connection.
5. Configure the IP address.
6. Configure the type of I/O module used in the Digital Data Interface.

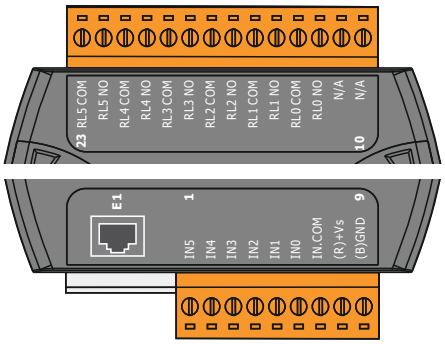


Fig. 10: Wilo IO 1 (ET-7060)

I/O module overview

Terminal 1 ... 7	Digital inputs
Terminal 8	Mains connection (+)
Terminal 9	Mains connection (-)
Terminal 12 ... 23	Relay outputs, normally open contact (NO)

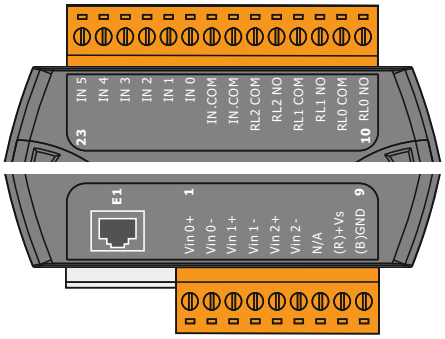


Fig. 11: Wilo IO 2 (ET-7002)

Terminal 1 ... 6	Analogue inputs
Terminal 8	Mains connection (+)
Terminal 9	Mains connection (-)
Terminal 10 ... 15	Relay outputs, normally open contact (NO)
Terminal 16 ... 23	Digital inputs

Input and output functions

It is possible to assign the same functions to the inputs and outputs and the frequency converter. **NOTICE! Connected inputs and outputs at the Digital Data Interface!** ("Settings ➔ I/O Extension")

4.6 LSI system mode

In the "LSI" system mode, the pumping station is completely controlled via the Digital Data Interface. Here, a system consists of at least the following products:

- Up to four pumps, each pump with Digital Data Interface and own frequency converter
- An I/O2 module
- A level sensor for the setpoint specification

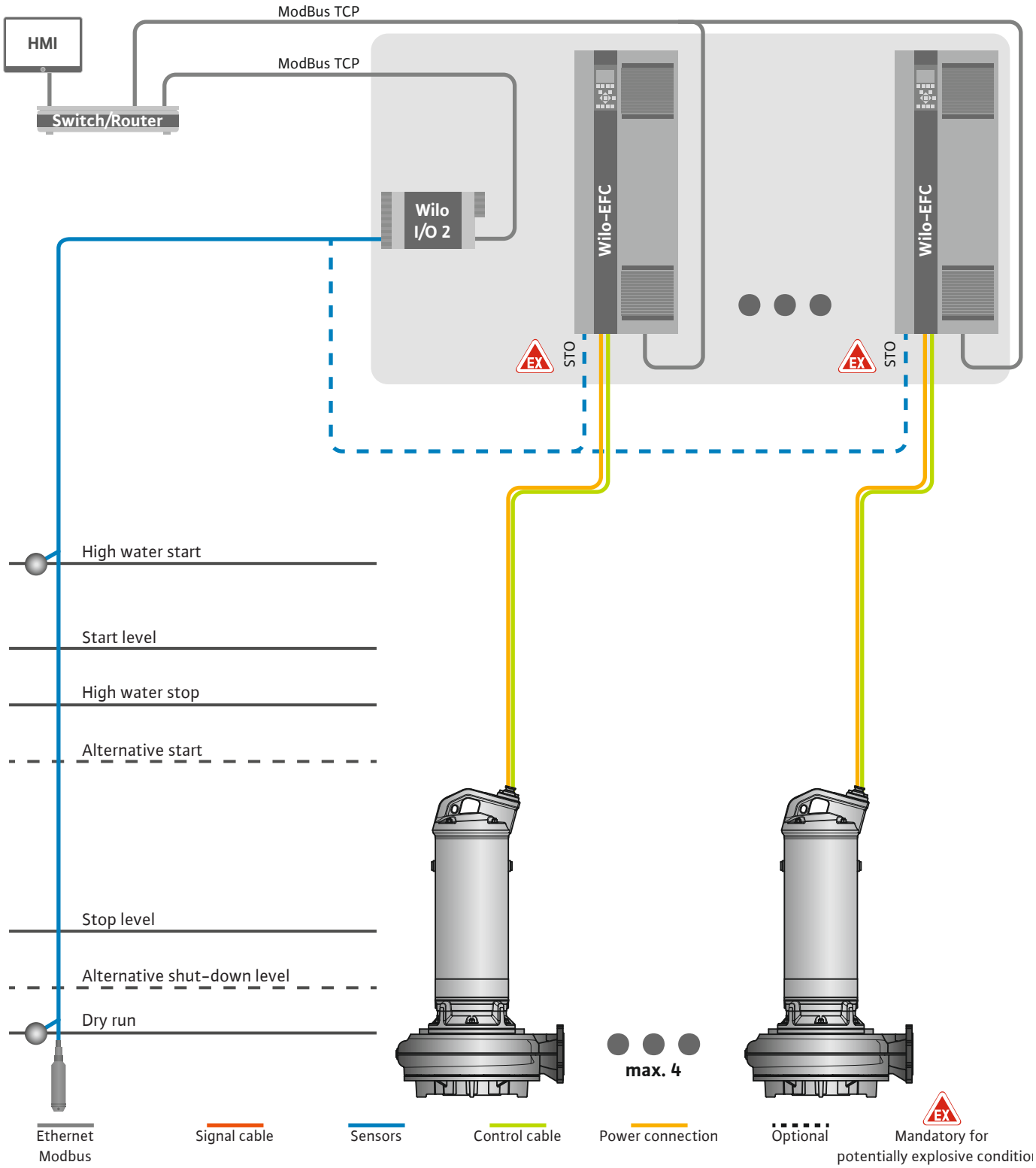


Fig. 12: Connection of LSI system mode: System overview

Here, the pumping station works autonomously and does not require a higher-level control system. For limited interaction with a higher-level controller, various functions are available at the outputs or via fieldbus:

- System approval
- Signalling of faults and warnings
- Transfer of measured values

CAUTION! An intervention of the higher-level control system outside the defined channels can cause the system to malfunction!

The cross-system parameters for sensors and control triggers are centrally connected to the I/O module. The corresponding functions are assigned via the Digital Data Interface.

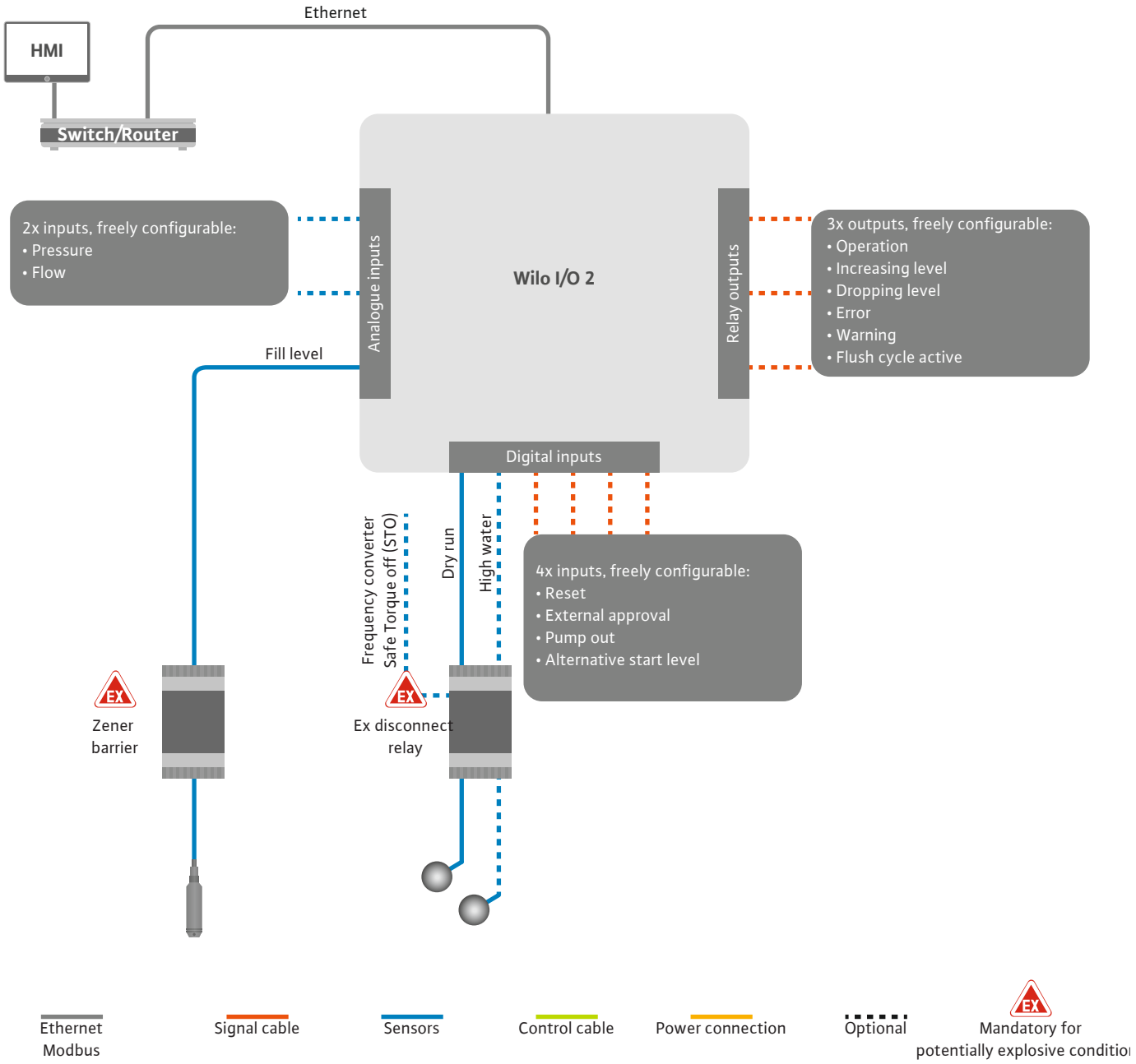


Fig. 13: Connection of LSI system mode: I/O2 module

The pump parameters (operating and fault messages) for the single pump are recorded via the frequency converter. In addition, current measured values can be output via the frequency converter. The functions are assigned via the Digital Data Interface.

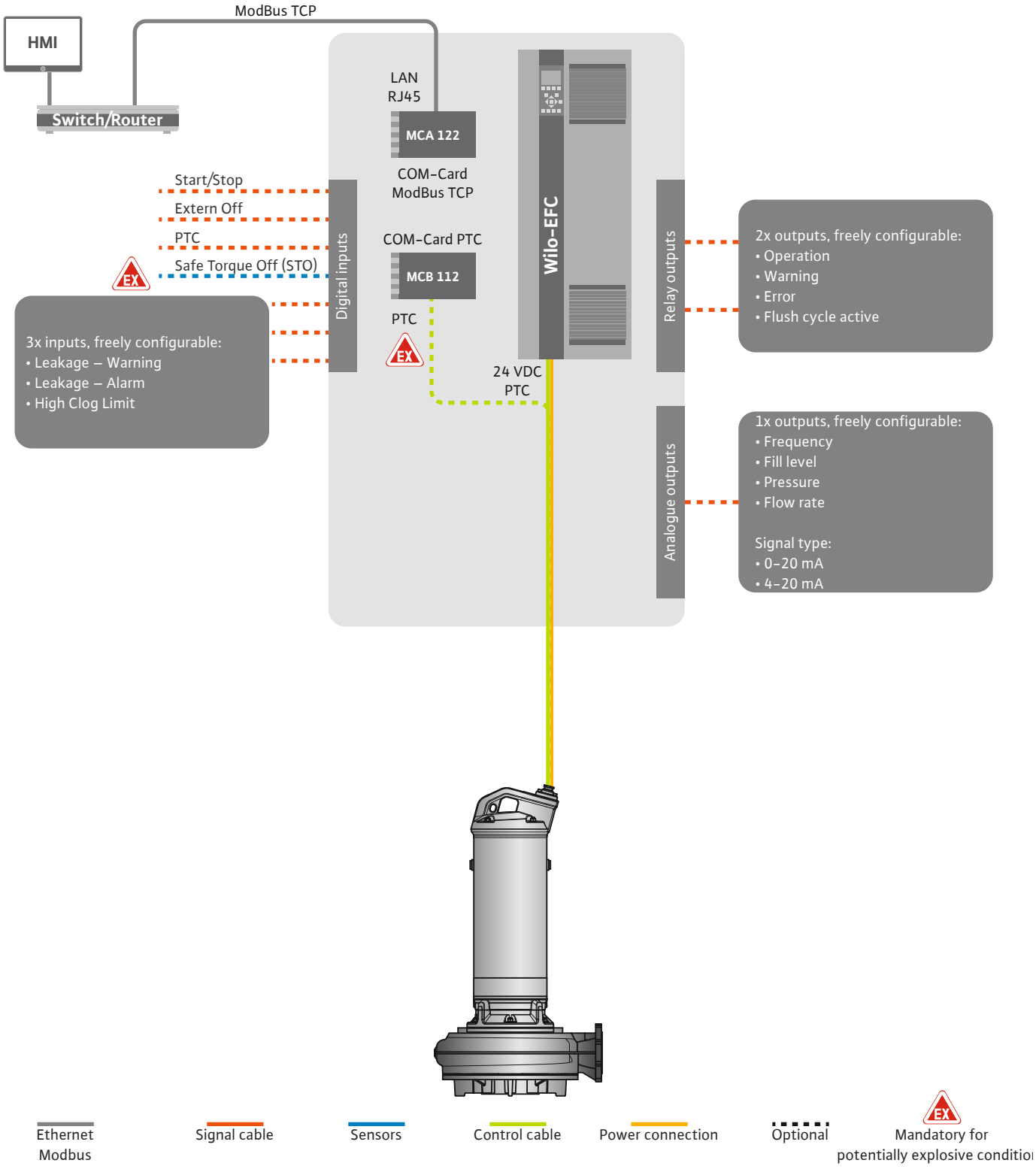


Fig. 14: Connection of LSI system mode: Frequency converter

CAUTION! Always use the digital inputs "Start/Stop", "External off" and "Safe Torque Off". If the inputs are not needed, install a converter bridge!

4.6.1 Control modes

The individual pumps work according to the Master/Slave principle. This is where each pump is set individually via the Slave home page. The higher-level Master home page is used to set the system-dependent parameters:

- Operating Mode – switch system on and off, define control mode.
- System Limits – define system limits.
- Basic settings for the control modes:
  - Level Controller
  - PID
  - High Efficiency(HE) Controller

All pumps in the system are controlled by the set parameters. The master pump is redundant in the system. If the current master pump fails, the master function is transferred to another pump.

4.6.1.1 Control mode: Level Controller

Up to six switching levels can be defined. The number of pumps and the desired operating frequency are set for each switching level.

4.6.1.2 Control mode: PID Controller

With PID control, the setpoint can be related to a constant flow, fill level or pressure in the system. The controlled output frequency is the same for all connected pumps. Based on the setpoint deviation and the output frequency, a pump is switched on or off after a time delay.

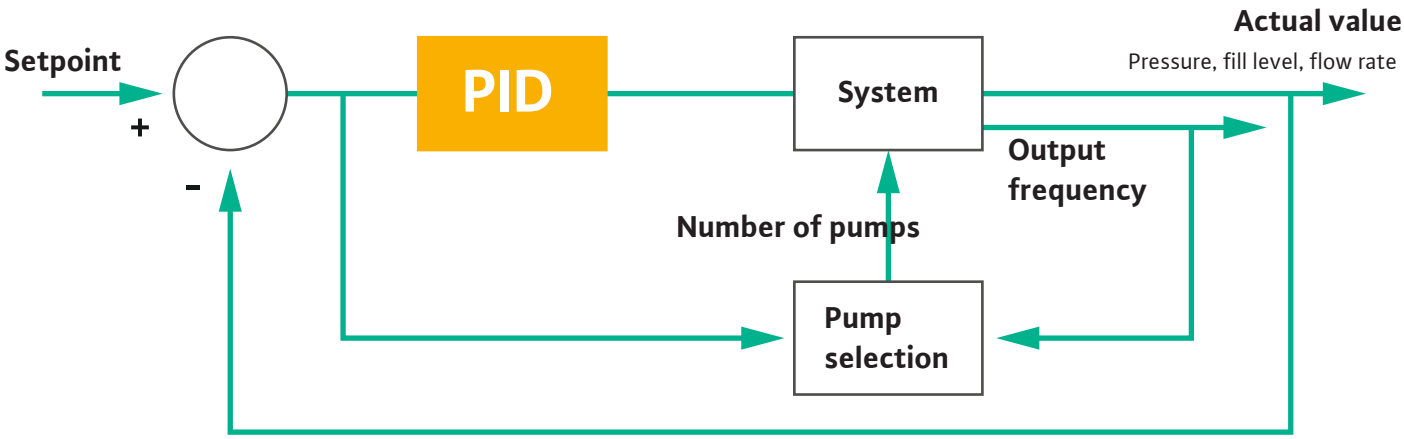


Fig. 15: Control loop with PID controller

NOTICE! A level sensor must always be present in the system for PID control. For a setpoint specification for pressure or flow measurement, an appropriate sensor must also be provided!

The PID controller consists of three parts:

- Proportional
- Integral
- Differential.

"FMIN/FMAX" refers to the specification of the Min/Max Frequency in the system limits.

Control conditions

If both conditions apply for a defined duration, a pump is switched on:

- Setpoint deviation is outside the defined limit.
- Output frequency reaches the **maximum** frequency.

If both conditions apply for a defined duration, a pump is switched off:

- Setpoint deviation is outside the defined limit.
- Output frequency reaches the **minimum** frequency.

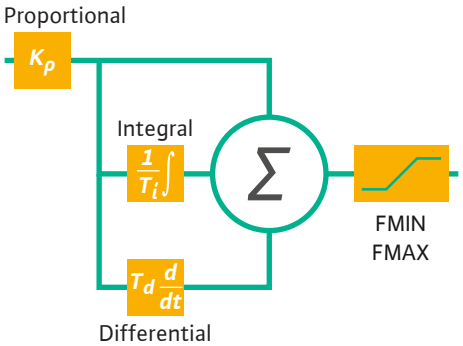


Fig. 16: PID controller

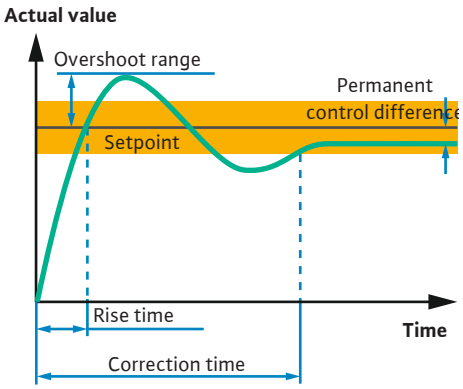


Fig. 17: Step response of a control loop

The following figure explains the control function. The following table clearly shows the dependencies of the individual components.

Step response of a control loop	Rise time	Overshoot range	Correction time	Permanent control difference
Proportional	Decrease	Increase	Small change	Decrease
Integral	Decrease	Increase	Increase	Eliminate
Differential	Small change	Decrease	Decrease	Small change

Table 1: Influence of the proportional, integral and differential components on the step response of a control loop

4.6.1.3 Control mode: High Efficiency(HE) Controller

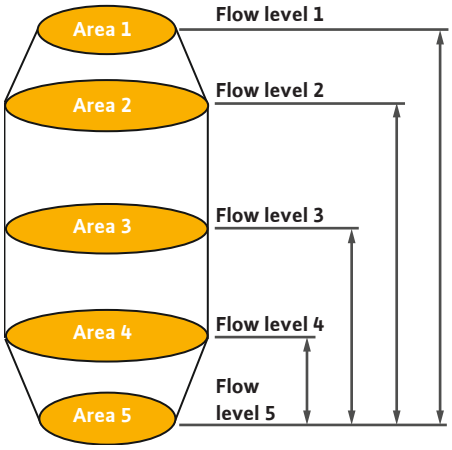


Fig. 18: HE controller: Illustration of chamber geometry

The HE controller enables energy-efficient control of the speed-adjustable sewage pumps. Using the level measurement, the operating frequency is constantly calculated, which is then transferred to the frequency converter. For calculating the operating frequency, the boundary conditions of the system are always considered:

- Control parameters
- Piping parameters
- Chamber geometry

The HE controller controls only one active pump. All other pumps in the system are regarded as standby pumps. During pump cycling, all existing pumps are taken into account.

To ensure operational reliability, the system curve is constantly monitored. If the system curve diverges significantly from the target state, countermeasures are initiated.

NOTICE! To calculate the system curve, flow measurements for different frequencies are required. If the pumping station has no flow meters, the flow rates are calculated.

How is the HE controller activated?

To activate the HE controller, set the following parameters in the Digital Data Interface:

1. Set control parameters.
2. Set piping parameters.
3. Calculate piping. The calculation takes approx. 1 ... 3 minutes.
4. Store chamber geometry.
   - ► The measurement of the system curve is automatically started with the next pump start.
   - ► For more information regarding the settings, refer to the chapter "Extended initial commissioning for the LSI system mode".

Measurement of the system curve

Four frequencies are preferably used for the measurement. These are equidistant frequencies between the minimum and rated frequency. Here, each frequency is used twice for 3 minutes. To ensure that the system curve is always up to date, a measurement is taken every day. Special features during the measurement:

- If the inlet flow is very high, the next frequency is selected just as high to match this. This ensures that the inlet flow is managed.
- If you reach the stop level, the measurement is continued during the next pumping sequence.

Pump operation at optimum frequency

After the system curve has been measured, the calculation of the energetically optimal frequency, i.e. the operating frequency with the lowest power consumption per cubic meter conveyed, is taken. This operating frequency is used for the next pumping sequences. If the inlet flow becomes greater than the volume flow, the control system intervenes:

- The operating frequency is increased until the volume flow is slightly lower than the inlet flow. This ensures that the pump chamber is filled up to the start level slowly.

- When you reach the start level, the volume flow is equal to the inlet flow. This keeps the flow level in the pump chamber constant.
- The control now reacts depending on the fill level:
  - When the fill level drops, the pump is operated again at the calculated operating frequency. The pump chamber is drained to the stop level.
  - If the fill level exceeds the start level, the pump is operated at rated frequency. The pump chamber is drained to the stop level. The calculated operating frequency will only be used again with the next draining sequence!

Sedimentation

The pipeline diameter is also monitored during the pumping sequence. If the pipeline diameter becomes too small due to deposits (sedimentation), a flush cycle is started at rated frequency. The flush cycle is terminated as soon as the set limit value is reached.

4.6.2 System-dependent framework parameters

Various system-dependent framework parameters are stored in the system limits:

- High water start and stop level
- Dry-running protection level
- **Alternative switch-on level**
  The "alternative switch-on level" is an additional switch-on level to the previous pump out of the pump chamber. This earlier switch-on level increases the standby chamber volume for special events, e.g. heavy rain. To activate the additional switch-on level, apply a trigger to the I/O module.
- **Alternative shut-down level**
  The "alternative shut-down level" is an additional shut-down level for lowering the fill level in the pump chamber or for aerating the level sensor. The additional shut-down level is activated automatically after a defined number of pump cycles is reached. The level value must be between the shut-down and dry-running protection level.
- Minimum and maximum operating frequency
- Dry run sensor source
- ...

4.6.3 Mains connection, pump

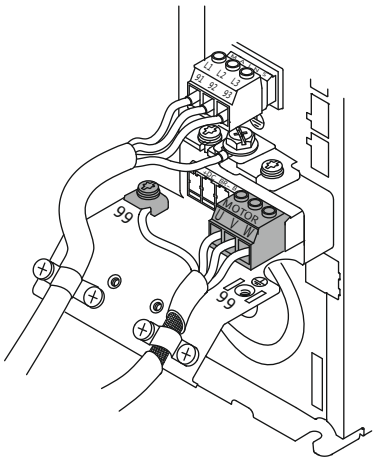


Fig. 19: Pump connection: Wilo-EFC

Wilo-EFC frequency converter

Terminal	Wiring diagram
96	U
97	V
98	W
99	Earth (PE)

Insert the motor connection cables into the frequency converter through the threaded cable gland. Connect the wires as per the connection diagram.

NOTICE! Widely position cable shielding!

4.6.4 Connecting PTC sensors to the motor winding

Wilo-EFC frequency converter

DANGER

Risk of fatal injury due to incorrect connection!

If the pump is used in explosive atmospheres, observe chapter "Electrical connection in potentially explosive atmospheres"!

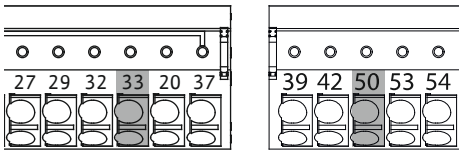


Fig. 20: Wilo-EFC terminal

Terminal	Control cable wire	Description
50	3	+10 VDC power supply
33	4	Digital input: PTC/WSK

Pt100 or Pt1000 sensors installed in the motor winding are used for thermal motor monitoring as part of software. View and adjust current temperature values and configure limit temperatures with the user interface. PTC sensors installed in the hardware define the maximum winding temperature and switch off the motor in an emergency.

CAUTION! Perform a functional check! Check the resistance prior to connecting the PTC sensor. Use an ohmmeter to measure the temperature sensor's resistance. PTC sensors have a cold resistance between 60 and 300 ohm.

4.6.5 Network connection

Wilo-EFC frequency converter

Prepare the network control cable and install the enclosed RJ45 plug. Connect to a network socket, e.g. at the "MCA 122" Ethernet module.

4.6.6 Connecting digital inputs

Note the following when connecting digital inputs:

- Use shielded cables.
- The unit automatically configures parameters during initial commissioning. Individual digital inputs are pre-assigned as part of this process. It is not possible to modify pre-assignments!
- Assign the corresponding function in the Digital Data Interface to guarantee correct functionality of freely configurable inputs.

DANGER

Risk of fatal injury due to incorrect connection!

If the pump is used in explosive atmospheres, observe chapter "Electrical connection in potentially explosive atmospheres"!

NOTICE

Observe the manufacturer's instructions!

For more information, read and comply with the frequency converter instructions.

Frequency converter: Wilo-EFC

- Input voltage: +24 VDC, terminal 12 and 13
- Reference potential (0 V): Terminal 20

Terminal	Function	Contact type
18	Start	Normally open contact (NO)
27	External off	Normally closed contact (NC)
37	Safe Torque Off (STO)	Normally closed contact (NC)
19, 29, 32	Freely configurable	

Description of preassigned input functions:

- Start
  Not needed in LSI system mode. **Install converter bridge between terminals 12 and 18!**
- External off
  Not needed in LSI system mode. **Install converter bridge between terminals 12 and 27!**

- Safe Torque Off (STO) – safe deactivation
  Hardware shutdown of the pump by the frequency converter, independent of the pump control. Automatic reactivation is not possible (reactivation lock). **NOTICE! If the input is not required, install a converter bridge between terminals 12 and 37!**

It is possible to assign the following functions to available inputs at the Digital Data Interface:

- Leakage Warn
  Signal for external sealing chamber monitoring. A warning message is output in the event of a fault.
- Leakage Alarm
  Signal for external sealing chamber monitoring. The pump is shut down in the event of a fault. Modify the alarm type in the configuration to define the downstream response.
- High Clogg Limit
  Activating higher tolerance ("Power Limit – High") for clogging detection.

Functions "High Water", "Dry Run" and "Reset" are connected to the I/O module and assigned in the Digital Data Interface!

Contact type for the corresponding function

Function	Contact type
Leakage Warn	Normally open contact (NO)
Leakage Alarm	Normally open contact (NO)
High Clogg Limit	Normally open contact (NO)

4.6.7 Relay output connection

Note the following when connecting relay outputs:

- Use shielded cables.
- You can freely configure the corresponding functions for relay outputs. Assign corresponding functions in the Digital Data Interface!

NOTICE

Observe the manufacturer's instructions!

For more information, read and comply with the frequency converter instructions.

Wilo-EFC frequency converter

- 2x type C relay outputs. **NOTICE! Observe the manufacturer instructions for exact relay output positioning!**
- Switching capacity: 240 VAC, 2 A
  A higher switching capacity can be applied at relay output 2 on the NO contact (terminal: 4/5): max. 400 VAC, 2 A

Terminal	Contact type
Relay output 1	
1	Centre terminal (COM)
2	Normally open contact (NO)
3	Normally closed contact (NC)
Relay output 2	
4	Centre terminal (COM)
5	Normally open contact (NO)
6	Normally closed contact (NC)

It is possible to assign the following functions to the Digital Data Interface:

- Run
  Individual run signal of the pump
- Error
  Individual fault signal of the pump: Alarm.
- Warning
  Individual fault signal of the pump: Warning.

- Cleaning
  Message when the cleaning sequence of the pump is started.

Functions "Rising Level" and "Falling Level" are connected to the I/O module and assigned in the Digital Data Interface!

4.6.8 Connecting analogue outputs

Note the following when connecting the analogue output:

- Use shielded cables.
- You can freely configure the corresponding functions for the output. Assign corresponding functions in the Digital Data Interface!

NOTICE

Observe the manufacturer's instructions!

For more information, read and comply with the frequency converter instructions.

Wilo-EFC frequency converter

- Terminal: 39/42
- Measurement range: 0...20 mA or 4...20 mA
  NOTICE! Also adjust the measurement range in the Digital Data Interface!

It is possible to assign the following functions to the Digital Data Interface:

- Frequency
  Current actual frequency output.
- Level
  Current fill level output. **NOTICE! For output, connect a corresponding signal transmitter to an input!**
- Pressure
  Current operating pressure output. **NOTICE! For output, connect a corresponding signal transmitter to an input!**
- Flow
  Display of the current flow quantity. **NOTICE! For output, connect a corresponding signal transmitter to an input!**

4.6.9 Connection input/output extensions (LSI mode)

NOTICE

Take note of additional literature!

To ensure proper use, additionally read and observe the manufacturer instructions.

	Wilo IO 2
General	
Type	ET-7002
Mains connection	10 ... 30 VDC
Operating temperature	-25 ... +75 °C
Dimensions (WxLxH)	72x123x35 mm
Digital inputs	
Number	6
Voltage level "On"	10 ... 50 VDC
Voltage level "Off"	max. 4 VDC
Relay outputs	
Number	3
Contact type	Normally open contact (NO)
Switching capacity	5 A, 250 VAC/24 VDC
Analogue inputs	
Number	3

	Wilo IO 2
Configurable measurement range	Yes, with jumper
Potential measurement ranges	0 … 10 V, 0 … 20 mA, 4 … 20 mA

Please refer to the manufacturer's instructions for all further technical data.

Installation

NOTICE! Refer to the manufacturer's instructions for any information on how to change the IP address and installation!

1. Adjust the signal type (current or voltage) for the measurement range: Install the jumper.
   NOTICE! Adjust the measurement range in the Digital Data Interface and send to the I/O module. Do not set the measurement range in I/O module.
2. Secure the module in the switch cabinet.
3. Connect inputs and outputs.
4. Connect the mains connection.
5. Configure the IP address.
6. Configure the type of I/O module used in the Digital Data Interface.

Overview I/O 2 module

Terminal 1 … 6	Analogue inputs
Terminal 8	Mains connection (+)
Terminal 9	Mains connection (–)
Terminal 10 … 15	Relay outputs, normally open contact (NO)
Terminal 16 … 23	Digital inputs

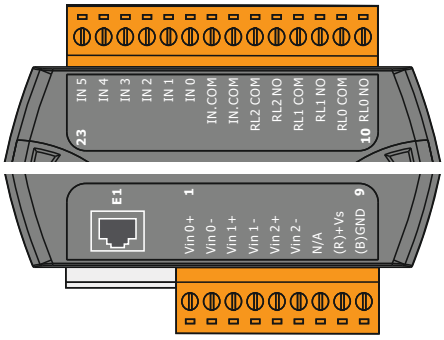


Fig. 21: Wilo IO 2 (ET-7002)

Inputs and outputs

NOTICE! Assign connected inputs and outputs in the Digital Data Interface to the master pump! ("Settings ➔ I/O Extension")

The following functions can be assigned to the **digital** inputs:

- High Water
  Signal for overflow level.
- Dry Run
  Signal for dry-running protection.
- Reset
  External signal to reset error messages.
- System Off
  External signal to switch off the system.
- Trigger Start Level
  Start drainage pumping sequence. Pump chamber is drained to the switch-off level.
- Alternative Start Level
  Activate alternative switch-on level.

The following functions can be assigned to the **analogue** inputs:

NOTICE! Assign function "fill level" to the analogue input for the level sensor!

- External Control Value
  Setpoint specification from a higher-level control system to the control of the pumping station as an analogue signal. **NOTICE! In LSI system mode, the pumping station operates autonomously from a higher-level control system. If the setpoint specification must be made by a higher-level control system, please contact customer service!**
- Level
  Setpoint specification for the control modes in LSI system mode.

  NOTICE! Requirements for the LSI system mode! Assign this function to an input.
- Pressure
  Recording the current system pressure to record data.

  NOTICE! Can be used as control value for the PID controller!

- Flow
  Recording the current flow rate to record data.

  NOTICE! Can be used as control value for the PID and HE controller!

The following functions can be assigned to the **relay outputs**:

- Run
  Collective run signal
- Rising Level
  Message for increasing level.
- Falling Level
  Message for dropping level.
- System Error
  Collective fault signal: Error.
- System Warning
  Collective fault signal: Warning.
- Cleaning
  Message when a cleaning sequence of a pump is active.

4.7 Electrical connection in potentially explosive atmospheres

DANGER

Risk of fatal injury due to incorrect connection!

If the pump is installed within potentially explosive atmospheres, connect dry-running protection and thermal motor monitoring to "Safe Torque Off"!

- Observe the instructions of the frequency converter!
- Observe all instructions in this chapter!

If the pump is installed within potentially explosive atmospheres, observe the following points:

Signal transmitter

- Install separate signal transmitter for dry-running protection.
- Connect float switch via Ex cut-off relay.
- Connect level sensors via Zener barrier.

Wilo-EFC frequency converter

- Install PTC thermistor card "MCB 112".
  Observe the instructions of the frequency converter and the PTC thermistor card!

  LSI system mode: install one card per frequency converter!
- Connect the PTC sensor to the PTC thermistor card "MCB 112":
  Terminals T1 and T2
- Connect PTC thermistor card "MCB 112" to "Safe Torque Off (STO)":
  - PTC thermistor card "MCB 112" Terminal 10 to terminal 33 on the frequency converter.
  - PTC thermistor card "MCB 112" Terminal 12 to terminal 37 on the frequency converter.
- Connect dry-running protection additionally to the PTC thermistor card "MCB 112".
  Terminals 3 to 9

  DANGER! LSI system mode: Connect dry-running protection to all frequency converters!

5 Operation

NOTICE

Automatic activation after power cut

Depending on the process, the product is switched on and off using separate controls. The product may automatically switch on following power cuts.

5.1 System requirements

The following components are required to configure and commission the pump:

- Computer with Windows, Macintosh or Linux operating systems with Ethernet connection
- Internet browser to access the user interface. The following Internet browsers are supported:
  - Firefox 65 or more recent
  - Google Chrome 60 or more recent
  - Other Internet browsers may be affected by restricted illustration!
- Ethernet network: 10BASE-T/100BASE-TX

5.2 User accounts

The Digital Data Interface features two user accounts:

- Anonymous user
  Standard user account without password to display settings. It is **not** possible to change settings.
- Regular user
  User account with password to configure settings.
  - User name: user
  - Password: user
    Log in using the sidebar menu. Users are automatically logged off after 2 minutes.

NOTICE! Change the default password during the initial configuration for security reasons!

NOTICE! Contact customer service if you have misplaced the new password! Customer service can restore the default password.

5.3 Operating elements

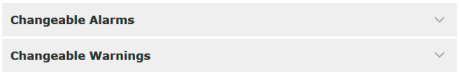


Fig. 22: Drop-down menu

Fig. 23: On/off switch

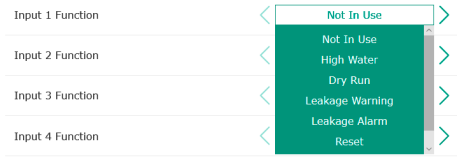


Fig. 24: Selection field

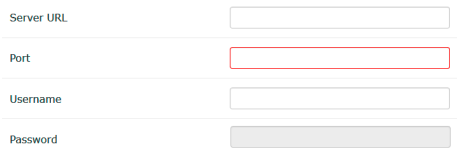


Fig. 25: Text field

Drop-down menu

Click a menu item to expand it. It is only ever possible to show one menu at the time. Click another menu item to close any expanded menu item.

On/off switch

Click the switch to switch the function on or off:

- "Grey" switch: Function **off**.
- "Green" switch: Function **on**.

Selection field

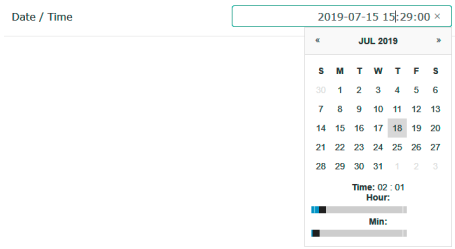
There are two options to select items:

- Use the two arrows on the left and right to browse values.
- Click the field to open the value list. Click the selected value.

Text field

You can directly input the corresponding value in text fields. Text field illustration depends on the input:

- White text field
  You **can** input or change the corresponding value.
- White text field with red edge
  Mandatory field! You **must** input the corresponding value.
- Grey text field
  Text input disabled. Value is inserted automatically or log in to change the value.



Date and time

Set the date and time using the selection field if the date and time are not synchronised using the NTP protocol. Click the input field to set the date and time:

- Select and click the date in the calendar.
- Set the time using the sliders.

Fig. 26: Date/time

5.4 Transferring input/changes

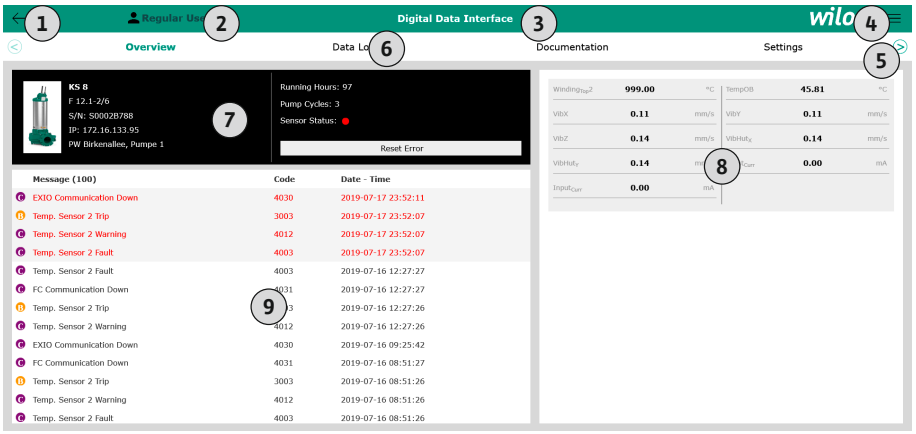
Any input and changes in the corresponding menus are not automatically transferred:

- Click "Save" in the corresponding menu to transfer input and changes.
- Select a different menu or change to the start screen to discard input or changes.

5.5 Start screen

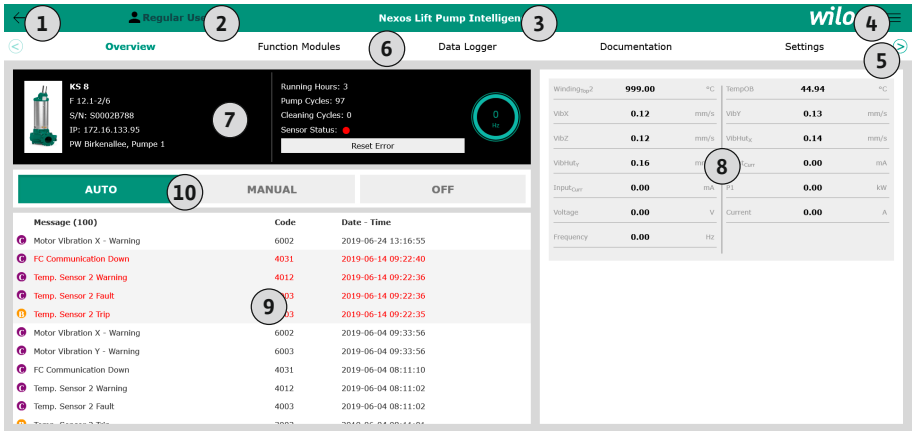
The Digital Data Interface is accessed and controlled in an Internet browser using a graphical user interface. The home page opens after entering the IP address. The home page lists all important pump or pumping station information at a glance. It also provides access to the main menu and user login. The display of the home page varies depending on the selected system mode.

5.5.1 Home page: DDI system mode



1	Back
2	User that has logged in
3	Software licence/system mode
4	Sidebar menu
5	Browse main menu
6	Main menu
7	Pump data
8	Sensor values
9	Error protocol

5.5.2 Home page: LPI system mode



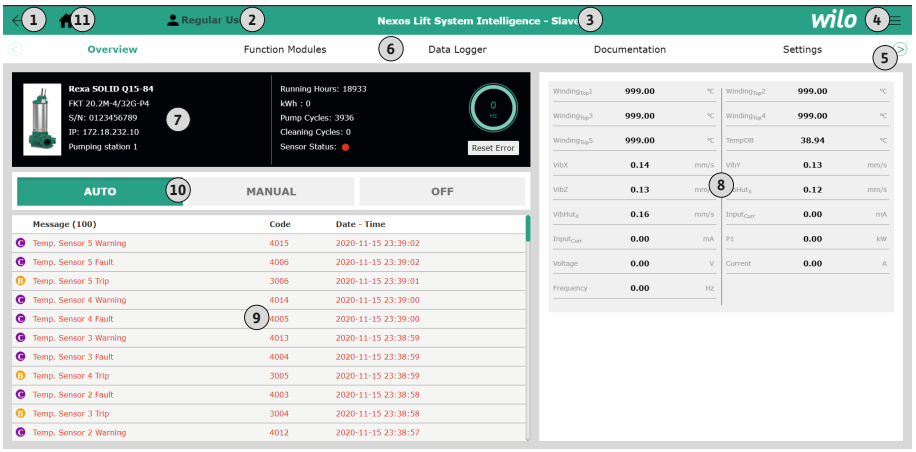
1	Back
2	User that has logged in
3	Software licence/system mode
4	Sidebar menu
5	Browse main menu
6	Main menu
7	Pump data
8	Sensor values
9	Error protocol
10	Pump operating mode

5.5.3 Home page: LSI system mode

In LSI system mode, there are two different home pages:

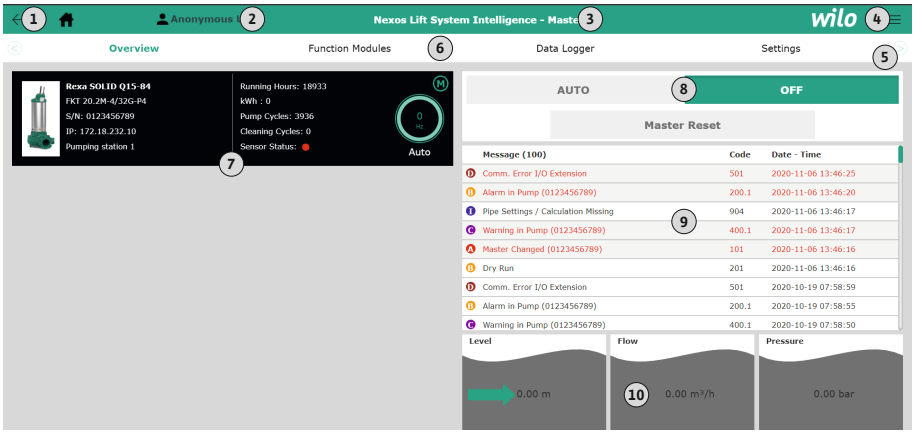
- Slave home page
  Each pump has its own home page. The current operating data of the pump can be viewed via this home page. This home page is also used to configure the pump.
- Master home page
  The system has a higher-level Master home page. The operating parameters of the pumping station and the individual pumps are displayed here. In addition, the control parameters of the pumping station are set via this home page.

Slave home page



1	Back
2	User that has logged in
3	Software licence/system mode
4	Sidebar menu
5	Browse main menu
6	Main menu
7	Pump data
8	Sensor values
9	Error log for the pump
10	Pump operating mode
11	Go to Master home page.

Master home page



1	Back
2	User that has logged in
3	Software licence/system mode
4	Sidebar menu
5	Browse main menu
6	Main menu
7	Display of existing pumps in the system with pump data
8	Operating mode of the system
9	Error log for the system
10	Operating data for the pumping station

5.5.4 Pump data

The following pump data is displayed depending on the configured system mode:

Pump data	System mode			
	DDI	LPI	LSI master	LSI slave
Pump type	•	•	•	•
Motor type	•	•	•	•
IP address	•	•	•	•
Installation name	•	•	•	•
Operating hours	•	•	•	•
Pump cycles	•	•	•	•
Cleaning cycles	–	•	•	•
Sensor status	•	•	•	•
Operating frequency	–	•	•	•
Pump operating mode	–	•	•	•

Key
– = Not available, • = Available

5.5.5 Sensor values

The following sensors can be displayed depending on the configured system mode and installed motor:

Description	Display	System mode		
		DDI	LPI	LSI slave
Winding temperature 1	Winding 1	•	•	•
Winding temperature 2	Winding 2	o	o	o
Winding temperature 3	Winding 3	o	o	o
Bearing temperature, top	Bearing 4	o	o	o
Bearing temperature, bottom	Bearing 5	o	o	o
Digital Data Interface temperature sensor	TempOB	•	•	•
Digital Data Interface vibration sensor	VibX, VibY, VibZ	•	•	•
Motor bearing vibration sensor	MotX, MotY	o	o	o
Leakage, sealing chamber	L.SC	o	o	o
Leakage, leakage chamber	L.LC	o	o	o
Power consumption	P1	–	•	•
Rated voltage	Voltage	–	•	•
Rated current	Current	–	•	•
Frequency	Frequency	–	•	•

Key
– = Not available, o = Optional, • = Available

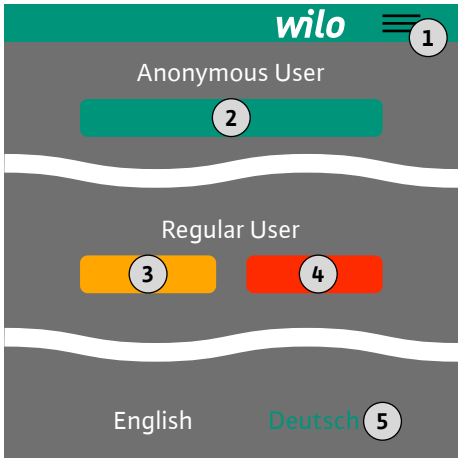
NOTICE! Only installed sensors are displayed. List varies depending on the installed motor.

5.5.6 Pump operating mode

Controll the pump directly from the start screen in "LPI" and "LSI" system modes:

- Off
  Pump off.
- Manual
  Switch on pump by hand. The pump runs until the "Off" button has been clicked or the switch-off level has been reached.
  NOTICE! Enter a frequency for the duty point for manual operation! (See menu: "Function Modules ➔ Operating Mode ➔ Frequency in Manual Mode")
  NOTICE! "LSI" system mode: manual operation is only possible if the master operating mode is "off"!
- Auto
  Automatic operation of the pump.
  "LPI" system mode: Setpoint specification using primary control.
  "LSI" system mode: Setpoint specification by the system master.

5.6 Sidebar menu



1	Hiding/expanding the sidebar menu
2	"Login" (green button)
3	"Edit profile" (yellow button)
4	"Logout" (red button)
5	Selecting the menu language – the currently configured language has been highlighted in green.

Click the hamburger icon to expand or hide the sidebar menu. Access the following functions using the sidebar menu:

- User management
  - Shows the user that is currently logged in: Anonymous user or Regular user
  - Logging in users: click "Login".
  - Logging off users: click "Logout".
  - Changing the user password: "Edit profile".
- Menu language
  Click the desired language.

6 Configuration

6.1 Operator responsibilities

- Provides the installation and operating instructions in the personnel's language.
- Make sure that the installation and operating instructions have been read and understood by all personnel.
- Safety devices and precautions (incl. emergency off) for the entire system are switched on and have been checked for problem-free operation.

6.2 Personnel qualifications

- Safe handling of web-based user interfaces
- Specialist language skills in English, for the following specialist areas
  - Electrical engineering, specialising in frequency converters
  - Pump technology, specialising in operating pump systems
  - Network technology, configuring network components

6.3 Prerequisites

The following prerequisites must have been met to be able to configure the Digital Data Interface:

Prerequisite	System mode		
	DDI	LPI	LSI
Network			
Ethernet network: 10BASE-T/100BASE-TX, IP-based, with DHCP server*	•	•	•
IP address of the frequency converter Verified from the DHCP server* by default. Refer to the manufacturer instructions for information on how to assign a fixed IP address!	–	•	•
IP address of the I/O module I/O module has been assigned a fixed IP address by default. Note the manufacturer instructions to change this IP address!	o	o	•
User interface			
Computer with Windows, Macintosh or Linux operating system, Ethernet connection and installed Internet browser**	•	•	•

Key
– = Not required, o = If required, • = Mandatory

***Network without DHCP server**
Digital Data Interface has been set to DHCP by default. Consequently, all required network parameters are access using the DHCP server. There must be a DHCP server in the network for the initial configuration. Consequently, it is possible to permanently configure the required IP addresses for operation without DHCP server.

****Supported Internet browser**
The following Internet browsers are supported:

- Firefox 65 or more recent

- Google Chrome 60 or more recent

6.4 Initial configuration

Below are step-by-step instructions for the different system modes. You must ensure the below points have been implemented before following the step-by-step instructions:

- All necessary electrical connections have been made.
- A fixed IP address has been defined for each component.
- Notebook or touch panel is available to access the web-based user interface (Web-HMI).

NOTICE

Users must log in to configure settings!

Users must log in using the sidebar menu:
– User name: user
– Password: user

The default password is changed as part of initial configuration!

6.4.1 Initial configuration: System mode "DDI"

Define a fixed IP address for the following components before starting the initial commissioning:

- Pump
- Notebook/touch panel (Web HMI)

Configure pump

1. Connect pump to DHCP server.
   There **must** be a DHCP server in the network for the initial configuration. Digital Data Interface has been set to DHCP by default. Consequently, all required network parameters are accessed using the DHCP server.
2. Set the IP address and subnet of the pump to the specified network configuration.
   Settings ➔ Digital Data Interface ➔ Network Interface Settings Network Interface Settings [▶ 44]
3. Reconnect to the set IP address.
4. "Regular user" user account: change the default password.
   Open sidebar menu and change user profile. Changing the default password for the "Regular User" user account [▶ 43]
5. Set the time/date.
   Set the correct time and date to correctly log all changes in the Digital Data Interface.
   Settings ➔ Clock Clock [▶ 43]
6. Set the language.
   Settings ➔ Menu Language Menu Language [▶ 43]

6.4.2 Initial configuration: System mode "LPI"

Define a fixed IP address for the following components before starting the initial commissioning:

- I/O module (if available)
- Frequency converter
- Pump
- Notebook/touch panel (Web HMI)

Configure I/O module (if available)

1. Set signal type of the analogue inputs at the I/O module (set jumper to current or voltage input).
2. Set IP address and subnet of the I/O module to the specified network configuration.
   See installation and operating instructions of the I/O module.
3. Connect the I/O module to the network.

NOTICE! Apart from the IP address, the I/O module requires no further software settings!

Configure frequency converter

1. Connect the frequency converter to the network.
2. Set the IP address and subnet of the frequency converter to the specified network configuration.
   See installation and operating instructions of the frequency converter: Parameters 12-0

3. Set operating mode of the frequency converter to "Off".
   See installation and operating instructions of the frequency converter: Press the Off key on the operating part.

Configure pump

1. Connect pump to DHCP server.
   There **must** be a DHCP server in the network for the initial configuration. Digital Data Interface has been set to DHCP by default. Consequently, all required network parameters are accessed using the DHCP server.
2. Set the IP address and subnet of the pump to the specified network configuration.
   Settings ➜ Digital Data Interface ➜ Network Interface Settings [▶ 44]
3. Reconnect to the set IP address.
4. "Regular user" user account: change the default password.
   Open sidebar menu and change user profile. Changing the default password for the "Regular User" user account [▶ 43]
5. Set the time/date.
   Set the correct time and date to correctly log all changes in the Digital Data Interface.
   Settings ➜ Clock [▶ 43]
6. Set the language.
   Settings ➜ Menu Language [▶ 43]
7. Set the system mode of the pump to "LPI".
   Settings ➜ Digital Data Interface ➜ System Mode Selection [▶ 45]
   NOTICE! Wait until the page updates!
8. Set type and IP address of the frequency converter in the Digital Data Interface.
   Settings ➜ Frequency Converter ➜ IP / Type Select [▶ 47]
9. Carry out auto-parameterisation.
   Settings ➜ Frequency Converter ➜ Auto Setup [▶ 47]
10. Set ramp times of the frequency converter in the Digital Data Interface.
    Settings ➜ Frequency Converter ➜ Ramp Settings [▶ 47]
11. Assign functions to the inputs/outputs of the frequency converter in the Digital Data Interface.
    Settings ➜ Frequency Converter ➜ Digital Inputs [▶ 47]
    Settings ➜ Frequency Converter ➜ Analog Inputs [▶ 48]
    Settings ➜ Frequency Converter ➜ Relay Outputs [▶ 48]
    Settings ➜ Frequency Converter ➜ Analog Outputs [▶ 49]
12. Start "Automatic motor adjustment" on the frequency converter.
    See installation and operating instructions of the frequency converter: Parameters 1-29
    CAUTION! Carry out complete "automatic motor adjustment". Reduced "automatic motor adjustment" can lead to wrong results!
    NOTICE! After carrying out the "automatic motor adjustment", check the number of poles of the motor: Parameters 1-39!
13. Set type and IP address of the I/O module in the Digital Data Interface (if available).
    Settings ➜ I/O Extension ➜ IP / Type Select [▶ 50]
14. Assign functions to I/O module inputs/outputs in the Digital Data Interface.
    Settings ➜ I/O Extension ➜ Digital Inputs [▶ 50]
    Settings ➜ I/O Extension ➜ Analog Inputs [▶ 50] (only Wilo I/O 2)
    Settings ➜ I/O Extension ➜ Relay Outputs [▶ 51]

Activate pump

1. Set frequency converter to "automatic mode".
   See installation and operating instructions of the frequency converter: Press the Auto On key on the operating part.
2. Set pump to "automatic mode".
   Function Modules ➜ Operating Mode (Pump) [▶ 54]
3. To be able to use the clogging detection, calibrate the reference curve.
   Function Modules ➜ Clog Detection ➜ Clog Detection – Teach Power Curve [▶ 54]

6.4.3 Initial configuration: System mode "LSI"

Define a fixed IP address for the following components before starting the initial commissioning:

- I/O module
- For each frequency converter
- For each pump
- Master-IP for system access
- Notebook/touch panel (Web HMI)

Configure I/O module

1. Set signal type of the analogue inputs at the I/O module (set jumper to current or voltage input).
2. Set IP address and subnet of the I/O module to the specified network configuration. See installation and operating instructions of the I/O module.
3. Connect the I/O module to the network.

NOTICE! Apart from the IP address, the I/O module requires no further software settings!

Configure frequency converter 1 ... 4

NOTICE! Repeat steps 1 – 3 for each frequency converter!

1. Connect the frequency converter to the network.
2. Set the IP address and subnet of the frequency converter to the specified network configuration.
   See installation and operating instructions of the frequency converter: Parameters 12-0
3. Set operating mode of the frequency converter to "Off".
   See installation and operating instructions of the frequency converter: Press the Off key on the operating part.

Configure pump 1 ... 4

NOTICE! Repeat steps 1 – 13 for each pump!

1. Connect pump to DHCP server.
   There **must** be a DHCP server in the network for the initial configuration. Digital Data Interface has been set to DHCP by default. Consequently, all required network parameters are accessed using the DHCP server.
2. Set the IP address and subnet of the pump to the specified network configuration.
   Settings ➔ Digital Data Interface ➔ Network Interface Settings [▶ 44]
3. Reconnect to the set IP address.
4. "Regular user" user account: change the default password.
   Open sidebar menu and change user profile. Changing the default password for the "Regular User" user account [▶ 43]
5. Set the time/date.
   Set the correct time and date to correctly log all changes in the Digital Data Interface.
   Settings ➔ Clock [▶ 43]
6. Set the language.
   Settings ➔ Menu Language [▶ 43]
7. Set the system mode of the pump to "LSI".
   Settings ➔ Digital Data Interface ➔ System Mode Selection [▶ 45]
   NOTICE! Wait until the page updates!
   In "LSI" system mode, the settings and functions are divided into master and slave. Observe the overview of the Settings [▶ 42] and Function modules [▶ 52].
8. Assign pump to system.
   Settings ➔ Digital Data Interface ➔ LSI Mode System Settings [▶ 45]
   NOTICE! Enter the same master IP address for each pump!
9. Set type and IP address of the frequency converter in the Digital Data Interface.
   Settings ➔ Frequency Converter ➔ IP / Type Select [▶ 47]
10. Carry out auto-parameterisation.
    Settings ➔ Frequency Converter ➔ Auto Setup [▶ 47]
11. Set ramp times of the frequency converter in the Digital Data Interface.
    Settings ➔ Frequency Converter ➔ Ramp Settings [▶ 47]

12. Assign functions to the inputs/outputs of the frequency converter in the Digital Data Interface.
    Settings ➜ Frequency Converter ➜ Digital Inputs [▶ 47]
    Settings ➜ Frequency Converter ➜ Relay Outputs [▶ 48]
    Settings ➜ Frequency Converter ➜ Analog Outputs [▶ 49]
13. Start "Automatic motor adjustment" on the frequency converter.
    See installation and operating instructions of the frequency converter: Parameters 1-29
    CAUTION! Carry out complete "automatic motor adjustment". Reduced "automatic motor adjustment" can lead to wrong results!
    NOTICE! After carrying out the "automatic motor adjustment", check the number of poles of the motor: Parameters 1-39!

Configure system settings

1. Open the **master home page** of the system.
   Enter the Master-IP address or click on the house icon on the Slave home page.
2. Check settings for time/date.
   Settings ➜ Clock [▶ 43]
3. Check language settings.
   Settings ➜ Menu Language [▶ 43]
4. Set the type and IP address of the I/O module in the Digital Data Interface.
   Settings ➜ I/O Extension ➜ IP / Type Select [▶ 50]
5. Assign functions to I/O module inputs/outputs in the Digital Data Interface.
   Settings ➜ I/O Extension ➜ Digital Inputs [▶ 50]
   Settings ➜ I/O Extension ➜ Analog Inputs [▶ 50]
   Settings ➜ I/O Extension ➜ Relay Outputs [▶ 51]
6. Select control mode: Auto Mode Selection
   Function Modules ➜ Operating Mode ➜ Operating Mode (System) [▶ 56]
7. Set the system limits.
   Function Modules ➜ System Limits ➜ Levels [▶ 57]
   Function Modules ➜ System Limits ➜ Dry Run Sensor Selection [▶ 57]
   Function Modules ➜ System Limits ➜ Pump Limits and Changer [▶ 57]
   Function Modules ➜ System Limits ➜ Min/Max Frequency [▶ 58]
8. Configure parameters for control mode:
   - Level Control
     Function Modules ➜ Level Controller ➜ Stop Level [▶ 59]
     Function Modules ➜ Level Controller ➜ Level 1 ... 6 [▶ 59]
   - PID
     Function Modules ➜ PID Controller ➜ PID Settings [▶ 59]
     Function Modules ➜ PID Controller ➜ Controller Parameter [▶ 60]
   - HE-Controller
     Function Modules ➜ High Efficiency(HE) Controller ➜ Control Settings [▶ 61]
     Function Modules ➜ High Efficiency(HE) Controller ➜ Pipe Settings [▶ 61]
     NOTICE! If all information about the pipe is stored, carry out "Calculate piping"!
     Function Modules ➜ High Efficiency(HE) Controller ➜ Tank Geometry [▶ 62]

Activate pump

NOTICE! Repeat steps 1 – 4 for each pump and frequency converter!

1. Open the **slave home page** of the pump.
2. Set frequency converter to "automatic mode".
   See installation and operating instructions of the frequency converter: Press the Auto On key on the operating part.
3. Set pump to "automatic mode".
   Function Modules ➜ Operating Mode (Pump) [▶ 54]
4. To be able to use the clogging detection, calibrate the reference curve.
   Function Modules ➜ Clog Detection ➜ Clog Detection - Teach Power Curve [▶ 54]

Activate system

1. Open the **master home page** of the system.
2. Set the system to "automatic mode": Operating Mode Selection
   Function Modules ➜ Operating Mode ➜ Operating Mode (System) [▶ 56]

6.5 Settings

NOTICE

Users must log in to configure settings!

Users must log in using the sidebar menu:
– User name: user
– Password: user

The default password is changed as part of initial configuration!

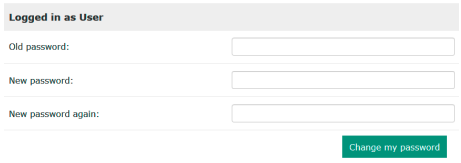
Overview of settings depending on the system mode.

Settings	System mode			
	DDI	LPI	LSI Master	LSI Slave
Menu Language	•	•	•	–
Clock	•	•	•	–
Units	•	•	–	•
Digital Data Interface				
Network Interface Settings	•	•	–	•
Proxy Settings	•	•	–	•
System Mode Selection	•	•	–	•
LPI Control Settings	–	•	–	–
LSI Mode System Settings	–	–	–	•
Limits Temperature Sensors	•	•	–	•
Limits Vibration Sensors	•	•	–	•
Frequency Converter				
IP / Type Select	–	•	–	•
Auto Setup	–	•	–	•
Ramp Settings	–	•	–	•
Digital Inputs	–	•	–	•
Analog Inputs	–	•	–	–
Relay Outputs	–	•	–	•
Analog Outputs	–	•	–	•
I/O Extension				
IP / Type Select	•	•	•	–
Digital Inputs	•	•	•	–
Analog Inputs (Wilo IO 2 only)	•	•	•	–
Relay Outputs	•	•	•	–
Alarm / Warning Types				
Changeable Alarms	•	•	–	•
Changeable Warnings	•	•	–	•

Key

– = Not available, • = Available

6.5.1 Changing the default password for the "Regular User" user account

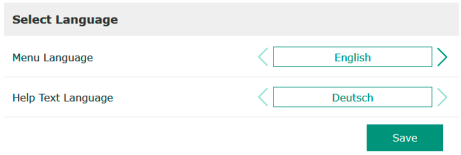


Open the sidebar menu and click "Edit profile" to change the default password.

- Old password: Enter the current password (default: "user")
- New password: Enter new password:
  - Alphanumeric password with at minimum two digits.
  - Length: at minimum 6 characters, at maximum 10 characters.
- New password again: Confirm the new password.
- Click "Change my password" to transfer the new password.

NOTICE! Contact customer service if you have misplaced the password! Customer service can restore the default password.

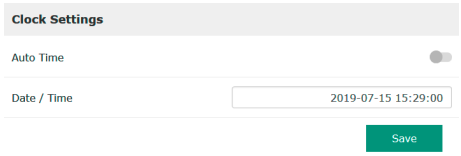
6.5.2 Menu Language



You can set separate languages for the menu and help texts.

- Menu Language
  Factory setting: English
- Help Text Language
  Factory setting: English

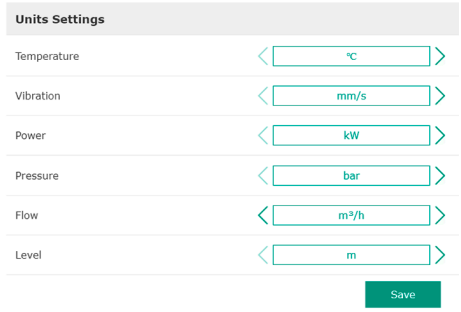
6.5.3 Clock



The date and time display can be synchronised or set manually via the NTP protocol.

- Auto Time
  Time and date are synchronised via the NTP protocol. Enter the desired NTP server in the "Network Interface Settings" menu (see menu: Settings ➔ Digital Data Interface ➔ Network Interface Settings).
  Factory setting: On
- Date / Time
  Deactivate the "Auto Time" function and click the field to manually set the time and date. A window opens with a calendar and two slide bars to set hours and minutes.

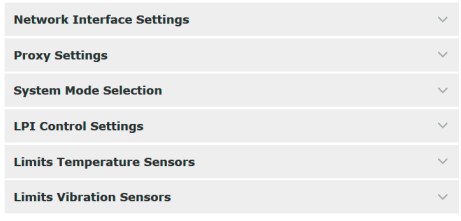
6.5.4 Units



Set the units:

- Temperature
  Factory setting: °C
  Input: °C, °F
- Vibration
  Factory setting: mm/s
  Input: mm/s, in/s
- Power
  Factory setting: kW
  Input: kW, hp
- Pressure
  Factory setting: bar
  Input: bar, psi
- Flow
  Factory setting: l/s
  Input: l/s, m³/h, US.liq.gal/min
- Level
  Factory setting: m
  Input: m, ft

6.5.5 Digital Data Interface

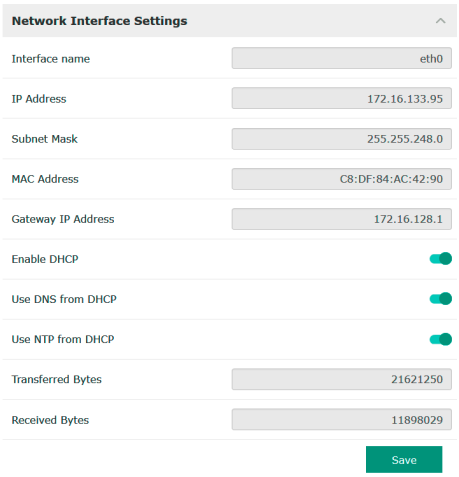


Digital Data Interface basic settings:

- Network Interface Settings
  Network communication settings
- Proxy Settings
  Proxy server settings
- System Mode Selection (visible to user that has logged in only)
  Selecting the desired system mode (DDI, LPI, LSI)
- LPI Control Settings
  Setting for pump setpoint specification

- Limits Temperature Sensors
  Limit values for warning and alarm
- Limits Vibration Sensors
  Limit values for warning and alarm

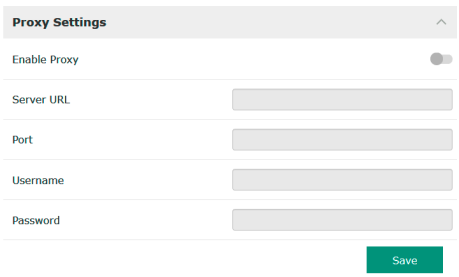
6.5.5.1 Network Interface Settings



Basic settings for the pump's network access to the local network.

- Interface name
  Fixed name of the Ethernet interface.
- IP Address
  IP address of the Digital Data Interface.
  Factory setting: transmitted via DHCP
- Subnet Mask
  Digital Data Interface subnet mask.
  Factory setting: transmitted via DHCP
- MAC Address
  Shows the MAC address.
- Gateway IP Address
  IP address of the (router) gateway.
  Factory setting: transmitted via DHCP
- Enable DHCP
  The local network settings are automatically transmitted via the DHCP protocol.
  Factory setting: On
  Enter the following information if the DHCP protocol is switched off:
  - IP Address
  - Subnet Mask
  - Gateway IP Address
  - Custom DNS
    CAUTION! If invalid values are entered, access to the pump will no longer be possible after saving!
- Use DNS from DHCP
  The IP address of the DNS server is transmitted via the DHCP protocol.
  Factory setting: On
  Enter the IP address of the DNS server manually if this function or the DHCP protocol is switched off.
- Custom DNS
  IP address of the DNS server.
- Use NTP from DHCP
  The DHCP server transmits the current time and the date via the NTP protocol.
  Factory setting: On
  Enter the IP address/domain of the DNS server manually if this function or the DHCP protocol is switched off.
- Custom NTP Server
  Address of the NTP server for time synchronisation.
  Factory setting: pool.ntp.org
- Transferred Bytes/Received Bytes
  Shows of the transmitted and received data packages.

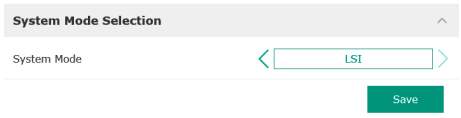
6.5.5.2 Proxy Settings



Basic settings for network access via a proxy server.

- Enable Proxy
  Factory setting: Off
- Server URL
  Domain or IP address of the proxy server.
- Port
  Network port used to communicate with the server.
- Username
  Login name
- Password
  Login password

6.5.5.3 System Mode Selection



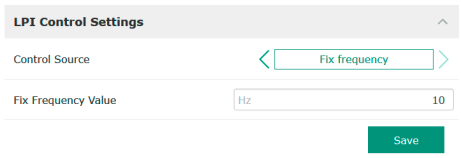
The control system comprises three different system modes: "DDI", "LPI" and "LSI". Potentially available system modes are enabled using the licence key. System modes are downward-compatible.

- System Mode Selection
  Factory setting: depends on licence
  Input: DDI, LPI, LSI

Description of the individual system modes:

- DDI system mode
  System mode with no control function. Only temperature and vibration sensor values are recorded, evaluated and saved. The pump and the frequency converter (if present) are controlled via the operator's primary control.
- LPI system mode
  System mode with control function for frequency converters and clogging detection. The pump/frequency converter pairing works as a unit: the frequency converter is controlled through the pump. This allows clogging detection to be carried out and, if necessary, a cleaning process to be started. Level-dependent control of the pump takes place via the operator's primary control.
- LSI system mode
  System mode for complete control of the pumping station with up to four pumps. In this process, one pump operates as the master and all other pumps are slaves. The master pump controls all other pumps depending on the system-specific parameters.

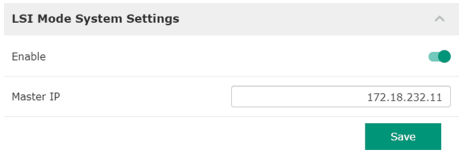
6.5.5.4 LPI Control Settings



Basic settings for "LPI" system mode.

- Control Source
  Setpoint specification from the primary control.
  Factory setting: Analog
  Input: Analog, Bus, Fix frequency
  - Analog
    Primary control values are transmitted to the frequency converter or an I/O module as analogue signals. **NOTICE! Configure an analogue input using the "Setpoint" value!**
  - Bus
    Primary control values are sent to the pump using the Ethernet network. ModBus TCP or OPC UA are used as communication protocols.
  - Fix frequency
    The pump runs at a fixed frequency.
- Fix Frequency Value
  In the "Control Source" setting, select the "Fix frequency" value enter the corresponding frequency.
  Factory setting: 0 Hz
  Input: 25 Hz to max. frequency (f_{op}) according to the rating plate

6.5.5.5 LSI Mode System Settings

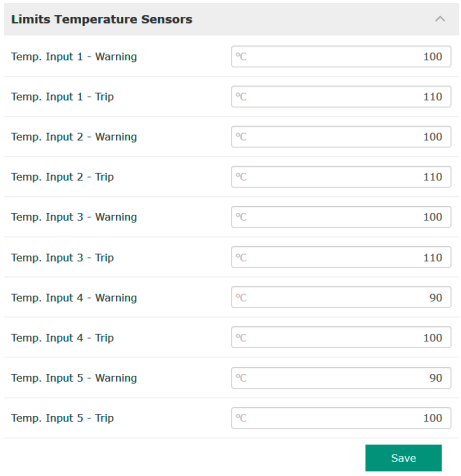


Combination of up to four pumps in one system.

- Enable
  Activate pump in the system.
  Factory setting: off
- Master IP
  Fixed IP address via which the system incl. the system home page can be reached. The IP address must be specified by the operator! Associating the pumps with the system is defined by this static IP address. Enter the Master IP for all pumps of a system. The master function is automatically assigned to a pump in the system (redundant master pump).

  NOTICE! All IP addresses (slave and master) in the same subnet!

6.5.5.6 Limits Temperature Sensors



Overview of potential temperature sensors and limit value input.

Temperature sensor overview

No.	Description	Display
Temp. input 1	Winding temperature 1	Winding Top/Bot 1
Temp. input 2	Winding temperature 2	Winding 2
Temp. input 3	Winding temperature 3	Winding 3
Temp. input 4	Top motor bearing temperature	Bearing Top 4
Temp. input 5	Bottom motor bearing temperature	Bearing Bot 5

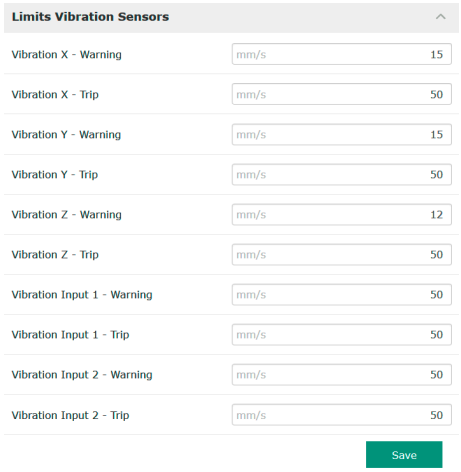
Limit value input

- Temp. Input 1 – Warning
  Limit value for a warning in °C.
  Factory setting: default factory setting
  Input: 0 °C to default factory setting
- Temp. Input 1 – Trip
  Limit value for pump shutdown in °C.
  Factory setting: default factory setting
  Input: 0 °C up to factory specification. The value must be 2 °C higher than the warning limit value.

Key

"1" is a placeholder for input numbers 1 to 5.

6.5.5.7 Limits Vibration Sensors



Overview of potential vibration sensors and inputting limit values.

Vibration sensor overview

No.	Description	Display
Vibration X, Y, Z	Vibration sensor in DDI	VibX, VibY, VibZ
Vibration input 1/input 2	Input for external vibration sensor	VibHut, VibTop, VibBot

Limit value input

- Vibration X – Warning
  Limit value for a warning in mm/s.
  Factory setting: default factory setting
  Input: 0 % to default factory setting
- Vibration X – Trip
  Limit value for pump shutdown in mm/s.
  Factory setting: default factory setting
  Input: 0 % to default factory setting. The value must be 2 % higher than the limit value for the warning.

Key

"X" represents a placeholder for the input number X, Y, Z, 1 or 2.

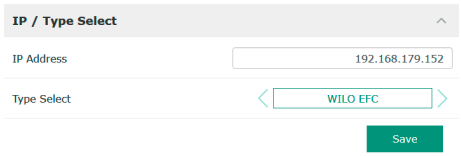
6.5.6 Frequency Converter

Frequency converter basic settings:

- IP / Type Select
  Settings for communication with the frequency converter
- Auto Setup
  Automatic frequency converter configuration
- Ramp Settings
  Timing for starting ramp and brake ramp
- Digital Inputs
  Digital input configuration.
- Analog Inputs
  Analogue input configuration.

- Relay Outputs
  Relay output configuration.
- Analog Outputs
  Analogue output configuration.

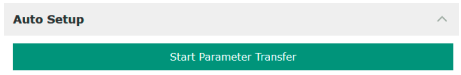
6.5.6.1 IP / Type Select



Basic setting for communication between pump and frequency converter.

- IP Address
  IP address of the frequency converter.
- Type Select
  Select appropriate frequency converter.
  Factory setting: Wilo-EFC

6.5.6.2 Auto Setup



Thanks to automatic parameter configuration the Digital Data Interface configures the basic settings of the connected frequency converter. Note the following:

- Automatic parameter configuration overwrites all settings within the frequency converter!
- Automatic parameter configuration configures digital input assignment!
- Run automatic motor adaptation in the frequency converter after having completed automatic parameter configuration!

Run automatic parameter configuration.

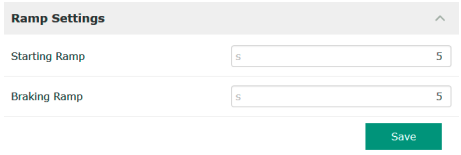
✓ IP address of the frequency converter has been entered.

✓ Correct frequency converter has been selected.

✓ Frequency converter is set to "Stop"

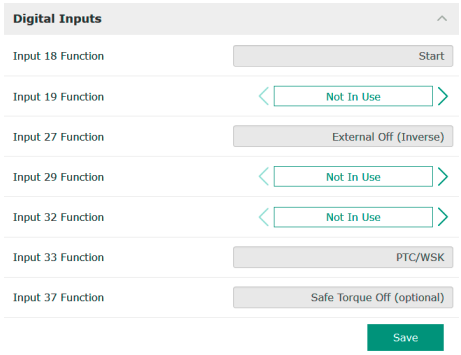
1. Click "Start Parameter Transfer"
2. "Auto Setup" starts.
3. The following message appears once the transfer has finished: "Succesfully Completed".

6.5.6.3 Ramp Settings



- Starting Ramp
  Timing in seconds.
  Factory setting: 5 s
  Input: 1 to 20 s
- Braking Ramp
  Timing in seconds.
  Factory setting: 5 s
  Input: 1 to 20 s

6.5.6.4 Digital Inputs



Assigning the available functions to the relevant inputs. Designation of the input terminals matches the designation at frequency converter Wilo-EFC.

The following inputs are permanently preassigned by automatic parameter configuration:

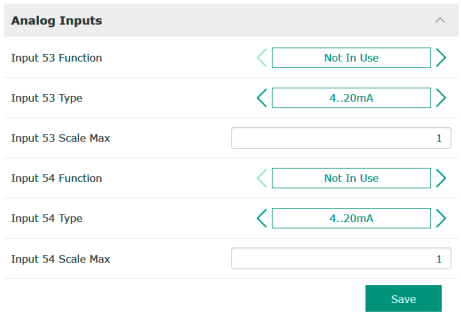
- Input 18 Function
  Function: Start
  Description: Input/output signal from primary control.
- Input 27 Function
  Function: External Off (Inverse)
  Description: Remote deactivation using a separate switch. **NOTICE! The input directly switches over the frequency converter!**
- Input 33 Function
  Function: PTC/WSK
  Description: Connection of hardware temperature sensor in the motor winding
- Input 37 Function
  Function: Safe Torque Off (STO) – safe deactivation
  Description: hardware pump deactivation by frequency converter, regardless of pump control. Automatic reactivation is not possible (reactivation lock).
  DANGER! Connect temperature sensor and dry-running protection hardware here if the pump is used within potentially explosive atmospheres! For this purpose, install the optionally available "MCB 112" expansion card in the frequency converter.

Available functions can be freely assigned for the following inputs:

- Input 19 Function
- Input 29 Function
- Input 32 Function
  Factory setting: Not In Use
  Input:
  - High Water
    Signal for overflow level.
  - Dry Run
    Signal for dry-running protection.
  - Leakage Warn
    Signal for external sealing chamber monitoring. A warning message is output in the event of a fault.
  - Leakage Alarm
    Signal for external sealing chamber monitoring. The pump is shut down in the event of a fault. Modify the alarm type in the configuration to define the downstream response.
  - Reset
    External signal to reset error messages.
  - High Clogg Limit
    Activating higher tolerance ("Power Limit - High") for clogging detection.

NOTICE! The assignment of the inputs must match the hardware allocation on the frequency converter!

6.5.6.5 Analog Inputs



Assignment of the available functions and input types to the relevant inputs. Designation of the input terminals matches the designation at frequency converter Wilo-EFC.

The following inputs can be configured:

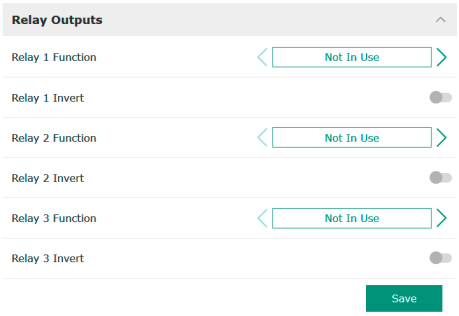
- Input 53 Function
- Input 54 Function

NOTICE! The assignment must match the hardware assignment at the frequency converter!

- Input 53 Function/Input 54 Function
  Factory setting: Not In Use
  Input:
  - External Control Value
    Setpoint specification to control the pump speed as part of an analogue signal from primary control.
  - Level
    Recording the current fill level to record data. Basis for the "Increasing" and "Dropping" level functions at the digital output.
  - Pressure
    Recording the current system pressure to record data.
  - Flow
    Recording the current flow rate to record data.
- Input 53 Type/Input 54 Type
  Also adjust the signal type (voltage (U) or current (I)) in the hardware at the frequency converter. Observe the frequency converter installation and operating instructions!
  Factory setting: 4...20 mA
  Input:
  - 0...20 mA
  - 4...20 mA
  - 0...10 V
- Input 53 Scale Max/Input 54 Scale Max
  Factory setting: 1
  Input: Maximum value as real numerical value with unit. The units for the control values are:
  - Level = m
  - Pressure = bar
  - Flow = l/s

  Separator for decimal places: Point

6.5.6.6 Relay Outputs



Assignment of the available functions to the relevant outputs. Designation of the output terminals matches the designation at frequency converter Wilo-EFC.

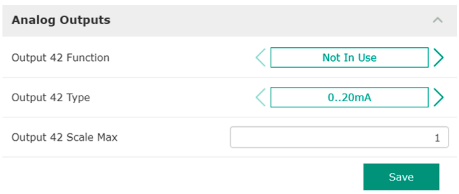
The following outputs can be configured:

- Relay 1 Function
- Relay 2 Function

NOTICE! The assignment must match the hardware assignment at the frequency converter!

- Relay 1 Function/Relay 2 Function
  Factory setting: Not In Use
  Input:
  - Run
    Individual run signal of the pump
  - Rising Level
    Message for increasing level.
  - Falling Level
    Message for dropping level.
  - Error
    Individual fault signal of the pump: Alarm.
  - Warning
    Individual fault signal of the pump: Warning.
  - Cleaning
    Message when the cleaning sequence of the pump is started.
- Relay 1 Invert/Relay 2 Invert
  Output functionality: normal or inverted.
  Factory setting: Off (normal)

6.5.6.7 Analog Outputs



Assignment of the available functions to the relevant outputs. Designation of the output terminals matches the designation at frequency converter Wilo-EFC.

The following outputs can be configured:

- Output 42 Function

NOTICE! The assignment must match the hardware assignment at the frequency converter!

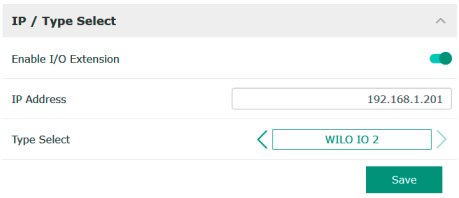
- Output 42 Function
  Factory setting: Not In Use
  Input:
  - Frequency
    Current actual frequency output.
  - Level
    Current fill level output. **NOTICE! For output, connect a corresponding signal transmitter to an input!**
  - Pressure
    Current operating pressure output. **NOTICE! For output, connect a corresponding signal transmitter to an input!**
  - Flow
    Display of the current flow quantity. **NOTICE! For output, connect a corresponding signal transmitter to an input!**
- Output 42 Type
  Factory setting: 4...20 mA
  Input:
  - 0...20 mA
  - 4...20 mA
- Output 42 Scale Max
  Factory setting: 1
  Input: Maximum value as real numerical value without unit or delimiters for decimal places: Point

6.5.7 I/O Extension

Basic I/O module settings (input/output extensions):

- IP / Type Select
  Settings for communication with the I/O module
- Digital Inputs
  Digital input configuration.
- Analog Inputs
  Configuration of the analogue inputs (only available in Wilo I/O 2).
- Relay Outputs
  Configuration of the relay outputs. The number of outputs depends on the selected I/O module.

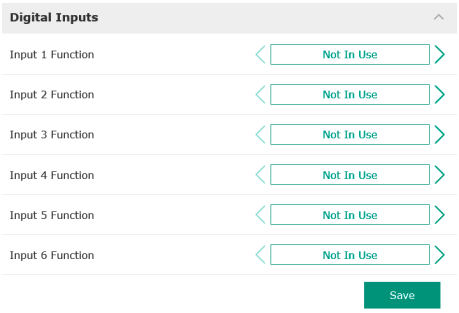
6.5.7.1 IP / Type Select



Basic setting for the communication between pump and I/O module.

- Enable I/O Extension
  Switch function on/off.
  Factory setting: Off
- IP Address
  IP address of the I/O module.
- Type Select
  Select I/O module.
  Factory setting: Wilo IO 1
  Input: Wilo IO 1 (ET-7060), Wilo IO 2 (ET-7002)

6.5.7.2 Digital Inputs

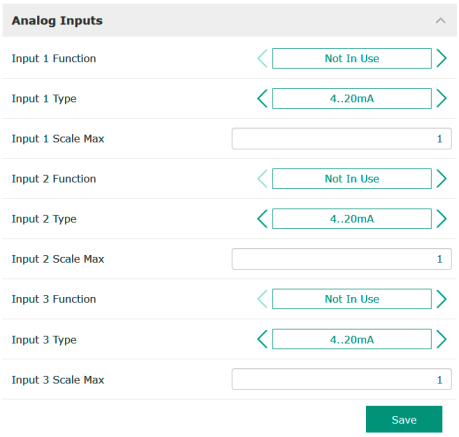


Assigning the available functions to the relevant inputs. The name of the input terminals matches the name on the I/O module. Available functions can be freely assigned for the following inputs:

- Input 1 Function
- Input 2 Function
- Input 3 Function
- Input 4 Function
- Input 5 Function
- Input 6 Function
  Factory setting: Not In Use
  Input:
  NOTICE! In LPI system mode, the functions on the I/O module are the same as on the frequency converter. The following description addresses the LSI system mode.
  - High Water
    Signal for overflow level.
  - Dry Run
    Signal for dry-running protection.
  - Reset
    External signal to reset error messages.
  - System Off
    External signal to switch off the system.
  - Trigger Start Level
    Start drainage pumping sequence. Pump chamber is drained to the switch-off level.
  - Alternative Start Level
    Activate alternative switch-on level.

NOTICE! The assignment must match the hardware assignment at the I/O module!

6.5.7.3 Analog Inputs



Assigning the available functions to the relevant inputs. The name of the input terminals matches the name on the I/O module. Available functions can be freely assigned for the following inputs:

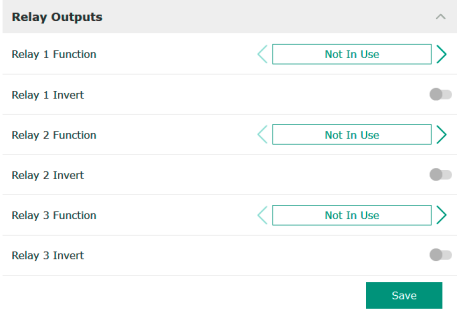
- Input 1 Function
- Input 2 Function
- Input 3 Function

Settings

- Input 1 Function ... Input 3 Function
  Factory setting: Not In Use
  Input:
  NOTICE! In LPI system mode, the functions on the I/O module are the same as on the frequency converter. The following description addresses the LSI system mode.
  - Level
    Setpoint specification for the control modes in LSI system mode.
    NOTICE! Requirements for the LSI system mode! Assign this function to an input.
  - Pressure
    Recording the current system pressure to record data.
    NOTICE! Can be used as control value for the PID controller!
  - Flow
    Recording the current flow rate to record data.
    NOTICE! Can be used as control value for the PID and HE controller!
  - External Control Value
    Setpoint specification from a higher-level control system to the control of the pumping station as an analogue signal. **NOTICE! In LSI system mode, the pumping station operates autonomously from a higher-level control system. If the setpoint specification must be made by a higher-level control system, please contact customer service!**
- Input 1 Type ... Input 3 Type
  Selected measurement range is transferred to the I/O module. **NOTICE! Set the signal type (current or voltage) in the hardware. Observe the manufacturer's instructions!**
  Factory setting: 4 ... 20 mA
  Input:
  - 0 ... 20 mA
  - 4 ... 20 mA
  - 0 ... 10 V
- Input 1 Scale Max ... Input 3 Scale Max
  Factory setting: 1
  Input: Maximum value as real numerical value with unit. The units for the control values are:
  - Level = m
  - Pressure = bar
  - Flow = l/s

  Separator for decimal places: Point

6.5.7.4 Relay Outputs



Assignment of the available functions to the relevant outputs. The name of the output terminals matches the name on the I/O module. Available functions can be freely assigned for the following outputs:

- Relay 1 Function
- Relay 2 Function
- Relay 3 Function
- Relay 4 Function
- Relay 5 Function
- Relay 6 Function

NOTICE! The Wilo IO 2 has only three relay outputs!

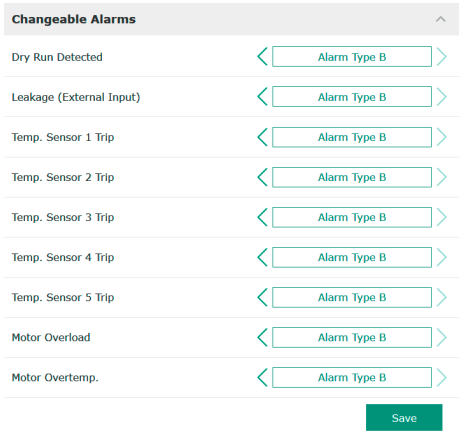
Settings

- Relay 1 Function ... Relay 6 Function
  Factory setting: Not In Use
  Input:
  NOTICE! In LPI system mode, the functions on the I/O module are the same as on the frequency converter. The following description addresses the LSI system mode.
  - Run
    Collective run signal
  - Rising Level
    Message for increasing level.
  - Falling Level
    Message for dropping level.
  - System Warning
    Collective fault signal: Warning.
  - System Error
    Collective fault signal: Error.
  - Cleaning
    Message when a cleaning sequence of a pump is active.
- Relay 1 Function ... Relay 6 Function
  Output operation: normal or inverting.
  Factory setting: off (normal)

6.5.8 Alarm / Warning Types

Two levels of priority can be assigned to certain alarm signals and warning messages.

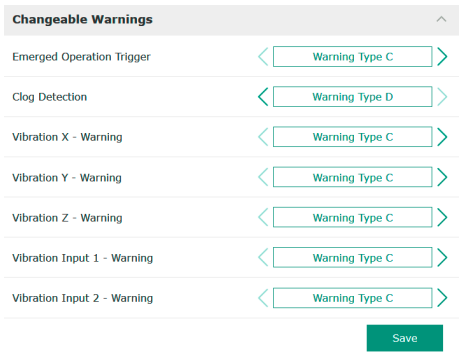
6.5.8.1 Changeable Alarms



The following priority settings can be assigned for the illustrated alarm signals:

- Alert Type A: The pump is shut down in the event of a fault. The alarm signal **must be reset manually**:
  - Reset Error on the start screen
  - "Reset" function at a digital input of the frequency converter or I/O module
  - Corresponding signal via fieldbus
- Alert Type B: The pump is shut down in the event of a fault. The alarm signal is automatically reset once the fault has been eliminated.

6.5.8.2 Changeable Warnings



The following priority settings can be assigned to the warning messages shown:

- Warning Type C: These warnings can switch a relay output on the frequency converter or of the I/O module.
- Warning Type D: These warnings are only displayed and logged.

6.6 Function modules

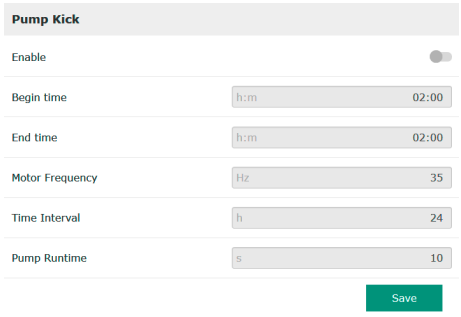
Functional overview depending on the system mode.

Function modules	System mode			
	DDI	LPI	LSI Master	LSI Slave
Pump Kick	–	•	–	•

Function modules	System mode			
	DDI	LPI	LSI Master	LSI Slave
Emerged Operation	–	•	–	•
Operating Mode (Pump)	–	•	–	•
Clog Detection	–	•	–	•
Anti-Clogging Sequence	–	•	–	•
Operating Mode (System)	–	–	•	–
System Limits	–	–	•	–
Level Controller	–	–	•	–
PID Controller	–	–	•	–
High Efficiency(HE) Controller	–	–	•	–

Key
– = Not available, • = Available

6.6.1 Pump Kick



Periodic pump operation is possible to prevent prolonged pump standstill.

- Enable
  Switch function on and off.
  Factory setting: Off
- End time and Begin time
  Periodic pump operation is not enforced outside this period.
  Factory setting: 00:00
  Input: hh:mm
- Motor Frequency
  Operating frequency for periodic pump operation.
  Factory setting: 35 Hz
  Input: 25 Hz to max. frequency according to the rating plate
- Time Interval
  Permissible standstill time between two periodic pump operation cycles.
  Factory setting: 24 h
  Input: 0 to 99 h.
- Pump Runtime
  Running time of the pump during periodic pump operation.
  Factory setting: 10 s
  Input: 0 to 30 s

6.6.2 Emerged Operation

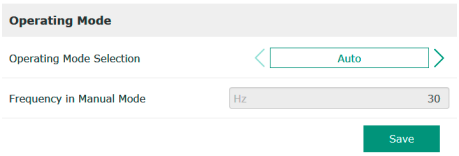
The motor winding is equipped with temperature monitoring. This monitoring enables the pump to carry out non-immersed operation without reaching the max. winding temperature. The temperature is measured using Pt100 sensors.

- Enable
  Switch function on and off.
  Factory setting: Off
- Restart Hysteresis
  Temperature difference to the temperature limit beyond which the pump is switched on again. **NOTICE! Required for "Two-point controller" operating mode only!**
  Factory setting: 5 °C
  Input: 1 bis 20 °C
- Temperature Limit
  The temperature limiter is activated once the set temperature limit has been reached.
  Factory setting: Ex works warning threshold for winding temperature
  Input: 40 °C to ex works shutdown temperature of the winding
- Operating Mode
  Factory setting: On/Off
  Input: On/Off (two-point controller) or PID

– On/Off (two-point controller)
Pump is switched off once it reaches the set temperature limit. The pump switches back on as soon as the winding temperature has once again dropped by the set hysteresis value.

– PID
In order to prevent the pump being shut down, the motor speed is controlled as a function of the winding temperature. The motor speed is reduced as the winding temperature increases. This enables a longer pump operation.

6.6.3 Operating Mode (Pump)



- Operating Mode Selection
Specify in which operating mode the pump is being used.
Factory setting: Off
Input: Auto, Manual or Off

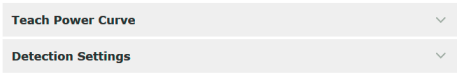
  – Off
  Pump off.

  – Manual
  Switch on pump by hand. The pump runs until the "Off" button has been clicked or the switch-off level has been reached.
  NOTICE! Enter a frequency for the duty point for manual operation! (See menu: "Function Modules ➔ Operating Mode ➔ Frequency in Manual Mode")
  NOTICE! "LSI" system mode: manual operation is only possible if the master operating mode is "off"!

  – Auto
  Automatic operation of the pump.
  "LPI" system mode: Setpoint specification using primary control.
  "LSI" system mode: Setpoint specification by the system master.

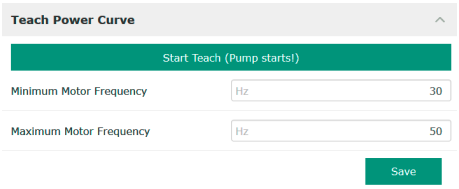
- Frequency in Manual Mode
Frequency set point for the duty point in **manual operation**.
Factory setting: 0 Hz
Input: 25 Hz to max. rated frequency according to the rating plate

6.6.4 Clog Detection



The pump is equipped with an algorithm that can detect clogging in the hydraulics. The basis for the algorithm is a deviation of the rated power from the reference curve. The reference curve is calibrated during a **“learning phase”**. The conditions for the clogging detection are saved in the **“Settings”**.

6.6.4.1 Clog Detection - Teach Power Curve



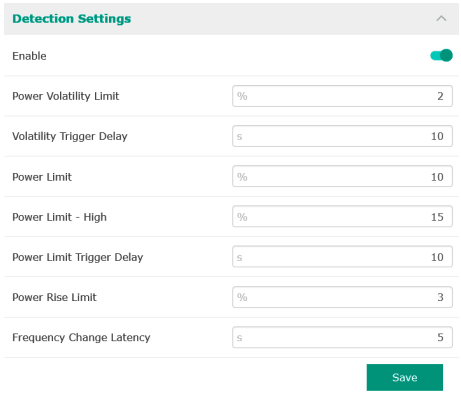
A reference curve must be calibrated to activate clogging detection.

- Minimum Motor Frequency
Minimum frequency from which clogging detection activates.
Factory setting: 30 Hz
Input: 1 Hz to max. rated frequency according to the rating plate
- Maximum Motor Frequency
Maximum frequency up to which clogging detection activates.
Factory setting: Rated frequency according to the rating plate
Input: 1 Hz to max. rated frequency according to the rating plate

Once all values have been set, click the "Start Teach (Pump starts!)" button to start the teach-in phase. On-screen feedback confirms completion of the teach-in phase.

NOTICE! No clogging detection during teach-in phase!

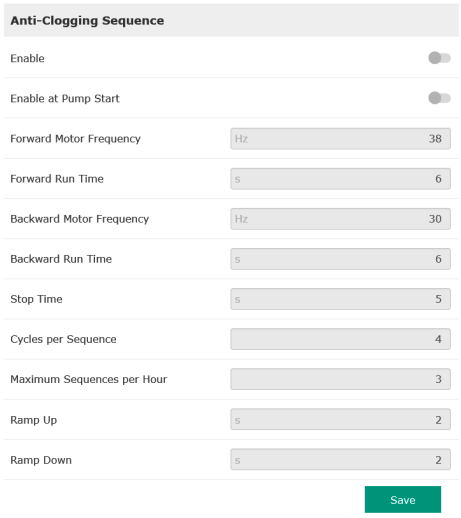
6.6.4.2 Clog Detection – Detection Settings



Defining the framework conditions for clogging detection. **NOTICE! Save a reference characteristic to be able to activate clogging detection!** (➔ "Teach Power Curve")

- Enable
  Switch function on and off.
  Factory setting: Off
- Power Volatility Limit
  Permissible variation from the averaged power consumption in %.
  Factory setting: 2 %
  Input: 0 to 100 %
- Volatility Trigger Delay
  A cleaning process is started if the permissible variation from the averaged power consumption over the set duration is greater than the permissible variation.
  Factory setting: 10 s
  Input: 0 to 60 s
- Power Limit
  Permissible variation from the reference curve in %.
  Factory setting: 10 %
  Input: 0 to 100 %
- Power Limit Trigger Delay
  A cleaning process is started once the permissible output deviation in relation to the reference characteristic is greater than the permissible deviation over the set duration.
  Factory setting: 10 s
  Input: 0 to 60 s
- Power Limit – High
  Permissible variation from the reference characteristic in %, if digital input "High Clog Limit" is active.
  Factory setting: 15 %
  Input: 0 to 100 %
- Power Rise Limit
  Comparison of the average power consumption during normal operation and during clogging detection. The average power consumption is recorded during normal operation and during clogging detection. The length of the recording is set ex works. Both values are compared with each other. A cleaning process is started if the value during clogging detection is higher than the value in normal operation by the set factor.
  Factory setting: 3 %
  Input: 0 to 100 %
- Frequency Change Latency
  Length of time after a change in frequency until new measuring data is saved for calculations.
  Factory setting: 5 s
  Input: 0 to 60 s

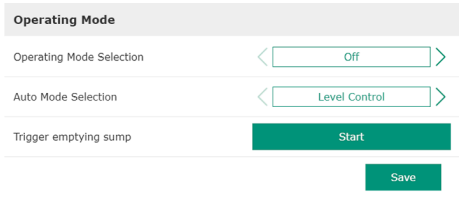
6.6.5 Anti-Clogging Sequence



If required the pump can start a cleaning sequence if clogging detection has been activated. In order to release and pump out the blockage, the pump runs alternately forwards and in reverse several times.

- Enable
  Switch function on and off.
  Factory setting: Off
- Enable at Pump Start
  A cleaning sequence is started prior to each pumping process.
  Factory setting: Off
- Forward Motor Frequency
  Frequency specification for forward operation during the cleaning sequence.
  Factory setting: 38 Hz
  Input: 0 to 60 Hz
- Forward Run Time
  Running time for forward operation.
  Factory setting: 6 s
  Input: 0 to 30 s
- Backward Motor Frequency
  Frequency specification for reverse operation during the cleaning sequence.
  Factory setting: 30 Hz
  Input: 0 to 60 Hz
- Backward Run Time
  Running time for reverse operation.
  Factory setting: 6 s
  Input: 0 to 30 s
- Stop Time
  Standstill time between forward and reverse operation.
  Factory setting: 5 s
  Input: 0 to 10 s
- Cycles per Sequence
  Number of forward and reverse operations during a cleaning sequence.
  Factory setting: 4
  Input: 1 to 10
- Maximum Sequences per Hour
  Max. number of cleaning sequences in one hour.
  Factory setting: 3
  Input: 1 to 10
- Ramp Up
  Start-up time of the motor from 0 Hz to the set frequency.
  Factory setting: 2 s
  Input: 0 to 10 s
- Ramp Down
  Switch-off time of the motor from the set frequency to 0 Hz.
  Factory setting: 2 s
  Input: 0 to 10 s

6.6.6 Operating Mode (System)

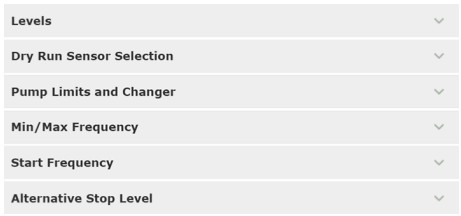


Specify basic settings for the system.

- Operating Mode Selection
  Specify in which operating mode the system is being operated.
  Factory setting: Off
  Input: Auto, Off
  - Off
    System off. Manual mode of individual pumps possible via the home page of the relevant pump.
  - Auto
    Automatic operation of the system via the set controller under "Auto Mode Selection".

- Auto Mode Selection
  Specify which controller controls the system.
  Factory setting: Level Control
  Input: Level Control, PID, HE-Controller
- Trigger emptying sump
  Start manual pump process. The max. specified pumps run up to the specified switch-off/stop level of the set level detection (see System Limits ➔ Pump Limits and Changer).

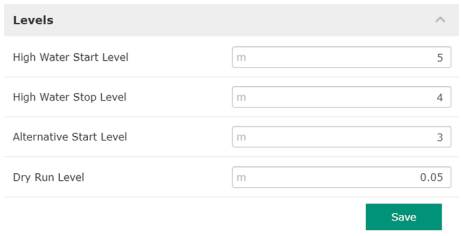
6.6.7 System Limits



Specify the permissible application limits of the system:

- Levels
  Specify the levels for high water and dry-running protection.
- Dry Run Sensor Selection
  Determine the signal source for dry running.
- Pump Limits and Changer
  Settings for regular pump cycling.
- Min/Max Frequency
  Specify the minimum and maximum operating frequency.
- Start Frequency
  Specify an increased operating frequency when starting the pump.
- Alternative Stop Level
  Additional shut-down level for completely draining the pump chamber and aeration of the level probe.

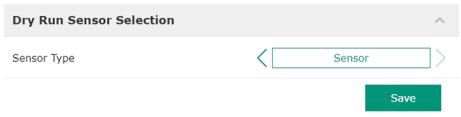
6.6.7.1 Levels



Define different filling levels for switching the pumps on and off. **NOTICE! Connect a level sensor for detecting the filling levels!**

- High Water Start Level
  If the set level is reached, start the max. specified pumps (see System Limits ➔ Pump Limits and Changer). An entry is made in the Data Logger.
  Factory setting: 100 m
  Input: 0.05 to 100 m
- High Water Stop Level
  If the set level is reached, all additionally started pumps are switched off. Only those pumps remain in operation that are required according to the control system. An entry is made in the Data Logger.
  Factory setting: 100 m
  Input: 0.05 to 100 m
- Alternative Start Level
  Additional switch-on level for draining the pump chamber earlier. This earlier switch-on level increases the standby chamber volume for special events, e.g. heavy rain. To activate the additional switch-on level, assign a digital input on the I/O module with the function "Alternative Start Level". If the set level is reached, start the max. specified pumps (see System Limits ➔ Pump Limits and Changer).
  Factory setting: 100 m
  Input: 0.05 to 100 m
- Dry Run Level
  All pumps are switched off when the set level has been reached. An entry is made in the Data Logger.
  Factory setting: 0.05 m
  Input: 0.05 to 100 m

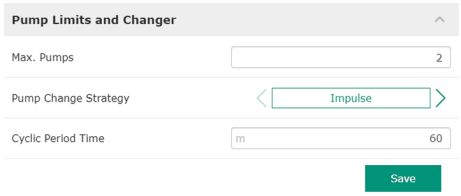
6.6.7.2 Dry Run Sensor Selection



Specify the sensor for the dry run.

- Sensor Type
  Factory setting: Sensor
  Input: Sensor, Dry Run Input
  - Sensor
    The dry run level is determined via the level sensor.
  - Dry Run Input
    The signal for the dry run level is transmitted via a digital input.

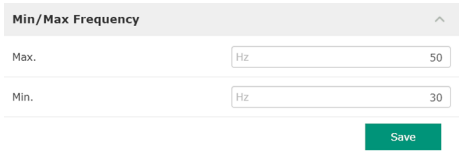
6.6.7.3 Pump Limits and Changer



The base-load pump is regularly switched in order to prevent irregular running times of the individual pumps.

- Max. Pumps
  Max. number of pumps in the system that may be operated simultaneously.
  Factory setting: 2
  Input: 1 to 4
- Pump Change Strategy
  Basic control for pump cycling.
  Factory setting: Impulse
  Input: Impulse, Cyclic
  - Impulse
    Pump cycling takes place after all pumps have been stopped.
  - Cyclic
    Pump cycling takes place after the specified time under "Cyclic Period Time".
- Cyclic Period Time
  If the "Cyclic" change mode is set, enter here the duration after which a pump cycling takes place.
  Factory setting: 60 min
  Input: 1 to 1140 min

6.6.7.4 Min/Max Frequency

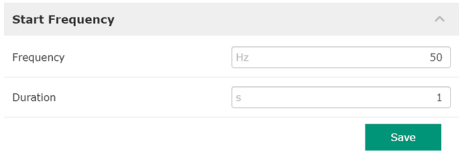


Specify the minimum and maximum operating frequency of the pumps in the system:

- Max.
  Maximum operating frequency of the pumps in the system.
  Factory setting: maximum frequency according to rating plate
  Input: from **minimum** to **maximum** frequency **according to rating plate**
- Min.
  Minimum operating frequency of the pumps in the system.
  Factory setting: minimum frequency according to rating plate
  Input: from **minimum** to **maximum** frequency **according to rating plate**

NOTICE! The input is limited by the application limit of the pump set by the factory!

6.6.7.5 Start Frequency



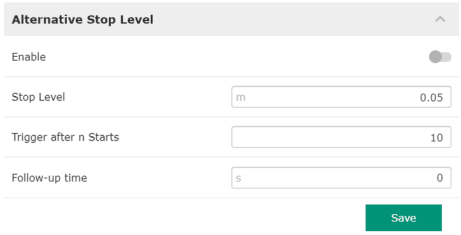
Specify an increased operating frequency when starting the pump.

- Frequency
  Operating frequency at pump start.
  Factory setting: maximum frequency according to rating plate
  Input: from **minimum** to **maximum** frequency **according to rating plate**

  NOTICE! This function is only active if the setpoint frequency of the controller is lower than the increased start frequency.

  NOTICE! If the set value is equal to the minimum frequency, the function is deactivated.
- Duration
  During the specified time, the pumps run at the increased operating frequency. The frequency is then individually controlled depending on the control mode.
  Factory setting: 1 s
  Input: 1 to 30 s

6.6.7.6 Alternative Stop Level



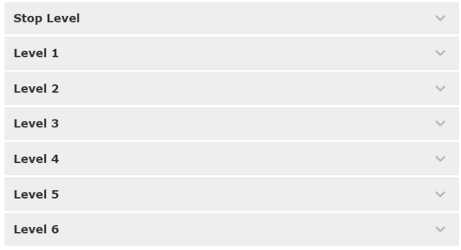
Additional switch-off level to lower the fill level in the pump chamber and to aerate the level sensor. The additional shut-down level is activated after a specified number of pump cycles has been reached.

NOTICE! Set switch-off level above the level value for dry-running protection!

- Enable
  Switch function on and off.
  Factory setting: Off
- Stop Level
  Set the desired fill level.
  Factory setting: 0.05 m
  Input: 0.05 to 100 m

- Trigger after n Starts
  Number of pump cycles until the additional switch-off level becomes active.
  Factory setting: 10
  Input: 2 to 100
- Follow-up time
  Follow-up time of the pumps until deactivation.
  Factory setting: 0 s
  Input: 0 to 300 s

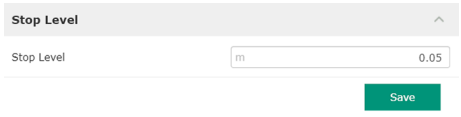
6.6.8 Level Controller



Specify individual switching levels:

- Stop level
  Shut-down level for all pumps.
- Levels 1 to 6
  Specify up to six switching levels.

6.6.8.1 Stop Level



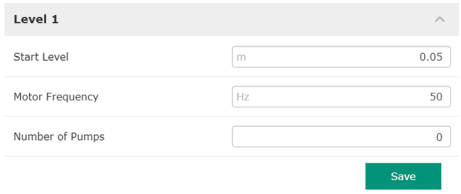
Shut-down level for all pumps.

NOTICE! Set switch-off level above the level value for dry-running protection!

NOTICE! If the "alternative switch-off level" is used, set this level value over the level value for the "alternative switch-off level"!

- Stop Level
  Factory setting: 0.05 m
  Input: 0.05 to 100 m

6.6.8.2 Level 1 ... 6

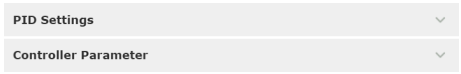


Specify up to six different switching levels for controlling the pumps. **NOTICE! It is not necessary to define the switching levels one after the other!**

- Start Level
  Start level for the pump sequence.
  Factory setting: 0.05 m
  Input: 0.05 to 100 m
- Motor Frequency
  Specification of the operating frequency for the pump sequence.
  Factory setting: Minimum frequency of the pump
  Input: Minimum frequency of the pump up to max. frequency of the pump according to the rating plate
- Number of Pumps
  Number of pumps that are started for the pump sequence.
  Factory setting: 0
  Input: 0 to 4

  NOTICE! The value 0 deactivates the level specification!

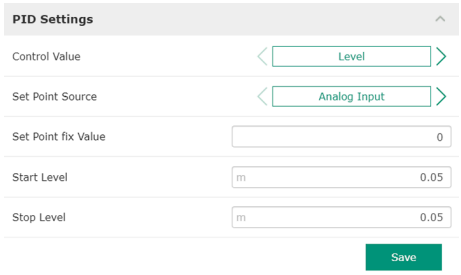
6.6.9 PID Controller



Settings for pump control:

- PID Settings
  Basic settings for the PID control.
- Controller Parameter
  Basic settings for the PID controller.

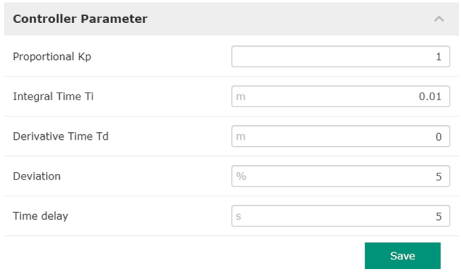
6.6.9.1 PID Settings



Basic settings for the PID control.

- Control Value
  Specifying the control parameter.
  Factory setting: Level
  Input: Level, Pressure, Flow
- Set Point Source
  Setpoint specification for the control.
  Factory setting: Analog Input
  Input: Analog Input, Bus Input, Fix
  - Analog Input
    The values of the lower-level control are transmitted in analogue form to the I/O module 2 (ET-7002). **NOTICE! Configure the analogue input with the "setpoint" value!**
  - Bus Input
    The values of the primary control are transmitted to the pump via the Ethernet network. ModBus TCP or OPC UA are used as communication protocols.
  - Fix
    Fixed specification for the setpoint.
- Set Point fix Value
  If the "Fix" value is selected in the setting "Set Point Source", enter the corresponding setpoint here.
  Factory setting: 0
  Input: free input of the desired setpoint. The units for the control values are:
  - Level = m
  - Pressure = bar
  - Flow = l/s
- Start Level
  When the set level is reached, at least one pump starts. The actual number of pumps started depends on the deviation from the target value. The maximum number of pumps to be started is set in the menu "System Limits" (see System Limits ➔ Pump Limits and Changer).
  Factory setting: 0.05 m
  Input: 0.05 to 100 m
- Stop Level
  All pumps are switched off when the set level has been reached.
  Factory setting: 0.05 m
  Input: 0.05 to 100 m

6.6.9.2 Controller Parameter



Basic settings for the PID controller.

- Proportional Kp
  Gain factor
  Factory setting: 1
  Input: -1000 to 1000

  NOTICE! For fill level control, set the proportional value Kp negative (-)!
- Integral Time Ti
  Reset/integral time
  Factory setting: 0.01 min
  Input: 0 to 10000 min
- Derivative Time Td
  Differential/retention time
  Factory setting: 0 min
  Input: 0 to 1000 min

  NOTICE! The differential component Td is generally not used in wastewater applications. Preferably set value to "0"!
- Deviation
  Permissible deviation between actual value and setpoint.
  Factory setting: 5 %
  Input: 0 to 100 %

  Control conditions

– Setpoint deviation is outside the defined limit.
– Output frequency reaches the **maximum** frequency.
If both conditions apply for a defined duration, a pump is **switched on**.

– Setpoint deviation is outside the defined limit.
– Output frequency reaches the **minimum** frequency.
If both conditions apply for a defined duration, a pump is **switched off**.

For the values of maximum and minimum frequency see System Limits ➔ Min/Max Frequency.

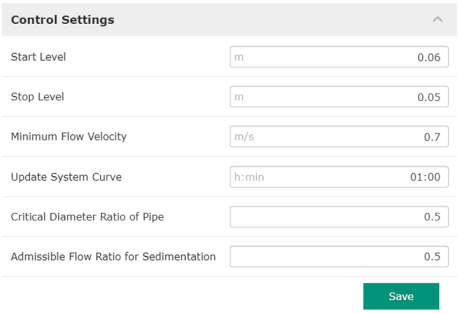
- Time delay
  Delay/follow-up time
  Factory setting: 5 s
  Input: 0 to 300 s

6.6.10 High Efficiency(HE) Controller

Settings for pump control:

- Control Settings
  Basic settings for the HE controller.
- Pipe Settings
  Piping details.
- Tank Geometry
  Chamber geometry details.

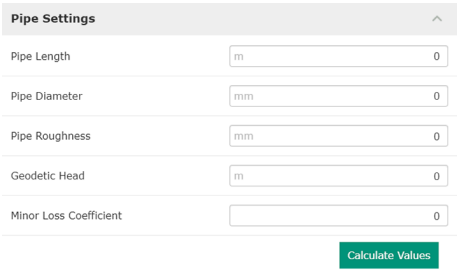
6.6.10.1 Control Settings



Basic settings for the pump control.

- Start Level
  A pump starts when the set level has been reached.
  Factory setting: 0.05 m
  Input: 0.05 to 100 m
- Stop Level
  The active pump is switched off when the set level has been reached.
  Factory setting: 0.05 m
  Input: 0 to 100 m
- Minimum Flow Velocity
  Specifying the minimum flow velocity in the piping.
  Factory setting: 0.7 m/s
  Input: 0 to 100 m/s
- Update System Curve
  Start time for measuring the system curve.
  Factory setting: 00:00 h
  Input: 00:00 to 23:59 hrs
- Critical Diameter Ratio of Pipe
  Permissible ratio of theoretical to actual piping cross-section. If the permissible ratio is not reached, sedimentation of the piping is detected. The piping is flushed at the rated frequency.
  Factory setting: 0.5
  Input: 0 to 1
- Admissible Flow Ratio for Sedimentation
  Permissible ratio of the flow rates during initial commissioning and before and during flushing. If the permissible ratio is exceeded, flushing is stopped.
  Factory setting: 0.5
  Input: 0 to 1

6.6.10.2 Pipe Settings

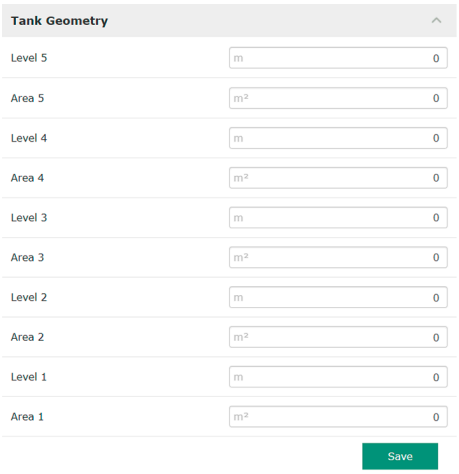


Piping details.

- Pipe Length
  Total length of the piping to the next pumping station.
  Factory setting: 0 m
  Input: 0 to 100,000 m
- Pipe Diameter
  Factory setting: 0 mm
  Input: 0 to 10,000 mm
- Pipe Roughness
  Indication of the absolute pipe roughness.
  Factory setting: 0 mm
  Input: 0 to 100 mm
- Geodetic Head
  Height difference between the water surface in the pump and the highest point in the connected pressure pipe.
  Factory setting: 0 m
  Input: 0 to 100 m
- Minor Loss Coefficient
  Dimensional ratio for calculating the pressure loss in the pressure pipe.
  Factory setting: 0
  Input: 0 to 100

To accept the specified values, click "Calculate Values".

6.6.10.3 Tank Geometry



Chamber geometry details. The system uses up to five parameters to calculate the geometry of the chamber. **NOTICE! The parameters do not have to be specified in sequence!**

- Level 1 ... 5
  Factory setting: 0 m
  Input: 0 to 100 m
- Area 1 ... 5
  Factory setting: 0 m²
  Input: 0 to 100 m²
  NOTICE! The value 0 deactivates the respective specification!

  NOTICE! In order for the pump to function properly, at least two surfaces must be specified: cylindrical chamber geometry, minimum and maximum flow level!

7 Extras

7.1 Backup/Restore

The following functions are available:

- Backup/Restore
  Possibility to save the current configuration or restore the configuration from a file.
- Restore Configuration Files
  Reset Digital Data Interface to the condition upon delivery.

Save configuration

1. Click "Save" next to "Save settings to local file".
2. Select the storage location in the selection window.
3. Click on "Save" in the selection window.
   ► Configuration saved.

Restore configuration settings

1. Click "Browse" next to "Load backup from local file".
2. Select the storage location of the desired configuration in the selection window.
3. Select file.

4. Click on "Open" in the selection window.
   ► The configuration is loaded.
   ► When the configuration is loaded, the message "Successfully loaded backup file!" is shown.

Restore to condition upon delivery

1. Click "Restore".
   ⇒ Security prompt appears: All existing configurations will be lost and default values will be loaded.
2. Confirm the safety query with "Ok".
   ► The condition upon delivery is loaded.
   ► If the condition upon delivery is loaded, the following message is displayed "Configuration files are restored successfully".

7.2 Software update

The following functions are available:

- Install new software bundle
  Install new firmware for the Digital Data Interface.
- Update device's license
  Install the Digital Data Interface upgrade for "LPI" or "LSI" operating modes.

Install new software bundle

Save a backup of the current configuration before updating the firmware! It is also recommended that productive systems undergo an internal test prior to application in the customer environment. Despite comprehensive quality assurance measures, this WILO SE cannot exclude all risks.

NOTICE! If the pump is operated in system mode "LSI", switch off the pump in the system before updating the firmware!

1. Open the home page of the slave pump.
2. Click "Settings".
3. Click "Digital Data Interface".
4. Click "LSI Mode System Settings".
5. Deactivate LSI mode.
6. If the firmware has been updated, reactivate LSI mode.

✓ LSI mode: LSI mode for the pump deactivated.
✓ Pump switched off.

1. Click "Browse" next to "Pick update bundle".
2. Select the location of the file in the selection window.
3. Select file.
4. Click on "Open" in the selection window.
5. Click "Submit".
   ⇒ The data is transferred to the Digital Data Interface. Once the file has been transferred, detailed information about the new version is displayed in the right-hand window.
6. Initiate update: Click "Apply".
   ► New firmware is loaded.
   ► Once the firmware is loaded, the message "Bundle uploaded successfully" is displayed.

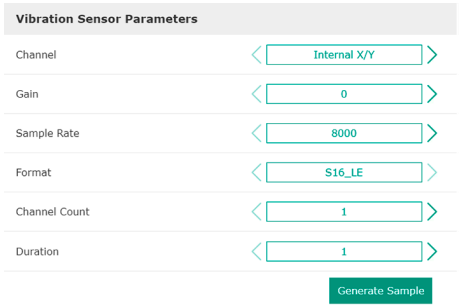
Update device's license

The Digital Data Interface comprises three different system modes: "DDI", "LPI" and "LSI" as well as different fieldbus types. The possible system modes and fieldbus types are enabled via the license key. This function also updates the license.

1. Click "Browse" next to "Select license file".
2. Select the location of the file in the selection window.
3. Select file.

4. Click on "Open" in the selection window.
5. Click "Save".
   - ▶ The license is loaded.
   - ▶ Once the license is loaded, the message "License is updated successfully" is displayed.

7.3 Vibration Sample



The existing vibration sensors record the vibrations of the pump at any time. With Vibration Sample, the acquired data can be saved in a wav file.

- Channel
  Selection of the sensor to be acquired.
  Factory setting: Internal X/Y
  Input:
  - Internal X/Y: Vibration sensor X/Y in DDI
  - Internal Z: Vibration sensor in DDI
  - Extern X/Y: External vibration sensor at input 1 or 2
- Gain
  Gain of the recorded signal up to approx. 60 dB.
  Factory setting: 0 %
  Input: 0 ... 100 % (corresponds to 0 ... 59.5 dB)

  Example calculation:
  - Gain: Factor 2
  - Calculation: $20\log_{10}(2) = 6.02$ dB
  - Value to be set: 10 (= 10 %)
- Sample Rate
  Factory setting: 8000 Hz
  Input: 8000 Hz, 16000 Hz, 44100 Hz
- Format
  Factory setting: S16_LE (Signed 16 Bit Little Endian)
- Channel Count
  Selection of the channel to be acquired.
  Factory setting: 1
  Input: 1 (Internal X / Internal Z / External 1), 2 (Internal X and Y / External 1 and 2)
- Duration
  Recording time
  Factory setting: 1 s
  Input: 1 ... 5 s

To start the measurement, click "Generate Sample".

7.4 Documentation

The following information can be displayed:

- Typeplate Data
  Illustration of technical data.
- Instruction Manual
  Installation and operating instructions in PDF format.
- Hydraulic Data
  Test report in PDF format.

The maintenance and installation logbook is additionally available using the "Regular user" user account:

- Maintenance Logbook
  Plain text field to record individual maintenance work.
- Installation Logbook
  Plain text field to describe installation. The "Name of the installation site" is displayed on the home page.

NOTICE! Comply with data protection regulations! Do not record any personal data in the maintenance and installation logbook.

7.5 Licences

Overview of all licences used and the corresponding version ("License" main menu).

8 Faults, causes and remedies

DANGER

Risk of fatal injury due to electrical current!

Improper conduct when carrying out electrical work can lead to death due to electric shock!

- Electrical work must be carried out by a qualified electrician!
- Observe local regulations!

8.1 Error types

The Digital Data Interface distinguishes between five different prioritisations for alarm and warning messages:

- Alert Type A
- Alert Type B
- Warning Type C
- Warning Type D
- Message Type I

NOTICE! The functionality of the alarms and warnings depends on the system mode!

8.1.1 Error types: DDI and LPI system mode

Functionality of the various alarm and warning messages:

- Alert Type A: The pump is **switched off** in the event of a fault. Reset the alarm signal **manually**:
  - "Reset Error" on the home page
  - Function "Reset" at a digital input of the frequency converter **or** I/O module
  - Corresponding signal via fieldbus
- Alert Type B: The pump is **switched off** in the event of a fault. When the fault is corrected, the alarm signal is automatically reset.
- Warning Type C: These warnings can switch a relay output of the frequency converter **or** the I/O module.
- Warning Type D: These warnings are only displayed and logged.
- Message Type I: Information about operating status.

8.1.2 Error types: LSI system mode

Functionality of the various alarm and warning messages:

- Alert Type A: In the event of a fault, the pump is **not** switched off. Reset the alarm signal **manually**:
  - "Master Reset" on the Master home page
  - Function "Reset" at a digital input of the **I/O modules**
  - Corresponding signal via fieldbus
- Alert Type B: In the event of a fault, the pump is **not** switched off. When the fault is corrected, the alarm signal is automatically reset.
  NOTICE! The dry-running protection always switches off the pump!
- Warning Type C: These warnings can switch a relay output of the **I/O module**.
- Warning Type D: These warnings are only displayed and logged.
- Message Type I: Information about operating status.

8.2 Error codes

Code	Type	Fault	Cause	Remedy
100.x	A	Pump Unit Offline (SERIAL NUMBER)	The connection to the specified pump cannot be established.	Check network connection. Check network settings.
101	A	Master Changed (SERIAL NUMBER)	The Master pump was changed due to the predefined change strategy or a communication error.	Check change strategy in the Master settings. Check network connection.
200	B	Alarm in Pump (SERIAL NUMBER)	Alarm at the specified pump.	Check the error log of the specified pump.
201	B	Dry Run	Dry-running level reached	Check the operating parameters of the system. Check level settings. Check the settings of the digital inputs.

Code	Type	Fault	Cause	Remedy
202	B	High Water	High water level reached	Check the operating parameters of the system. Check level settings. Check the settings of the digital inputs.
203	B	Sensor Error	Measured value is outside the measurement range, sensor defective.	Contact customer service.
400	C	Warning in Pump (SERIAL NUMBER)	Warning for the specified pump.	Check the error log of the specified pump.
500	D	Pipe Sedimentation High	Blockage in the piping. After detection, a flushing cycle is started at maximum frequency for the next pump cycles. If the permissible ratio (Admissible Flow Ratio for Sedimentation) is exceeded, flushing is terminated.	Check piping, remove blockages. Check "High Efficiency(HE) Controller" settings.
501	D	Comm. Error I/O Extension	Communication with I/O module failed.	Check network connection. Check I/O module. Check settings for the I/O module in the Master settings.
900	I	More than 4 Pumps in System	Maximum number of pumps in the system exceeded.	Integrate a maximum of 4 pumps into the system.
901	I	Pump removed from System (SERIAL NUMBER)	Pump has been removed from the system.	Check network connection.
902	I	Pipe Measurement Incomplete	Calculation of piping parameters was not successfully executed.	Check settings under High Efficiency(HE) Controller/Pipe Settings and recalculate. If the message is still displayed, contact customer service.
903	I	Pipe Calculation Timeout	Calculation of piping parameters was aborted due to a timeout.	Check settings under High Efficiency(HE) Controller/Pipe Settings and recalculate. If the message is still displayed, contact customer service.
904	I	Pipe Settings / Calculation Missing	Calculation of piping parameters has not yet been carried out. HE controller cannot be activated.	Input settings under High Efficiency(HE) Controller/Pipe Settings and start calculation.
1000	A	Motor Safe Stop Alarm	"Safe Torque Off" active.	Check connection: 24 VDC must apply at terminal 37 of the frequency converter. A manual reset is required once the fault has been eliminated! Installation in potentially explosive atmospheres: Check switch-off parameters (thermal motor monitoring, dry-running protection).
1001	A	Motor Ground Fault Alarm	Short circuit to earth between an output phase and earth (between frequency converter and motor or directly in the motor)	Have the electrical connection at the frequency converter checked by a qualified electrician. Have the electrical connection at the motor checked by a qualified electrician.
1002	A	Motor Short Circuit Alarm	Short circuit in motor or at motor connection	Have the electrical connection at the motor checked by a qualified electrician.
2000	B	Motor Vibration X - Trip	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.

Code	Type	Fault	Cause	Remedy
2001	B	Motor Vibration Y – Trip	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.
2002	B	Motor Vibration Z – Trip	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.
2003	B	Vibration Input 1 – Trip	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.
2004	B	Vibration Input 2 – Trip	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.
2005	B	FC Overload Alarm	Temperature sensor of the performance card records excessive or insufficient temperature.	Check frequency converter ventilation.
2005	B	FC Overload Alarm	Switch-off temperature (75 °C) of the control card reached.	Check frequency converter ventilation.
2005	B	FC Overload Alarm	Inverter overload	Compare rated current: – Compare output current displayed at LCP with rated current of the frequency converter – Compare the output current displayed at the LCP with measured motor current Display thermal load on LCP and monitor value: – If the frequency converter is operated **above** the permanent rated current, the counter increases. – If the frequency converter is operated **below** the permanent rated current, the counter decreases.
2006	B	FC Line Alarm	Mains connection: one phase is missing	Have the electrical connection at the frequency converter checked by a qualified electrician. Have the electrical connection at the motor checked by a qualified electrician.
2006	B	FC Line Alarm	Mains connection: excessive phase asymmetry	Have the electrical connection at the frequency converter checked by a qualified electrician. Have the electrical connection at the motor checked by a qualified electrician.
2006	B	FC Line Alarm	Motor connection: one phase is missing	Have the electrical connection at the frequency converter checked by a qualified electrician. Have the electrical connection at the motor checked by a qualified electrician.
2007	B	FC DC Circuit Alarm	Overvoltage	Extend ramp time for brake ramp.
2007	B	FC DC Circuit Alarm	Undervoltage	Have the electrical connection at the frequency converter checked by a qualified electrician. Check the pre-charge circuit.
2008	B	FC Supply Alarm	No supply voltage at frequency converter	Have the electrical connection at the frequency converter checked by a qualified electrician.
2008	B	FC Supply Alarm	External 24 VDC supply overloaded	Have the electrical connection at the frequency converter checked by a qualified electrician.
2008	B	FC Supply Alarm	1.8 VDC supply of the control card outside tolerance range.	Have the electrical connection at the frequency converter checked by a qualified electrician.

Code	Type	Fault	Cause	Remedy
3000	A/B	Dry Run Detected	Tank fill level has reached a critical level.	Check installation (e.g. inlet, outlet, level settings). Check digital input settings.
3001	A/B	Leakage Input Alarm	Leakage detected	Check the external electrode (optional) function. Change the oil in the sealing chamber. Check digital input settings.
3002	A/B	Temp. Sensor 1 Trip	Winding temperature limit reached	Check motor for overload. Check motor cooling. Check temperature limit values in Digital Data Interface and correct if necessary.
3003	A/B	Temp. Sensor 2 Trip	Winding temperature limit reached	Check motor for overload. Check motor cooling. Check temperature limit values in Digital Data Interface and correct if necessary.
3004	A/B	Temp. Sensor 3 Trip	Winding temperature limit reached	Check motor for overload. Check motor cooling. Check temperature limit values in Digital Data Interface and correct if necessary.
3005	A/B	Temp. Sensor 4 Trip	Bearing temperature limit value reached	For dry well installation: Check ambient temperature, keep to maximum value. Check temperature limit values in Digital Data Interface and correct if necessary.
3006	A/B	Temp. Sensor 5 Trip	Bearing temperature limit value reached	For dry well installation: Check ambient temperature, keep to maximum value. Check temperature limit values in Digital Data Interface and correct if necessary.
3007	A/B	Motor Overload	Torque limit reached	If the system exceeds the motor's torque limit during the acceleration ramp, extend the time for the acceleration ramp. If the system exceeds the generator's torque limit during the brake ramp, extend the time for the brake ramp. If the torque limit is reached during operation, increase the torque limit. Make sure the system can be operated with a higher torque, if necessary, contact customer service. Excessive motor current consumption, check operating conditions.
3007	A/B	Motor Overload	Excess current	Disconnect the motor from the mains connection and turn the shaft by hand. Contact customer service if it is not possible to turn the shaft by hand. Check the motor power/frequency converter configuration. Contact customer service if the motor power is too high. Check parameters 1-20 to 1-25 in the frequency converter for correct motor data and adapt if necessary.

Code	Type	Fault	Cause	Remedy
3008	A/B	Motor Overtemp.	Thermal motor monitoring has triggered.	Motor overheated, check cooling and operating conditions. Check motor for mechanical overload. Check thermal motor monitoring connection (frequency converter: terminal 33 and terminal 50 (+10 VDC). Check parameters 1-93 "Thermistor Source" in the frequency converter if a thermal switch or thermistor is used: Value must correspond to sensor wiring.
4000	C	High Water Detected	Tank fill level has reached a critical level.	Check installation (e.g. inlet, outlet, level settings). Check digital input settings.
4001	C	Leakage Input Warning	Leakage detected	Check the external electrode (optional) function. Change the oil in the sealing chamber. Check digital input settings.
4002	C	Temp. Sensor 1 Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4003	C	Temp. Sensor 2 Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4004	C	Temp. Sensor 3 Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4005	C	Temp. Sensor 4 Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4006	C	Temp. Sensor 5 Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4007	C	Internal Vibration Sensor Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4008	C	Current Sensor 1 Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4009	C	Current Sensor 2 Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4010	C	Onboard Temp. Sensor Fault	Sensor faulty, measured value outside measurement range.	Contact customer service.
4011	C	Temp. Sensor 1 Warning	Winding temperature limit reached.	Check motor for overload. Check motor cooling. Check temperature limit values in Digital Data Interface and correct if necessary.
4012	C	Temp. Sensor 2 Warning	Winding temperature limit reached.	Check motor for overload. Check motor cooling. Check temperature limit values in Digital Data Interface and correct if necessary.
4013	C	Temp. Sensor 3 Warning	Winding temperature limit reached.	Check motor for overload. Check motor cooling. Check temperature limit values in Digital Data Interface and correct if necessary.
4014	C	Temp. Sensor 4 Warning	Bearing temperature limit reached.	For dry well installation: Check ambient temperature, keep to maximum value. Check temperature limit values in Digital Data Interface and correct if necessary.
4015	C	Temp. Sensor 5 Warning	Bearing temperature limit reached.	For dry well installation: Check ambient temperature, keep to maximum value. Check temperature limit values in Digital Data Interface and correct if necessary.

Code	Type	Fault	Cause	Remedy
4016	C	Temp. On Board Warning	Temperature limit value reached in Digital Data Interface.	Check motor for overload. Check motor cooling.
4017	C	General FC Alarm	"Terminal 50" frequency converter: Voltage <10 V	Remove cable at terminal 50: – If the frequency converter no longer shows the warning, there is a problem with the customer's wiring. – If the frequency converter continues to show the warning, replace the control card.
4017	C	General FC Alarm	No motor connected to the frequency converter output.	Connect motor.
4017	C	General FC Alarm	Motor overload	Motor overheated, check cooling and operating conditions. Check motor for mechanical overload.
4017	C	General FC Alarm	Speed limit reached.	Check operating conditions.
4017	C	General FC Alarm	Voltage limit reached.	Check operating conditions.
4017	C	General FC Alarm	Temperature of the frequency converter too cold for operation.	Check temperature sensor in frequency converter. Check sensor cable between IGBT and Gate actuation card.
4018	C	Motor Ground Fault Warning	Short circuit to earth between an output phase and earth (between frequency converter and motor or directly in the motor)	Have the electrical connection at the frequency converter checked by a qualified electrician. Have the electrical connection at the motor checked by a qualified electrician.
4019	C	Motor Overload	Torque limit reached	If the system exceeds the motor's torque limit during the acceleration ramp, extend the time for the acceleration ramp. If the system exceeds the generator's torque limit during the brake ramp, extend the time for the brake ramp. If the torque limit is reached during operation, increase the torque limit. Make sure the system can be operated with a higher torque, if necessary, contact customer service. Excessive motor current consumption, check operating conditions.
4019	C	Motor Overload	Excess current	Disconnect the motor from the mains connection and turn the shaft by hand. Contact customer service if it is not possible to turn the shaft by hand. Check the motor power/frequency converter configuration. Contact customer service if the motor power is too high. Check parameters 1-20 to 1-25 in the frequency converter for correct motor data and adapt if necessary.
4020	C	Motor Overtemp.	Thermal motor monitoring has triggered.	Motor overheated, check cooling and operating conditions. Check motor for mechanical overload. Check thermal motor monitoring connection (frequency converter: terminal 33 and terminal 50 (+10 VDC). Check parameters 1-93 "Thermistor Source" in the frequency converter if a thermal switch or thermistor is used: Value must correspond to sensor wiring.

Code	Type	Fault	Cause	Remedy
4022	C	Motor Safe Stop Warning	"Safe Torque Off" active.	Check connection: 24 VDC must apply at terminal 37 of the frequency converter. A manual reset is required once the fault has been eliminated! Installation in potentially explosive atmospheres: Check switch-off parameters (thermal motor monitoring, dry-running protection).
4024	C	FC Overload Warning	Temperature sensor of the performance card records excessive or insufficient temperature.	Check frequency converter ventilation.
4024	C	FC Overload Warning	Switch-off temperature (75 °C) of the control card reached.	Check frequency converter ventilation.
4024	C	FC Overload Warning	Inverter overload	Compare rated current: – Compare output current displayed at LCP with rated current of the frequency converter – Compare the output current displayed at the LCP with measured motor current Display thermal load on LCP and monitor value: – If the frequency converter is operated **above** the permanent rated current, the counter increases. – If the frequency converter is operated **below** the permanent rated current, the counter decreases. Check parameters 1-20 to 1-25 in the frequency converter for correct motor data and adapt if necessary.
4025	C	FC Line Warning	Mains connection: one phase is missing	Have the electrical connection at the frequency converter checked by a qualified electrician. Have the electrical connection at the motor checked by a qualified electrician.
4025	C	FC Line Warning	Mains connection: excessive phase asymmetry	Have the electrical connection at the frequency converter checked by a qualified electrician. Have the electrical connection at the motor checked by a qualified electrician.
4025	C	FC Line Warning	Motor connection: one phase is missing	Have the electrical connection at the frequency converter checked by a qualified electrician. Have the electrical connection at the motor checked by a qualified electrician.
4026	C	FC DC Circuit Warning	Overvoltage	Extend ramp time for brake ramp.
4026	C	FC DC Circuit Warning	Undervoltage	Have the electrical connection at the frequency converter checked by a qualified electrician. Check the pre-charge circuit.
4027	C	FC Supply Warning	No supply voltage at frequency converter	Have the electrical connection at the frequency converter checked by a qualified electrician.
4027	C	FC Supply Warning	External 24 VDC supply overloaded	Have the electrical connection at the frequency converter checked by a qualified electrician.
4027	C	FC Supply Warning	1.8 VDC supply of the control card outside tolerance range.	Have the electrical connection at the frequency converter checked by a qualified electrician.
4028	C	FC Communication Warning	Control word timeout	Check Ethernet connection. Increase parameter 8-03 "Control Timeout Time" in frequency converter. Check communication device function. Check if wiring is EMC-compliant.

Code	Type	Fault	Cause	Remedy
4029	C	General FC Warning	"Terminal 50" frequency converter: Voltage <10 V	Remove cable at "terminal 50": – If the frequency converter no longer shows the warning, there is a problem with the customer's wiring. – If the frequency converter continues to show the warning, replace the control card.
4029	C	General FC Warning	No motor connected to the frequency converter output.	Connect motor.
4029	C	General FC Warning	Motor overload	Motor overheated, check cooling and operating conditions. Check motor for mechanical overload.
4029	C	General FC Warning	Speed limit reached.	Check operating conditions.
4029	C	General FC Warning	Voltage limit reached.	Check operating conditions.
4029	C	General FC Warning	Temperature of the frequency converter too cold for operation.	Check temperature sensor in frequency converter. Check sensor cable between IGBT and Gate actuation card.
4030	C	EXIO Communication Down	Communication with I/O module failed.	Check the I/O module settings at the Digital Data Interface. Check the settings in the I/O module. Check Ethernet connection.
4031	C	FC Communication Down	Communication with frequency converter failed.	Check the frequency converter settings at the Digital Data Interface. Check settings in the frequency converter. Check Ethernet connection.
4034	C	Leakage Detected 1	Leakage detected in leakage chamber.	Drain leakage chamber.
4035	C	Leakage Detected 2	Leakage detected in sealing chamber.	Change the oil in the sealing chamber.
5000	D	Clog Detection Teach Failure	Teach-in process not completed: – Pump switched to manual mode or pump stopped during teach-in process. – Timeout because setpoint frequency has not been reached.	Check pump for clogging. Make sure the level in the run-down tank is sufficient. Check the settings for the teach-in process in the Digital Data Interface.
6000	C/D	Emerged Operation – Limit Temperature	Adjusted temperature value reached.	Check the settings of the "Non-immersed operation" function in the Digital Data Interface.
6001	C/D	Clog Detection	Potential deposits in the hydraulics	Activate "Cleaning sequence" function.
6002	C/D	Motor Vibration X – Warning	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.
6003	C/D	Motor Vibration Y – Warning	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.
6004	C/D	Motor Vibration Z – Warning	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.
6005	C/D	Vibration Input 1 – Warning	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.

Code	Type	Fault	Cause	Remedy
6006	C/D	Vibration Input 2 – Warning	Vibration limit value exceeded.	Check pump and installation (e.g. not running smoothly, poor duty point, distorted installation). Check vibration limit values in the Digital Data Interface and correct if necessary.
8001	D	Auto Setup Failed	Unable to complete automatic parameter configuration.	Frequency converter set to "Stop". Check the frequency converter settings in the Digital Data Interface and restart automatic parameter configuration.
8002	D	Auto Setup Timed Out	2 minute time limit exceeded.	Frequency converter set to "Stop". Check the frequency converter settings in the Digital Data Interface and restart automatic parameter configuration.
10004	I	Pump Kick is Running	Pump has exceeded the permissible standstill time.	
10005	I	Cleaning-Cycle is Running	Cleaning sequence in progress: – Prior to each pumping process – Clogging detected	
10006	I	Teach was Successful	Teach-in process for clogging detection completed.	
10007	I	Update Succeeded	Update completed.	
10008	I	Update Failed	Unable to complete update.	Contact customer service.

9 Appendix

9.1 Fieldbus: Parameter overview

The individual fieldbus parameters for the fieldbus types Modbus TCP and OPC UA are listed below.

NOTICE! The parameters for the LSI master are listed for each fieldbus type in a separate table!

NOTICE! For the fieldbus "ModBus TCP", the slave number is: 255, Port: 502!

Explanations for individual parameter groups in the system mode DDI, LPI and LSI (Slave)

- Parameter group Status
  Includes information on operating status, warnings and alarms.
- Parameter group Motor Information
  Includes information about motor ratings, motor and hydraulic type, pump serial number as well as minimum and maximum frequency.
- Parameter group Sensor Locations/Types
  Contains information about the sensor types (temperature, current and vibration) and their installation.
- Parameter group Data Readouts
  Contains the current sensor values, operating hours, pump and cleaning cycles as well as the energy consumption of the pump.
- Parameter group Time
  Contains information about the date and time.
- Parameter group Control Word
  Contains the settings of the pump operation mode, setpoint frequency, ramp times, pump enable and pump functions.
- Parameter group Sensor Trip/Warning
  Contains the threshold settings for the temperature and vibration sensors.

Explanations for individual parameter groups in the system mode LSI (Master)

- Parameter group System Variables
  Includes information on system operating status, system warnings and system alarms.
- Parameter group Analog Variables
  Contains the current fill level values, pressure and flow as well as the frequency and number of running pumps in the system.

- Parameter group Data Time Variables
  Contains information about the date and time.
- Parameter group Pump 1 ... Pump 4
  Contains information about the individual pump: Serial number, motor and hydraulic type, status, warnings, alarms, current performance, operating hours, number of pump and cleaning cycles, kWh counter.
- Parameter group Control Word
  Includes the releases for PID control, for draining the tank and for the alternative start level.
- Parameter group Modes
  Contains the settings of the system operating mode and the control mode in automatic mode.
- Parameter group PID Setpoint
  Contains the setting for the PID setpoint.

See also

- ModBus TCP: DDI/LPI/LSI Slave-Parameter [▶ 75]
- OPC-UA: DDI/LPI/LSI Slave-Parameter [▶ 82]
- ModBus TCP: LSI Master-Parameter [▶ 89]
- OPC-UA: LSI Master-Parameter [▶ 93]

Group	Symbol	Register Type	Address in DDI	Address in LPI	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
Status	MB_Status_Word	Input Registers	0	0	0	1	UINT	Bitfield	0	Run			not available in DDI mode
									1	Rising Water Level			not available in DDI mode
									2	Falling Water Level			not available in DDI mode
									3	External Off			not available in DDI mode
									4	Pump Kick Running	10004		not available in DDI mode
									5	Anticlog Running	10005		not available in DDI mode
Status	MS_Warning_Word_MSB	Input Registers	1	1	1	2	DWORD (High - Low)	Bitfield	0	Communication Error FC	4031		not available in DDI mode
									1				
									2				
									3	Thermostat active	6000		not available in DDI mode
									4	Clog Detection	6001		not available in DDI mode
									5	Vibration X Warning	6002		
									6	Vibration Y Warning	6003		
									7	Vibration Z Warning	6004		
									8	Vibration 1 Warning	6005		
									9	Vibration 2 Warning	6006		
									10	Current 1 Leackage	4034		
									11	Current 2 Leackage	4035		
									12	Clog Detection Teach failed	5000		not available in DDI mode
									13				
									14				
									15	FC Autosetup failed	8001		not available in DDI mode
									16	FC Autosetup Timeout	8002		not available in DDI mode
Status	MS_Warning_Word_LSB	Input Registers	3	3	3	2	DWORD (High - Low)	Bitfield	0	High Water detected	4000		
									1	Leackage Input	4001		
									2	Temp 1 fault	4002		
									3	Temp 2 fault	4003		
									4	Temp 3 fault	4004		
									5	Temp 4 fault	4005		

Group	Symbol	Register Type	Address in DDI	Address in LPI	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
									6	Temp 5 fault	4006		
									7	Internal Vibration fault	4007		
									8	Current Input 1 fault	4008		
									9	Current Input 2 fault	4009		
									10	Onboard Temp fault	4010		
									11	Temp 1	4011		
									12	Temp 2	4012		
									13	Temp 3	4013		
									14	Temp 4	4014		
									15	Temp 5	4015		
									16	Onboard Temp	4016		
									17				
									18	General FC Alarm	4017		not available in DDI mode
									19	Motor Ground fault	4018		not available in DDI mode
									20	Motor Overload	4019		not available in DDI mode
									21	Motor Overtemp	4020		not available in DDI mode
									22				
									23	Safe Stop	4022		not available in DDI mode
									24	AMA not OK	4023		not available in DDI mode
									25	FC Overload Warning	4024		not available in DDI mode
									26	FC Line Warning	4025		not available in DDI mode
									27	FC DC Circuit Warning	4026		not available in DDI mode
									28	FC Supply Warning	4027		not available in DDI mode
									29	FC Communication	4028		not available in DDI mode
									30	General FC Warning	4029		not available in DDI mode
									31	Communication Error IO Extension	4030		not available in LSI mode
Status	MS_Alarm_Word_MSB	Input Registers	5	5	5	2	DWORD (High - Low)	Bitfield					
Status	MS_Alarm_Word_LSB	Input Registers	7	7	7	2	DWORD (High - Low)	Bitfield	0	Motor Ground Fault	1001		not available in DDI mode
									1	Motor Short	1002		not available in DDI mode

Group	Symbol	Register Type	Address in DDI	Address in LPI	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
									2	Safe Stop	1000		not available in DDI mode
									3	Vibration X trip	2000		
									4	Vibration Y trip	2001		
									5	Vibration Z trip	2002		
									6	Vibration 1 trip	2003		
									7	Vibration 2 trip	2004		
									8	FC Overload	2005		not available in DDI mode
									9	FC Line	2006		not available in DDI mode
									10	FC DC Circuit	2007		not available in DDI mode
									11	FC Supply	2008		not available in DDI mode
									12	Dry Run detected	3000		
									13	Leackage Input alarm	3001		
									14	Temp Sensor 1 trip	3002		
									15	Temp Sensor 2 trip	3003		
									16	Temp Sensor 3 trip	3004		
									17	Temp Sensor 4 trip	3005		
									18	Temp Sensor 5 trip	3006		
									19	Motor Overload	3007		not available in DDI mode
									20	Motor Overtemp	3008		not available in DDI mode
Motor Information	NP_Serial_Number	Input Registers	1000	1000	1000	8	String(16)						
Motor Information	NP_Motor_Type	Input Registers	1008	1008	1008	16	String(32)						
Motor Information	NP_Pump_Type	Input Registers	1024	1024	1024	16	String(32)						
Motor Information	NP_Nominal_Pwr	Input Registers	1040	1040	1040	2	FLOAT32 (High - Low)					kW	
Motor Information	NP_Nominal_Volt	Input Registers	1042	1042	1042	2	FLOAT32 (High - Low)					V	
Motor Information	NP_Nominal_Curr	Input Registers	1044	1044	1044	2	FLOAT32 (High - Low)					A	
Motor Information	NP_Nominal_Freq	Input Registers	1046	1046	1046	2	FLOAT32 (High - Low)					Hz	
Motor Information	NP_Max_St_Per_Hour	Input Registers	1048	1048	1048	2	FLOAT32 (High - Low)						
Motor Information	NP_Max_Freq	Input Registers	1050	1050	1050	2	FLOAT32 (High - Low)					Hz	
Motor Information	NP_Min_Freq	Input Registers	1052	1052	1052	2	FLOAT32 (High - Low)					Hz	

Group	Symbol	Register Type	Address in DDI	Address in LPI	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
Sensor Locations/Types	SI_Temperature[1].Location	Input Registers	2000	2000	2000	1	UINT	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	SI_Temperature[2].Location	Input Registers	2001	2001	2001	1	UINT	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	SI_Temperature[3].Location	Input Registers	2002	2002	2002	1	UINT	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	SI_Temperature[4].Location	Input Registers	2003	2003	2003	1	UINT	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	SI_Temperature[5].Location	Input Registers	2004	2004	2004	1	UINT	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	SI_VibrationExtern1.Location	Input Registers	2005	2005	2005	1	UINT	ENUM					0=unused / 1=motor_hut_x / 2=motor_hut_y / 3=bearing_top_x / 4=bearing_ top_y / 5=bearing_bottom_x / 6=bearing_bottom_y
Sensor Locations/Types	SI_VibrationExtern2.Location	Input Registers	2006	2006	2006	1	UINT	ENUM					0=unused / 1=motor_hut_x / 2=motor_hut_y / 3=bearing_top_x / 4=bearing_ top_y / 5=bearing_bottom_x / 6=bearing_bottom_y
Sensor Locations/Types	SI_Current[0].Sensor_Type	Input Registers	2007	2007	2007	1	UINT	ENUM					0=unused / 1=current_signal_only / 2=leackage_ switch / 3=sealing_CLP_V01 / 4=leackage_CLP_V01
Sensor Locations/Types	SI_Current[1].Sensor_Type	Input Registers	2008	2008	2008	1	UINT	ENUM					0=unused / 1=current_signal_only / 2=leackage_ switch / 3=sealing_CLP_V01 / 4=leackage_CLP_V02
Data Readouts	IO_Temperature[1].Value	Input Registers	3000	3000	3000	2	FLOAT32 (High - Low)					°C	
Data Readouts	IO_Temperature[2].Value	Input Registers	3002	3002	3002	2	FLOAT32 (High - Low)					°C	
Data Readouts	IO_Temperature[3].Value	Input Registers	3004	3004	3004	2	FLOAT32 (High - Low)					°C	
Data Readouts	IO_Temperature[4].Value	Input Registers	3006	3006	3006	2	FLOAT32 (High - Low)					°C	
Data Readouts	IO_Temperature[5].Value	Input Registers	3008	3008	3008	2	FLOAT32 (High - Low)					°C	
Data Readouts	IO_Temperature[0].Value	Input Registers	3010	3010	3010	2	FLOAT32 (High - Low)					°C	
Data Readouts	IO_Current[0].Value	Input Registers	3012	3012	3012	2	FLOAT32 (High - Low)					mA	
Data Readouts	IO_Current[1].Value	Input Registers	3014	3014	3014	2	FLOAT32 (High - Low)					mA	
Data Readouts	IO_Vibration[0].Value	Input Registers	3016	3016	3016	2	FLOAT32 (High - Low)					mm/s	

Group	Symbol	Register Type	Address in DDI	Address in LPI	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
Data Readouts	IO_Vibration[1].Value	Input Registers	3018	3018	3018	2	FLOAT32 (High - Low)					mm/s	
Data Readouts	IO_Vibration[2].Value	Input Registers	3020	3020	3020	2	FLOAT32 (High - Low)					mm/s	
Data Readouts	IO_Vibration[3].Value	Input Registers	3022	3022	3022	2	FLOAT32 (High - Low)					mm/s	
Data Readouts	IO_Vibration[4].Value	Input Registers	3024	3024	3024	2	FLOAT32 (High - Low)					mm/s	
Data Readouts	IO_FC_Power.Value	Input Registers	-	3026	3026	2	FLOAT32 (High - Low)					kW	
Data Readouts	IO_FC_Voltage.Value	Input Registers	-	3028	3028	2	FLOAT32 (High - Low)					V	
Data Readouts	IO_FC_Current.Value	Input Registers	-	3030	3030	2	FLOAT32 (High - Low)					A	
Data Readouts	IO_FC_Frequency.Value	Input Registers	-	3032	3032	2	FLOAT32 (High - Low)					Hz	
Data Readouts	IO_Level.Value	Input Registers	3026	3034	3034	2	FLOAT32 (High - Low)					m	
Data Readouts	IO_Pressure.Value	Input Registers	3028	3036	3036	2	FLOAT32 (High - Low)					bar	
Data Readouts	IO_Flow.Value	Input Registers	3030	3038	3038	2	FLOAT32 (High - Low)					l/s	
Data Readouts	RT_RUNNING_TIME_RTN	Input Registers	3032	3040	3040	2	DWORD (High - Low)					hr	
Data Readouts	RT_PUMP_CYCLE_CNT_RTN	Input Registers	3034	3042	3042	2	DWORD (High - Low)						
Data Readouts	RT_CLEANING_CYCLE_CNT_RTN	Input Registers	-	3044	3044	2	DWORD (High - Low)						
Data Readouts	RT_ENERGY_CONSUMPTION	Input Registers	-	3046	3046	2	DWORD (High - Low)					kWh	
Time	RI_System_Current_Year	Input Registers	4000	4000	4000	1	UINT					year	
Time	RI_System_Current_Month	Input Registers	4001	4001	4001	1	UINT					month	
Time	RI_System_Current_Day	Input Registers	4002	4002	4002	1	UINT					day	
Time	RI_System_Current_Hour	Input Registers	4003	4003	4003	1	UINT					hr	
Time	RI_System_Current_Minute	Input Registers	4004	4004	4004	1	UINT					min	
Time	RI_System_Current_Second	Input Registers	4005	4005	4005	1	UINT					s	
Time	RI_System_Uptime	Input Registers	4006	4006	4006	2	DWORD (High - Low)					s	
Time	RI_System_Current_Ms	Input Registers	4008	4008	4008	2	DWORD (High - Low)					ms	
Control Word	MB_Control_Word	Holding Registers	0	0	0	1	UINT	Bitfield	0	Reset			
									1	Start			Applies only for LPI mode
									2				
									3				
									4				
									5				

Group	Symbol	Register Type	Address in DDI	Address in LPI	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
									6				
									7				
									8				
									9				
									10				
									11				
									12				
									13				
									14				
									15	Save Config			Rising edge of this Bit is needed after changing a parameter of the group *Control Word*. This is not applicable for *Reset, Start and MB_Bus_Control_Value*
Control Word	MB_Bus_Control_Value	Holding Registers	-	1	1	1	UINT	100				Hz	
Control Word	MB_Operation_Mode	Holding Registers	-	2	2	1	UINT	ENUM					0=manual / 1=auto / 2=off
Control Word	MB_Manual_Frequency	Holding Registers	-	3	3	1	UINT	100				Hz	
Control Word	MB_FC_Ramp_Up_Time	Holding Registers	-	4	4	1	UINT	100				s	
Control Word	MB_FC_Ramp_Down_Time	Holding Registers	-	5	5	1	UINT	100				s	
Control Word	MB_Enable_Pump_Kick	Holding Registers	-	7	7	1	UINT	ENUM					0=off / 1=on
Control Word	MB_Enable_Thermostat_Mode	Holding Registers	-	6	6	1	UINT	ENUM					0=off / 1=on
Control Word	MB_Allow_Anticlog	Holding Registers	-	8	8	1	UINT	ENUM					0=off / 1=on
Sensor Trip/Warning	MB_Temp_Sensors[0].Warning	Holding Registers	1000	1000	1000	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[0].Trip	Holding Registers	1001	1001	1001	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[1].Warning	Holding Registers	1002	1002	1002	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[1].Trip	Holding Registers	1003	1003	1003	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[2].Warning	Holding Registers	1004	1004	1004	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[2].Trip	Holding Registers	1005	1005	1005	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[3].Warning	Holding Registers	1006	1006	1006	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[3].Trip	Holding Registers	1007	1007	1007	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[4].Warning	Holding Registers	1008	1008	1008	1	UINT	10					
Sensor Trip/Warning	MB_Temp_Sensors[4].Trip	Holding Registers	1009	1009	1009	1	UINT	10					

Group	Symbol	Register Type	Address in DDI	Address in LPI	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
Sensor Trip/Warning	MB_Vib_Sensors[0].Warning	Holding Registers	1010	1010	1010	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[0].Trip	Holding Registers	1011	1011	1011	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[1].Warning	Holding Registers	1012	1012	1012	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[1].Trip	Holding Registers	1013	1013	1013	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[2].Warning	Holding Registers	1014	1014	1014	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[2].Trip	Holding Registers	1015	1015	1015	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[3].Warning	Holding Registers	1016	1016	1016	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[3].Trip	Holding Registers	1017	1017	1017	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[4].Warning	Holding Registers	1018	1018	1018	1	UINT	10					
Sensor Trip/Warning	MB_Vib_Sensors[4].Trip	Holding Registers	1019	1019	1019	1	UINT	10					

9.1.2 OPC-UA: DDI/LPI/LSI Slave-Parameter

Group	Symbol	MODE	DDI	LPI	LSI	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
Status	Status_Word	read only	x	x	x	UINT16	Bitfield	0	Run			not available in DDI mode
								1	Rising Water Level			not avaiable in DDI mode
								2	Falling Water Level			not avaiable in DDI mode
								3	External Off			not avaiable in DDI mode
								4	Pump Kick Running	10004		not avaiable in DDI mode
								5	Anticlog Running	10005		not available in DDI mode
Status	Warning_Word_MSB	read only	x	x	x	UINT32	Bitfield	0	Communication Error FC	4031		not available in DDI mode
								1				
								2				
								3	Thermostat active	6000		not available in DDI mode
								4	Clog Detection	6001		not available in DDI mode
								5	Vibration X Warning	6002		
								6	Vibration Y Warning	6003		
								7	Vibration Z Warning	6004		
								8	Vibration 1 Warning	6005		
								9	Vibration 2 Warning	6006		
								10	Current 1 Leackage	4034		
								11	Current 2 Leackage	4035		
								12	Clog Detection Teach failed	5000		not available in DDI mode
								13				
								14				
								15	FC Autosetup failed	8001		not available in DDI mode
								16	FC Autosetup Timeout	8002		not available in DDI mode
Status	Warning_Word_LSB	read only	x	x	x	UINT32	Bitfield	0	High Water detected	4000		
								1	Leackage Input	4001		
								2	Temp 1 fault	4002		
								3	Temp 2 fault	4003		
								4	Temp 3 fault	4004		
								5	Temp 4 fault	4005		
								6	Temp 5 fault	4006		

Group	Symbol	MODE	DDI	LPI	LSI	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
								7	Internal Vibration fault	4007		
								8	Current Input 1 fault	4008		
								9	Current Input 2 fault	4009		
								10	Onboard Temp fault	4010		
								11	Temp 1	4011		
								12	Temp 2	4012		
								13	Temp 3	4013		
								14	Temp 4	4014		
								15	Temp 5	4015		
								16	Onboard Temp	4016		
								17				
								18	General FC Alarm	4017		not available in DDI mode
								19	Motor Ground fault	4018		not available in DDI mode
								20	Motor Overload	4019		not available in DDI mode
								21	Motor Overtemp	4020		not available in DDI mode
								22				
								23	Safe Stop	4022		not available in DDI mode
								24	AMA not OK	4023		not available in DDI mode
								25	FC Overload Warning	4024		not available in DDI mode
								26	FC Line Warning	4025		not available in DDI mode
								27	FC DC Circuit Warning	4026		not available in DDI mode
								28	FC Supply Warning	4027		not available in DDI mode
								29	FC Communication	4028		not available in DDI mode
								30	General FC Warning	4029		not available in DDI mode
								31	Communication Error IO Extension	4030		not available in LSI mode
Status	Alarm_Word_MSB	read only	x	x	x	UINT32	Bitfield					
Status	Alarm_Word_LSB	read only	x	x	x	UINT32	Bitfield	0	Motor Ground Fault	1001		not available in DDI mode
								1	Motor Short	1002		not available in DDI mode
								2	Safe Stop	1000		not available in DDI mode
								3	Vibration X trip	2000		

Group	Symbol	MODE	DDI	LPI	LSI	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
								4	Vibration Y trip	2001		
								5	Vibration Z trip	2002		
								6	Vibration 1 trip	2003		
								7	Vibration 2 trip	2004		
								8	FC Overload	2005		not available in DDI mode
								9	FC Line	2006		not available in DDI mode
								10	FC DC Circuit	2007		not available in DDI mode
								11	FC Supply	2008		not available in DDI mode
								12	Dry Run detected	3000		
								13	Leackage Input alarm	3001		
								14	Temp Sensor 1 trip	3002		
								15	Temp Sensor 2 trip	3003		
								16	Temp Sensor 3 trip	3004		
								17	Temp Sensor 4 trip	3005		
								18	Temp Sensor 5 trip	3006		
								19	Motor Overload	3007		not available in DDI mode
								20	Motor Overtemp	3008		not available in DDI mode
Motor Information	Serial_Number	read only	x	x	x	STRING256						
Motor Information	Motor Type	read only	x	x	x	STRING257						
Motor Information	Pump Type	read only	x	x	x	STRING258						
Motor Information	Nominal_Pwr	read only	x	x	x	FLOAT32 (High - Low)					kW	
Motor Information	Nominal_Volt	read only	x	x	x	FLOAT32 (High - Low)					V	
Motor Information	Nominal_Curr	read only	x	x	x	FLOAT32 (High - Low)					A	
Motor Information	Nominal_Freq	read only	x	x	x	FLOAT32 (High - Low)					Hz	
Motor Information	Max_St_Per_Hour	read only	x	x	x	FLOAT32 (High - Low)						
Motor Information	Max_Freq	read only	x	x	x	FLOAT32 (High - Low)					Hz	
Motor Information	Min_Freq	read only	x	x	x	FLOAT32 (High - Low)					Hz	
Sensor Locations/Types	TempIn1Location	read only	x	x	x	UINT8	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations

Group	Symbol	MODE	DDI	LPI	LSI	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
Sensor Locations/Types	TempIn2Location	read only	x	x	x	UINT8	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	TempIn3Location	read only	x	x	x	UINT8	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	TempIn4Location	read only	x	x	x	UINT8	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	TempIn5Location	read only	x	x	x	UINT8	ENUM					0=unused / 1=winding_top / 2=winding_bottom / 3=bearing_top / 4=bearing_bottom / 5=cooling_liquid / 6=motor_laminations
Sensor Locations/Types	VibrationExtern1Location	read only	x	x	x	UINT8	ENUM					0=unused / 1=motor_hut_x / 2=motor_hut_y / 3=bearing_top_x / 4=bearing_ top_y / 5=bearing_bottom_x / 6=bearing_bottom_y
Sensor Locations/Types	VibrationExtern2Location	read only	x	x	x	UINT8	ENUM					0=unused / 1=motor_hut_x / 2=motor_hut_y / 3=bearing_top_x / 4=bearing_ top_y / 5=bearing_bottom_x / 6=bearing_bottom_y
Sensor Locations/Types	CurrentIn1Type	read only	x	x	x	UINT8	ENUM					0=unused / 1=current_signal_only / 2=leackage_ switch / 3=sealing_CLP_V01 / 4=leackage_CLP_V02
Sensor Locations/Types	CurrentIn2Type	read only	x	x	x	UINT8	ENUM					0=unused / 1=current_signal_only / 2=leackage_ switch / 3=sealing_CLP_V01 / 4=leackage_CLP_V03
Data Readouts	Temperature0	read only	x	x	x	FLOAT32 (High - Low)					°C	
Data Readouts	Temperature1	read only	x	x	x	FLOAT32 (High - Low)					°C	
Data Readouts	Tempreature2	read only	x	x	x	FLOAT32 (High - Low)					°C	
Data Readouts	Temperature3	read only	x	x	x	FLOAT32 (High - Low)					°C	
Data Readouts	Temperature4	read only	x	x	x	FLOAT32 (High - Low)					°C	
Data Readouts	Temperature5	read only	x	x	x	FLOAT32 (High - Low)					°C	
Data Readouts	Current0	read only	x	x	x	FLOAT32 (High - Low)					mA	
Data Readouts	Current1	read only	x	x	x	FLOAT32 (High - Low)					mA	
Data Readouts	Vibration0	read only	x	x	x	FLOAT32 (High - Low)					mm/s	
Data Readouts	Vibration1	read only	x	x	x	FLOAT32 (High - Low)					mm/s	
Data Readouts	Vibration2	read only	x	x	x	FLOAT32 (High - Low)					mm/s	
Data Readouts	Vibration3	read only	x	x	x	FLOAT32 (High - Low)					mm/s	
Data Readouts	Vibration4	read only	x	x	x	FLOAT32 (High - Low)					mm/s	
Data Readouts	FC_power	read only	-	x	x	FLOAT32 (High - Low)					kW	
Data Readouts	FC_Voltage	read only	-	x	x	FLOAT32 (High - Low)					V	

Group	Symbol	MODE	DDI	LPI	LSI	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
Data Readouts	FC_Current	read only	-	x	x	FLOAT32 (High - Low)					A	
Data Readouts	FC_Frequency	read only	-	x	x	FLOAT32 (High - Low)					Hz	
Data Readouts	Level	read only	x	x	x	FLOAT32 (High - Low)					m	
Data Readouts	Pressure	read only	x	x	x	FLOAT32 (High - Low)					bar	
Data Readouts	Flow	read only	x	x	x	FLOAT32 (High - Low)					l/s	
Data Readouts	Running_Hours	read only	x	x	x	UINT64					hr	
Data Readouts	Pump_Cycles	read only	x	x	x	UINT64						
Data Readouts	Cleaning_Cycles	read only	x	x	x	UINT64						
Data Readouts	Energy_Consumption	read only	-	x	x	UINT64					kWh	
Time	System_Current_Year	read only	x	x	x	UINT8					year	
Time	System_Current_Month	read only	x	x	x	UINT8					month	
Time	System_Current_Day	read only	x	x	x	UINT8					day	
Time	System_Current_Hour	read only	x	x	x	UINT8					hr	
Time	System_Current_Minute	read only	x	x	x	UINT8					min	
Time	System_Current_Second	read only	x	x	x	UINT8					s	
Time	System_Uptime	read only	x	x	x	UINT32					s	
Time	System_Current_Ms	read only	x	x	x	UINT32					ms	
Control Word	Control Word	read/write	x	x	x	UINT16	Bitfield	0	Reset			
								1	Start			Applies only for LPI mode
								2				
								3				
								4				
								5				
								6				
								7				
								8				
								9				
								10				
								11				
								12				

Group	Symbol	MODE	DDI	LPI	LSI	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
								13				
								14				
								15	Save Config			Rising edge of this Bit is needed after changing a parameter of the group *Control Word*. This is not applicable for *Reset, Start and MB_Bus_Control_Value*
Control Word	Bus_Control_Value	read/write	-	x	x	UINT16	100				Hz	
Control Word	Operation_Mode	read/write	-	x	x	UINT8	ENUM					0=manual / 1=auto / 2=off
Control Word	Manual_Frequency	read/write	-	x	x	UINT16	100				Hz	
Control Word	FC_Ramp_Up_Time	read/write	-	x	x	UINT17	100				s	
Control Word	FC_Ramp_Down_Time	read/write	-	x	x	UINT18	100				s	
Control Word	Enable_Thermostat_Mode	read/write	-	x	x	UINT19	ENUM					0=off / 1=on
Control Word	Enable_Pump_Kick	read/write	-	x	x	UINT20	ENUM					0=off / 1=on
Control Word	Allow_Anticlog	read/write	-	x	x	UINT21	ENUM					0=off / 1=on
Sensor Trip/Warning	Temp_Sensors0_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors0_Trip	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors1_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors1_Trip	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors2_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors2_Trip	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors3_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors3_Trip	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors4_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Temp_Sensors4_Trip	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors0_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors0_Trip	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors1_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors1_Trip	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors2_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors2_Trip	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors3_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors3_Trip	read/write	x	x	x	UINT16	10					

Group	Symbol	MODE	DDI	LPI	LSI	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
Sensor Trip/Warning	Vib_Sensors4_Warning	read/write	x	x	x	UINT16	10					
Sensor Trip/Warning	Vib_Sensors4_Trip	read/write	x	x	x	UINT16	10					

Group	Symbol	Register Type	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
System Variables	MB_Sys_Status_Word	Input Registers	10000	1	UINT	Bitfield	0	Run			
							1	Rising Water Level			
							2	Falling Water Level			
							3	External Off			
							4				
							5	Anticlog Running	10005		
System Variables	MS_Sys_Warning_Word_MSB	Input Registers	10001	2	DWORD (High - Low)	Bitfield					
System Variables	MS_Sys_Warning_Word_LSB	Input Registers	10003	2	DWORD (High - Low)	Bitfield	0	Pump 1 Warning	400.1		
							1	Pump 2 Warning	400.2		
							2	Pump 3 Warning	400.3		
							3	Pump 4 Warning	400.4		
							4	Pipe Sedimentation Warn	500		
							5	IO Extension Comm Error	501		
System Variables	MS_Sys_Alarm_Word_MSB	Input Registers	10005	2	DWORD (High - Low)	Bitfield					
System Variables	MS_Sys_Alarm_Word_LSB	Input Registers	10007	2	DWORD (High - Low)	Bitfield	0	Pump 1 Offline	100.1		
							1	Pump 2 Offline	100.2		
							2	Pump 3 Offline	100.3		
							3	Pump 4 Offline	100.4		
							4	Master switched	101		
							5	Pump 1 Alarm	200.1		
							6	Pump 2 Alarm	200.2		
							7	Pump 3 Alarm	200.3		
							8	Pump 4 Alarm	200.4		
							9	Dry Run	201		
							10	High Water	202		
							11	Sensor Error	203		
Analog Variables	IO_Level.Value	Input Registers	10009	2	FLOAT32 (High - Low)					m	
Analog Variables	IO_Pressure.Value	Input Registers	10011	2	FLOAT32 (High - Low)					bar	
Analog Variables	IO_Flow.Value	Input Registers	10013	2	FLOAT32 (High - Low)					l/s	
Analog Variables	IO_Frequency	Input Registers	10015	2	FLOAT32 (High - Low)					Hz	

Group	Symbol	Register Type	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
Analog Variables	SYS_No_Of_Pumps	Input Registers	10017	1	UINT						
Data Time Variables	RI_System_Current_Year	Input Registers	10018	1	UINT					year	
Data Time Variables	RI_System_Current_Month	Input Registers	10019	1	UINT					month	
Data Time Variables	RI_System_Current_Day	Input Registers	10020	1	UINT					day	
Data Time Variables	RI_System_Current_Hour	Input Registers	10021	1	UINT					hr	
Data Time Variables	RI_System_Current_Minute	Input Registers	10022	1	UINT					min	
Data Time Variables	RI_System_Current_Second	Input Registers	10023	1	UINT					s	
Data Time Variables	RI_System_Uptime	Input Registers	10024	2	DWORD (High - Low)					s	
Data Time Variables	RI_System_Current_Ms	Input Registers	10026	2	DWORD (High - Low)					ms	
Pump 1	MSC_Infos[0].Serial_Number	Input Registers	11000	8	String(16)						
Pump 1	MSC_Infos[0].Motor_Type	Input Registers	11008	16	String(32)						
Pump 1	MSC_Infos[0].Pump_Type	Input Registers	11024	16	String(32)						
Pump 1	MSC_Infos[0].Status	Input Registers	11040	1	UINT						
Pump 1	MSC_Infos[0].Warning_MSB	Input Registers	11041	2	DWORD (High - Low)						
Pump 1	MSC_Infos[0].Warning_LSB	Input Registers	11043	2	DWORD (High - Low)						
Pump 1	MSC_Infos[0].Alarm_MSB	Input Registers	11045	2	DWORD (High - Low)						
Pump 1	MSC_Infos[0].Alarm_LSB	Input Registers	11047	2	DWORD (High - Low)						
Pump 1	MSC_Infos[0].FC_Power	Input Registers	11049	2	FLOAT32 (High - Low)					kW	
Pump 1	MSC_Infos[0].Operation_Hours	Input Registers	11051	2	DWORD (High - Low)					hr	
Pump 1	MSC_Infos[0].Number_Of_Start	Input Registers	11053	2	DWORD (High - Low)						
Pump 1	MSC_Infos[0].Number_Of_Cleaning	Input Registers	11055	2	DWORD (High - Low)						
Pump 1	MSC_Infos[0].Energy_Consumption	Input Registers	11057	2	FLOAT32 (High - Low)					kWh	
Pump 2	MSC_Infos[1].Serial_Number	Input Registers	12000	8	String(16)						
Pump 2	MSC_Infos[1].Motor_Type	Input Registers	12008	16	String(32)						
Pump 2	MSC_Infos[1].Pump_Type	Input Registers	12024	16	String(32)						
Pump 2	MSC_Infos[1].Status	Input Registers	12040	1	UINT						
Pump 2	MSC_Infos[1].Warning_MSB	Input Registers	12041	2	DWORD (High - Low)						
Pump 2	MSC_Infos[1].Warning_LSB	Input Registers	12043	2	DWORD (High - Low)						
Pump 2	MSC_Infos[1].Alarm_MSB	Input Registers	12045	2	DWORD (High - Low)						
Pump 2	MSC_Infos[1].Alarm_LSB	Input Registers	12047	2	DWORD (High - Low)						

Group	Symbol	Register Type	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
Pump 2	MSC_Infos[1].FC_Power	Input Registers	12049	2	FLOAT32 (High - Low)					kW	
Pump 2	MSC_Infos[1].Operation_Hours	Input Registers	12051	2	DWORD (High - Low)					hr	
Pump 2	MSC_Infos[1].Number_Of_Start	Input Registers	12053	2	DWORD (High - Low)						
Pump 2	MSC_Infos[1].Number_Of_Cleaning	Input Registers	12055	2	DWORD (High - Low)						
Pump 2	MSC_Infos[1].Energy_Consumption	Input Registers	12057	2	FLOAT32 (High - Low)					kWh	
Pump 3	MSC_Infos[2].Serial_Number	Input Registers	13000	8	String(16)						
Pump 3	MSC_Infos[2].Motor_Type	Input Registers	13008	16	String(32)						
Pump 3	MSC_Infos[2].Pump_Type	Input Registers	13024	16	String(32)						
Pump 3	MSC_Infos[2].Status	Input Registers	13040	1	UINT						
Pump 3	MSC_Infos[2].Warning_MSB	Input Registers	13041	2	DWORD (High - Low)						
Pump 3	MSC_Infos[2].Warning_LSB	Input Registers	13043	2	DWORD (High - Low)						
Pump 3	MSC_Infos[2].Alarm_MSB	Input Registers	13045	2	DWORD (High - Low)						
Pump 3	MSC_Infos[2].Alarm_LSB	Input Registers	13047	2	DWORD (High - Low)						
Pump 3	MSC_Infos[2].FC_Power	Input Registers	13049	2	FLOAT32 (High - Low)					kW	
Pump 3	MSC_Infos[2].Operation_Hours	Input Registers	13051	2	DWORD (High - Low)					hr	
Pump 3	MSC_Infos[2].Number_Of_Start	Input Registers	13053	2	DWORD (High - Low)						
Pump 3	MSC_Infos[2].Number_Of_Cleaning	Input Registers	13055	2	DWORD (High - Low)						
Pump 3	MSC_Infos[2].Energy_Consumption	Input Registers	13057	2	FLOAT32 (High - Low)					kWh	
Pump 4	MSC_Infos[3].Serial_Number	Input Registers	14100	8	String(16)						
Pump 4	MSC_Infos[3].Motor_Type	Input Registers	14108	16	String(32)						
Pump 4	MSC_Infos[3].Pump_Type	Input Registers	14124	16	String(32)						
Pump 4	MSC_Infos[3].Status	Input Registers	14140	1	UINT						
Pump 4	MSC_Infos[3].Warning_MSB	Input Registers	14141	2	DWORD (High - Low)						
Pump 4	MSC_Infos[3].Warning_LSB	Input Registers	14143	2	DWORD (High - Low)						
Pump 4	MSC_Infos[3].Alarm_MSB	Input Registers	14145	2	DWORD (High - Low)						
Pump 4	MSC_Infos[3].Alarm_LSB	Input Registers	14147	2	DWORD (High - Low)						
Pump 4	MSC_Infos[3].FC_Power	Input Registers	14149	2	FLOAT32 (High - Low)					kW	
Pump 4	MSC_Infos[3].Operation_Hours	Input Registers	14151	2	DWORD (High - Low)					hr	
Pump 4	MSC_Infos[3].Number_Of_Start	Input Registers	14153	2	DWORD (High - Low)						
Pump 4	MSC_Infos[3].Number_Of_Cleaning	Input Registers	14155	2	DWORD (High - Low)						

Group	Symbol	Register Type	Address in LSI	Size	Data Type	Scaling	Bit	Bit-Function	Code	Unit	Description
Pump 4	MSC_Infos[3].Energy_Consumption	Input Registers	14157	2	FLOAT32 (High - Low)					kWh	
Control Word	MB_Sys_Control_Word	Holding Registers	10000	1	UINT	Bitfield	0	Reset			Reset errors on a rising edge of this bit
							1	PID Controller Enable			Activation of PID controller
							2	Trigger Start Level			Start emptying the pump sump
							3	Alternative Start Level			Activates the alternative start level configured via web interface
							4				
							5				
							6				
							7				
							8				
							9				
							10				
							11				
							12				
							13				
							14				
							15	Save Config			Rising edge of this Bit is needed after changing a parameter of the group *Control Word* or group *Modes*. This is not applicable for *Reset*.
Modes	MB_Sys_Operating_Mode	Holding Registers	10001	1	UINT	ENUM					0=off /1=on
Modes	MB_Sys_Auto_Mode_Selection	Holding Registers	10002	1	UINT	ENUM					0=Level Control / 1=PID Controller / 2=High Efficiency Controller
PID Setpoint	MB_Sys_PID_Setpoint	Holding Registers	10200	1	UINT	100				%	Setpoint in % of scale multiplied by 100 (0 = 0%, 10000 = 100%)

Group	Symbol	MODE	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
System Variables	Sys_Status_Word	read only	UINT16	Bitfield	0	Run			
					1	Rising Water Level			
					2	Falling Water Level			
					3	External Off			
					4				
					5	Anticlog Running	10005		
System Variables	Sys_Warning_Word_MSB	read only	UINT32	Bitfield					
System Variables	Sys_Warning_Word_LSB	read only	UINT32	Bitfield	0	Pump 1 Warning	400.1		
					1	Pump 2 Warning	400.2		
					2	Pump 3 Warning	400.3		
					3	Pump 4 Warning	400.4		
					4	Pipe Sedimentation Warn	500		
					5	IO Extension Comm Error	501		
System Variables	Sys_Alarm_Word_MSB	read only	UINT32	Bitfield					
System Variables	Sys_Alarm_Word_LSB	read only	UINT32	Bitfield	0	Pump 1 Offline	100.1		
					1	Pump 2 Offline	100.2		
					2	Pump 3 Offline	100.3		
					3	Pump 4 Offline	100.4		
					4	Master switched	101		
					5	Pump 1 Alarm	200.1		
					6	Pump 2 Alarm	200.2		
					7	Pump 3 Alarm	200.3		
					8	Pump 4 Alarm	200.4		
					9	Dry Run	201		
					10	High Water	202		
					11	Sensor Error	203		
Analog Variables	Level.Value	read only	FLOAT32 (High - Low)					m	
Analog Variables	Pressure.Value	read only	FLOAT32 (High - Low)					bar	
Analog Variables	Flow.Value	read only	FLOAT32 (High - Low)					l/s	
Analog Variables	Frequency.Value	read only	FLOAT32 (High - Low)					Hz	

Group	Symbol	MODE	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
Analog Variables	No_Of_Pumps	read only	UINT8						
Data Time Variables	System_Current_Year	read only	UINT8					year	
Data Time Variables	System_Current_Month	read only	UINT8					month	
Data Time Variables	System_Current_Day	read only	UINT8					day	
Data Time Variables	System_Current_Hour	read only	UINT8					hr	
Data Time Variables	System_Current_Minute	read only	UINT8					min	
Data Time Variables	System_Current_Second	read only	UINT8					s	
Data Time Variables	System_Uptime	read only	UINT32					s	
Data Time Variables	System_Current_Ms	read only	UINT32					ms	
Pump1	Master0_Serial_Number	read only	STRING256						
Pump1	Master0_Motor_Type	read only	STRING256						
Pump1	Master0_Pump_Type	read only	STRING256						
Pump1	Master0_Status	read only	UINT16						
Pump1	Master0_Warning_MSB	read only	UINT32						
Pump1	Master0_Warning_LSB	read only	UINT32						
Pump1	Master0_Alarm_MSB	read only	UINT32						
Pump1	Master0_Alarm_LSB	read only	UINT32						
Pump1	Master0_FC_Power	read only	FLOAT32 (High - Low)					kW	
Pump1	Master0_Operating_Hours	read only	UINT32					hr	
Pump1	Master0_Number_Of_Start	read only	UINT32						
Pump1	Master0_Number_Of_Cleaning	read only	UINT32						
Pump1	Master0_Energy_Consumption	read only	FLOAT32 (High - Low)					kWh	
Pump2	Master1_Serial_Number	read only	STRING256						
Pump2	Master1_Motor_Type	read only	STRING256						
Pump2	Master1_Pump_Type	read only	STRING256						
Pump2	Master1_Status	read only	UINT16						
Pump2	Master1_Warning_MSB	read only	UINT32						
Pump2	Master1_Warning_LSB	read only	UINT32						
Pump2	Master1_Alarm_MSB	read only	UINT32						
Pump2	Master1_Alarm_LSB	read only	UINT32						

Group	Symbol	MODE	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
Pump2	Master1_FC_Power	read only	FLOAT32 (High - Low)					kW	
Pump2	Master1_Operating_Hours	read only	UINT32					hr	
Pump2	Master1_Number_Of_Start	read only	UINT32						
Pump2	Master1_Number_Of_Cleaning	read only	UINT32						
Pump2	Master1_Energy_Consumption	read only	FLOAT32 (High - Low)					kWh	
Pump3	Master2_Serial_Number	read only	STRING256						
Pump3	Master2_Motor_Type	read only	STRING256						
Pump3	Master2_Pump_Type	read only	STRING256						
Pump3	Master2_Status	read only	UINT16						
Pump3	Master2_Warning_MSB	read only	UINT32						
Pump3	Master2_Warning_LSB	read only	UINT32						
Pump3	Master2_Alarm_MSB	read only	UINT32						
Pump3	Master2_Alarm_LSB	read only	UINT32						
Pump3	Master2_FC_Power	read only	FLOAT32 (High - Low)					kW	
Pump3	Master2_Operating_Hours	read only	UINT32					hr	
Pump3	Master2_Number_Of_Start	read only	UINT32						
Pump3	Master2_Number_Of_Cleaning	read only	UINT32						
Pump3	Master2_Energy_Consumption	read only	FLOAT32 (High - Low)					kWh	
Pump4	Master3_Serial_Number	read only	STRING256						
Pump4	Master3_Motor_Type	read only	STRING256						
Pump4	Master3_Pump_Type	read only	STRING256						
Pump4	Master3_Status	read only	UINT16						
Pump4	Master3_Warning_MSB	read only	UINT32						
Pump4	Master3_Warning_LSB	read only	UINT32						
Pump4	Master3_Alarm_MSB	read only	UINT32						
Pump4	Master3_Alarm_LSB	read only	UINT32						
Pump4	Master3_FC_Power	read only	FLOAT32 (High - Low)					kW	
Pump4	Master3_Operating_Hours	read only	UINT32					hr	
Pump4	Master3_Number_Of_Start	read only	UINT32						
Pump4	Master3_Number_Of_Cleaning	read only	UINT32						

Group	Symbol	MODE	TYPE	Scaling	Bit	Bit-Function	Code	Unit	Description
Pump4	Master3_Energy_Consumption	read only	FLOAT32 (High - Low)					kWh	
Control Word	Sys_Control_Word	read/write	UINT16	Bitfield	0	Reset			Reset errors on a rising edge of this bit
					1	PID Controller Enable			Activation of PID controller
					2	Trigger Start Level			Start emptying the pump sump
					3	Alternative Start Level			Activates the alternative start level configured via web interface
					4				
					5				
					6				
					7				
					8				
					9				
					10				
					11				
					12				
					13				
					14				
					15	Save Config			Save configuration
Modes	Sys_Operating_Mode	read/write	UINT8	ENUM					0=off /1=on
Modes	Sys_Auto_Mode_Selection	read/write	UINT8	ENUM					0=Level Control / 1=PID Controller / 2=High Efficiency Controller
PID Setpoint	Sys_PID_Setpoint.Variable	read/write	UINT16	100				%	Setpoint in % of scale multiplied by 100 (0 = 0%, 10000 = 100%)

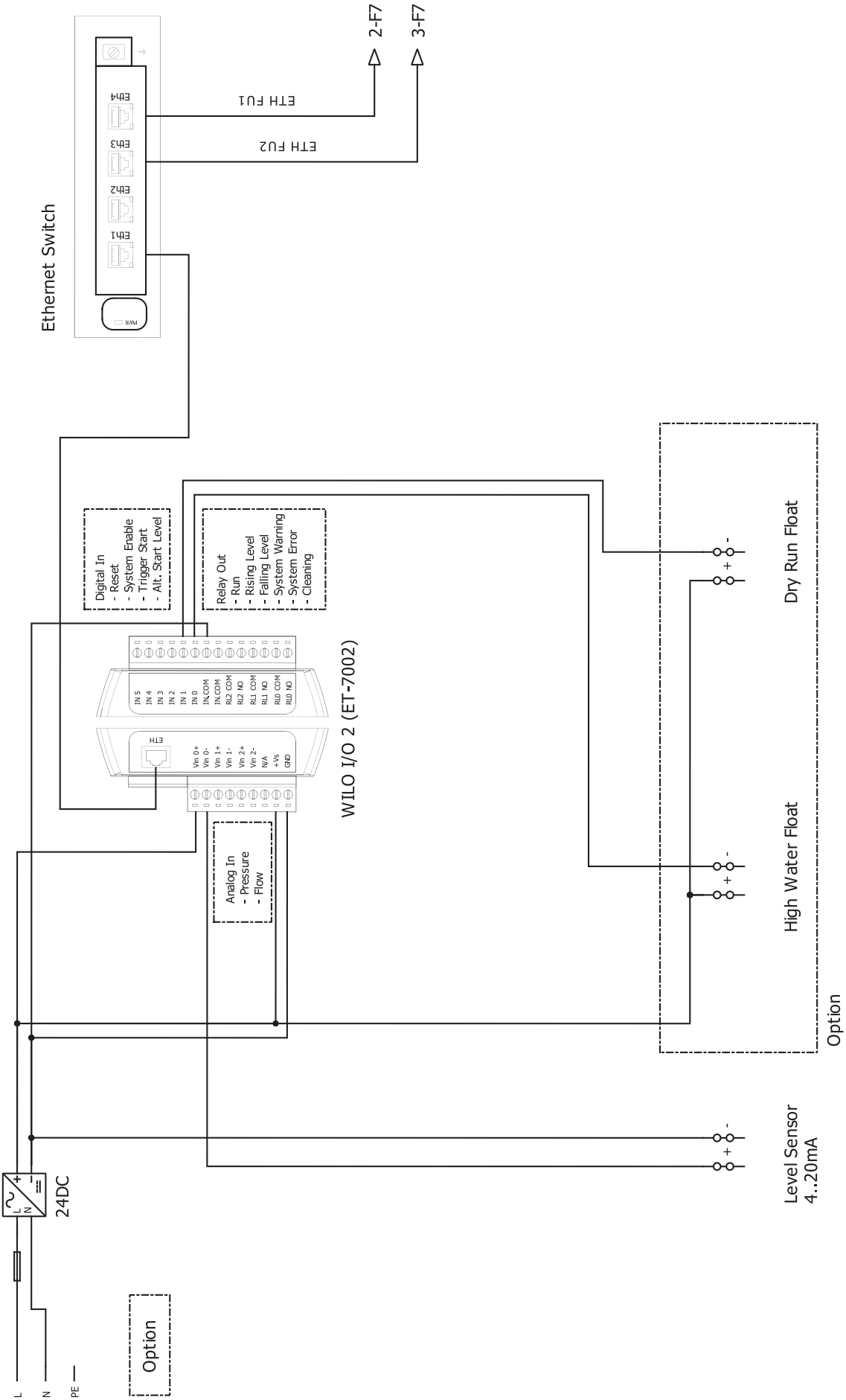
9.2 Example circuit diagrams for LSI system mode

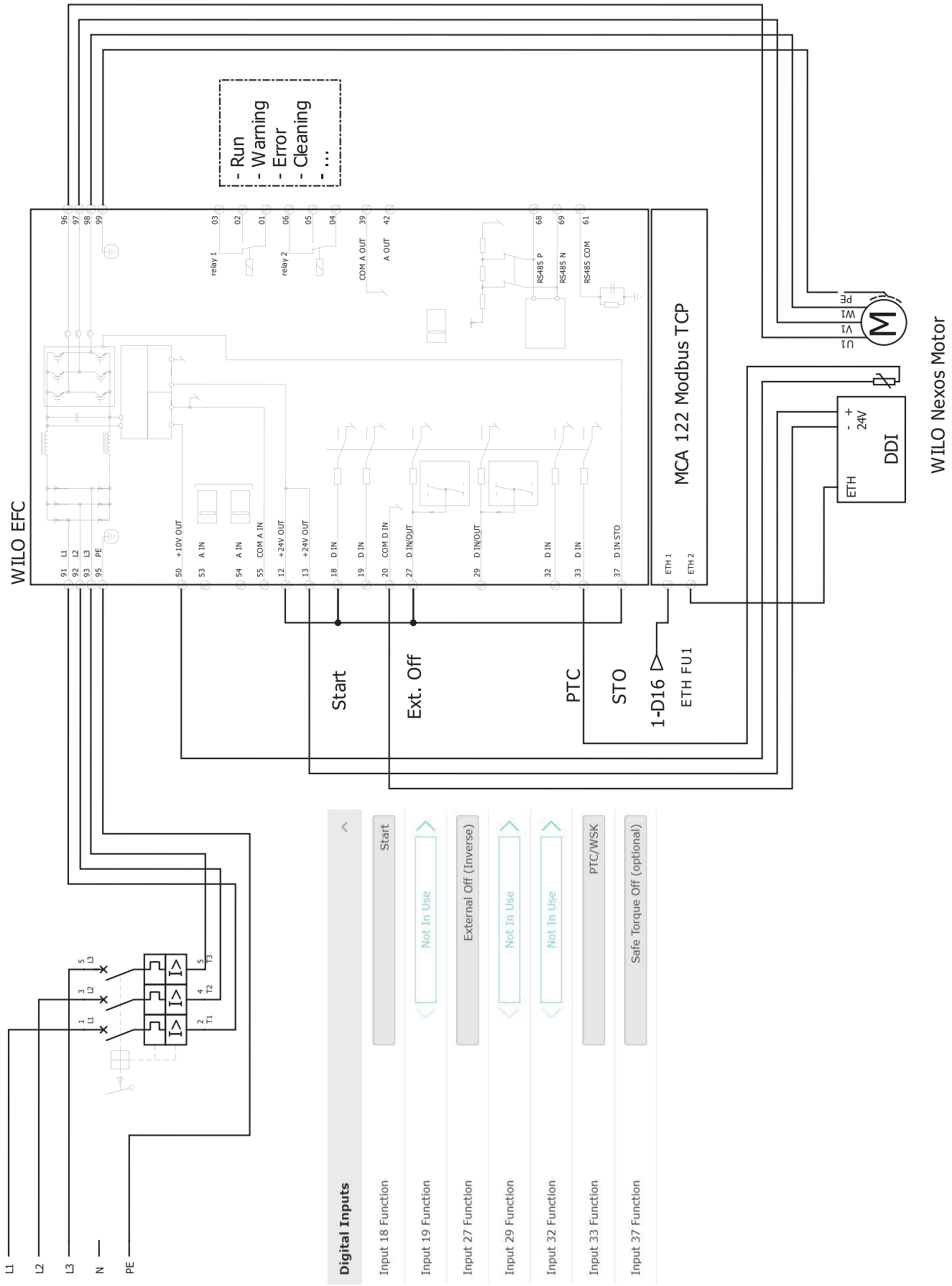
NOTICE! The following circuit diagrams refer to a pumping station with two pumps. The circuit diagrams for the connection of the frequency converter and the pump also apply to pump 3 and 4 of a pumping station.

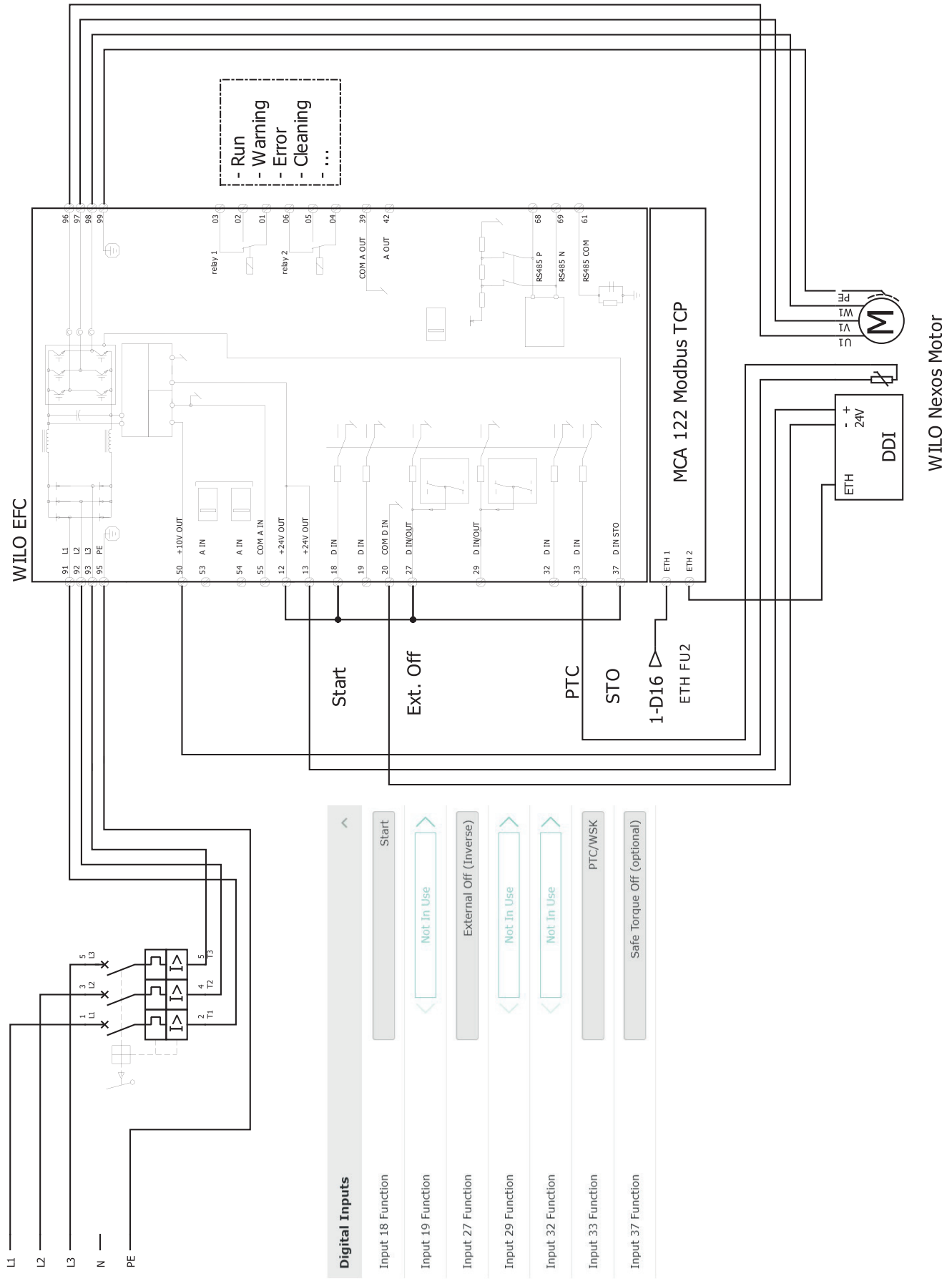
See also

- LSI System mode: connection example without Ex [▶ 98]
- LSI System mode: connection example with Ex [▶ 101]

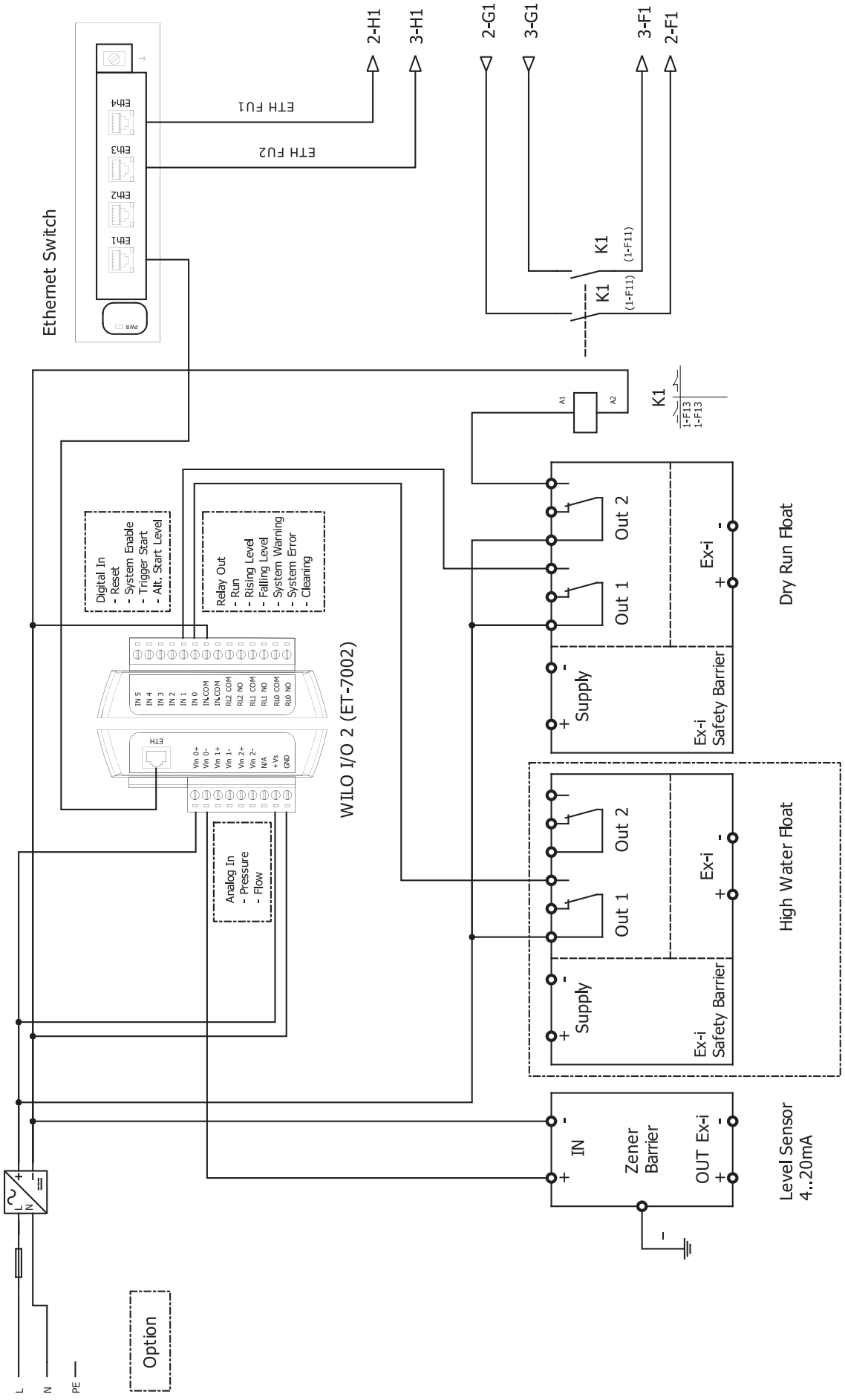
9.2.1 LSI System mode: connection example without Ex

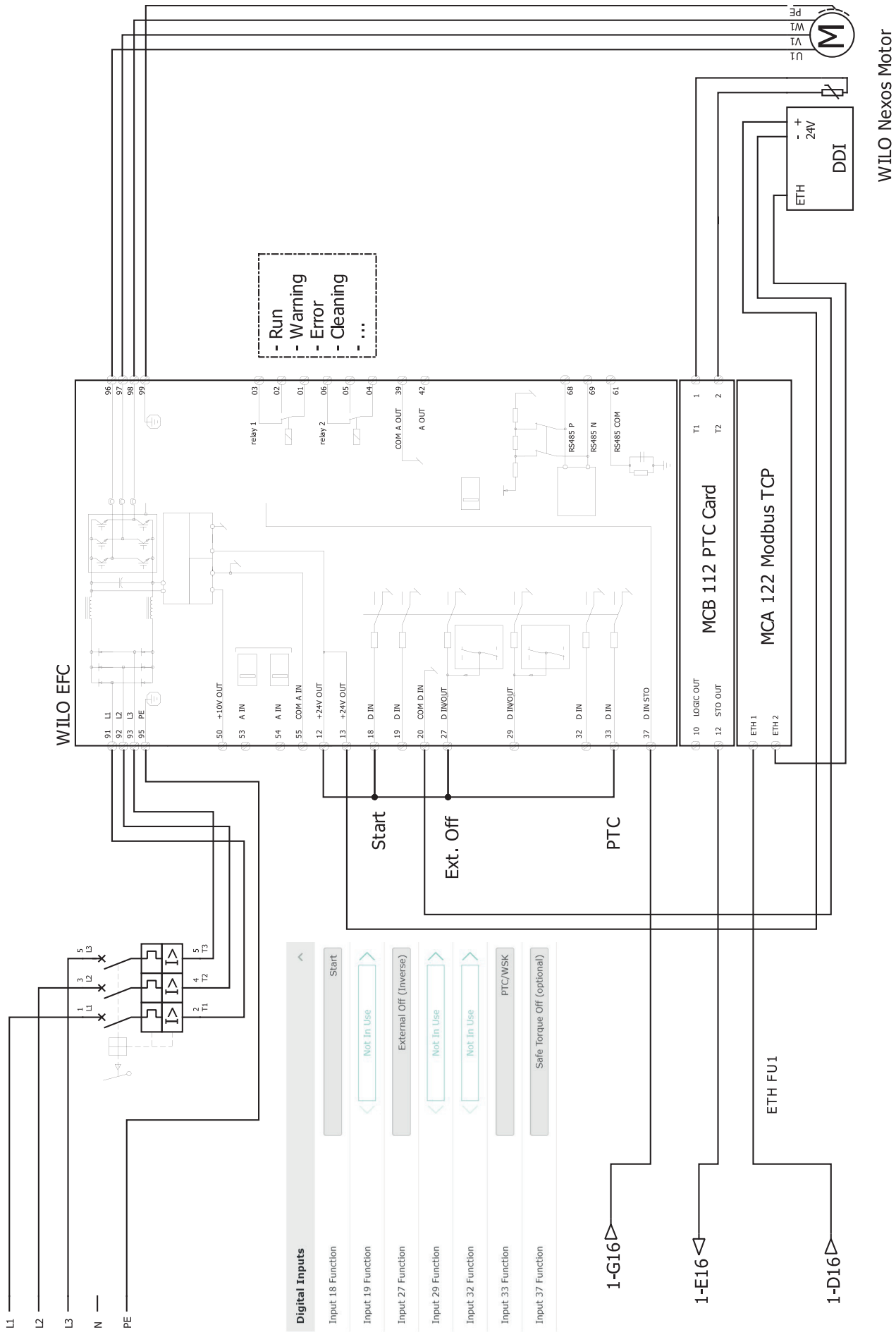


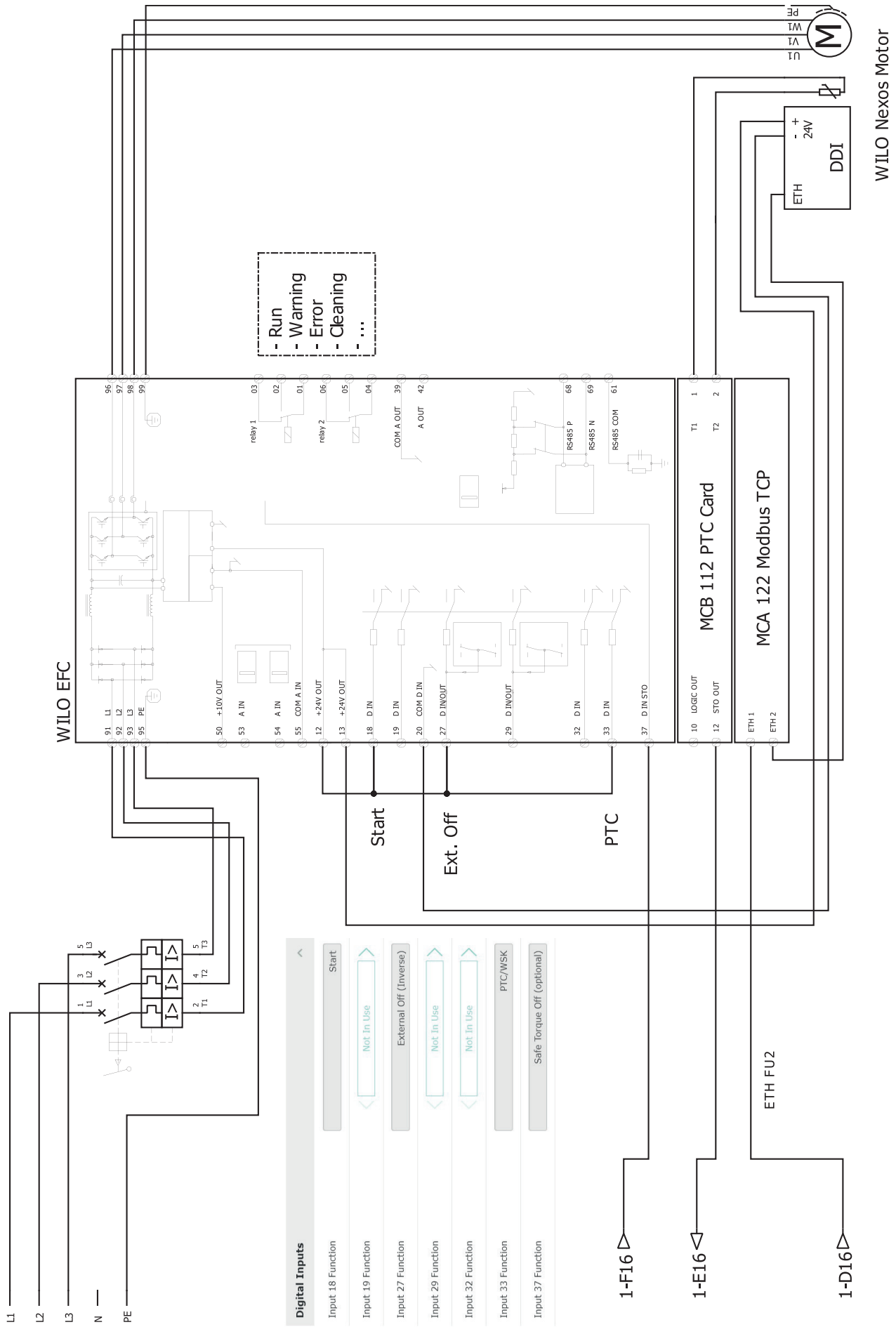

WILO EFC
MCA 122 Modbus TCP
- Run
- Warning
- Error
- Cleaning
- ...
Start
Ext. Off
PTC
STO
1-D16
ETH FU1
DDI
WILO Nexos Motor
L1
L2
L3
N
PE
Digital Inputs
Input 18 Function
Start
Input 19 Function
Not In Use
Input 27 Function
External Off (Inverse)
Input 29 Function
Not In Use
Input 32 Function
Not In Use
Input 33 Function
PTC/WSK
Input 37 Function
Safe Torque Off (optional)


- Run
- Warning
- Error
- Cleaning
- ...
WILO EFC
MCA 122 Modbus TCP
WILO Nexos Motor
DDI
ETH
24V
Start
Ext. Off
PTC
STO
1-D16
ETH FU2
L1
L2
L3
N
PE
Digital Inputs
Input 18 Function
Input 19 Function
Input 27 Function
Input 29 Function
Input 32 Function
Input 33 Function
Input 37 Function
Start
Not In Use
External Off (Inverse)
Not In Use
Not In Use
PTC/WSK
Safe Torque Off (optional)

9.2.2 LSI System mode: connection example with Ex




WILO Nexos Motor
U1
V1
W1
PE
DDI
24V
ETH
WILO EFC
MCB 112 PTC Card
MCA 122 Modbus TCP
- Run
- Warning
- Error
- Cleaning
- ...
relay 1
relay 2
COM A OUT
A OUT
RS485 P
RS485 N
RS485 COM
+10V OUT
A IN
COM A IN
+24V OUT
D IN
COM D IN
D IN/OUT
LOGIC OUT
STO OUT
ETH 1
ETH 2
Start
Ext. Off
PTC
ETH FU1
1-G16
1-E16
1-D16
L1
L2
L3
N
PE
Digital Inputs
Input 18 Function
Input 19 Function
Input 27 Function
Input 29 Function
Input 32 Function
Input 33 Function
Input 37 Function
Start
Not In Use
External Off (Inverse)
Not In Use
Not In Use
PTC/WSK
Safe Torque Off (optional)


WILO Nexos Motor
U1
V1
W1
PE
DDI
ETH
24V
- Run
- Warning
- Error
- Cleaning
- ...
WILO EFC
MCB 112 PTC Card
MCA 122 Modbus TCP
Start
Ext. Off
PTC
ETH FU2
1-F16
1-E16
1-D16
L1
L2
L3
N
PE
Digital Inputs
Input 18 Function
Input 19 Function
Input 27 Function
Input 29 Function
Input 32 Function
Input 33 Function
Input 37 Function
Start
Not In Use
External Off (Inverse)
Not In Use
Not In Use
PTC/WSK
Safe Torque Off (optional)

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