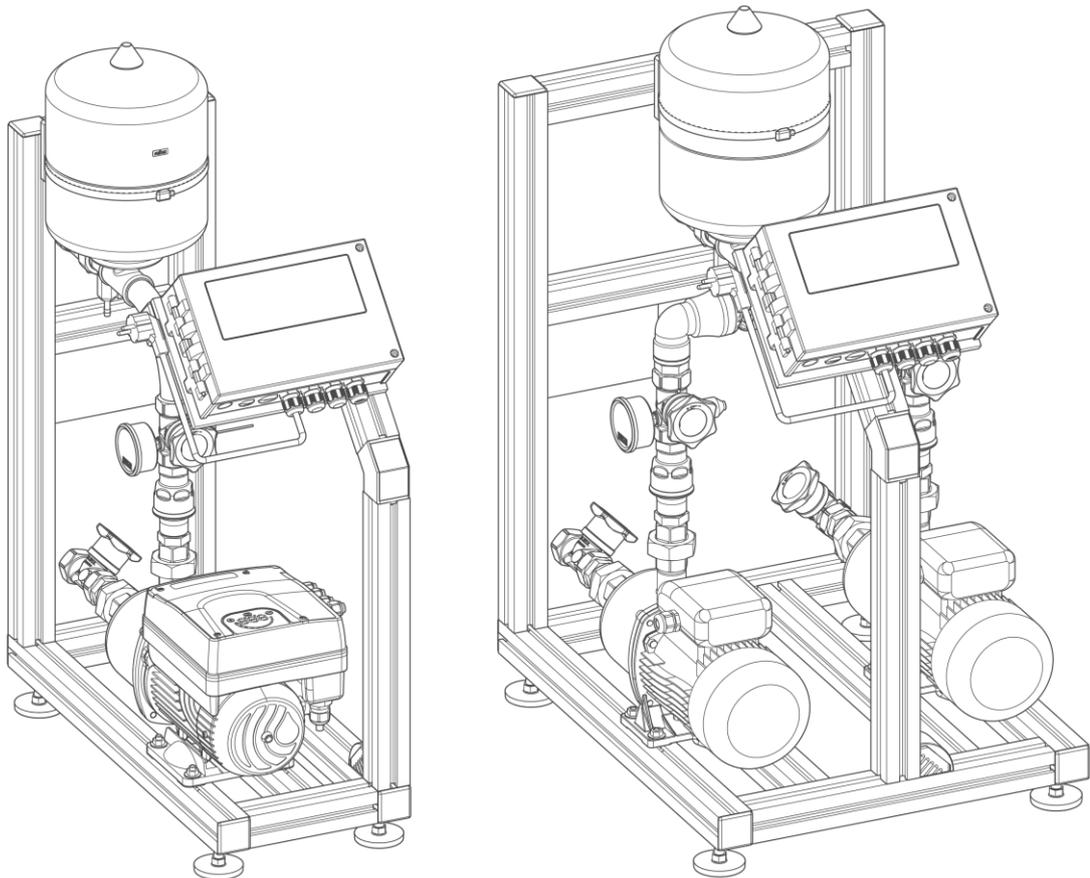


We understand water.



Pressure booster system | GENO-FU-X, HR-X

Operation manual

grünbeck

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1 Introduction

This manual is intended for owners/operators/operating companies and qualified specialists and ensures the safe and efficient handling of the product. The manual is an integral part of the product.

- Carefully read this manual and the component instructions contained therein before you operate your product.
- Comply with all safety information and handling instructions.
- Keep this manual and all other applicable documents, so that they are available when needed.

Figures in this manual are for basic understanding and may differ from the actual version.

1.1 Validity of the manual

This manual applies to following products:

- Pressure booster system GENO-FU-X
- Pressure booster system GENO-HR-X
- Special versions, which essentially correspond to the indicated standard products. Information on changes can be found on the respective information sheet that will be enclosed in these cases.

1.2 Other applicable documents

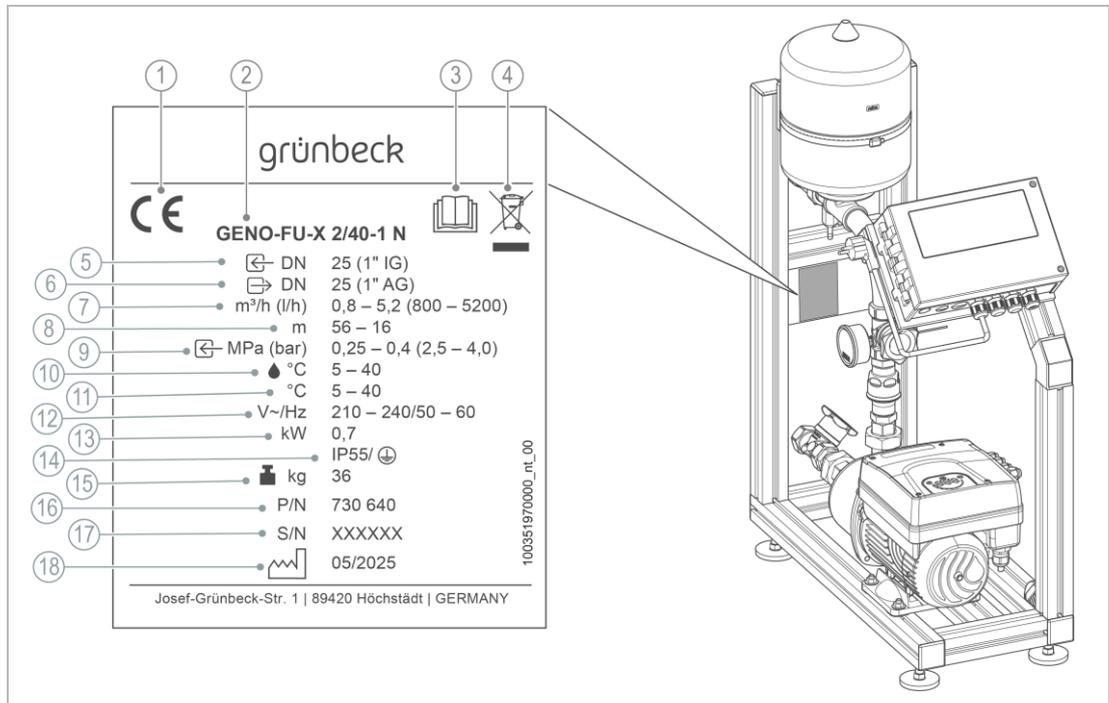
- Electrical circuit diagram GENO-FU-X, GENO-HR-X
- Manuals for components from other manufacturers

1.3 Product identification

You can identify your product based on the product designation and the order number on the type plate.

► Check whether the products indicated in chapter 1.1 correspond to your product.

The type plate is located at the frame.



Designation	
1	CE mark
2	Product designation
3	Adhere to the Operation Manual
4	Disposal information
5	Nominal connection diameter, suction side
6	Nominal connection diameter, pressure side
7	Delivery rate
8	Delivery head
9	Operating pressure

Designation	
10	Media temperature
11	Ambient temperature
12	Mains connection voltage/frequency
13	Electrical power input
14	Protection/protection class
15	Operating weight
16	Order no.
17	Serial no.
18	Date of manufacture

1.4 Symbols used

Symbol	Meaning
	Danger and risk
	Important information or prerequisite
	Useful information or tip
	Written documentation required
	Reference to further documents
	Work that must only be carried out by qualified specialists
	Work that must only be carried out by qualified electricians
	Work that must only be carried out by technical service personnel

1.5 Depiction of warnings

This manual contains information and instructions that you must observe for your personal safety. The information and instructions are highlighted by a warning symbol and are structured as shown below:



SIGNAL WORD Type and source of hazard

- Possible consequences
- ▶ Preventive measures

The following signal words are defined depending on the degree of danger and might be used in this document:

Warning sign and signal word	Consequences if the information/instructions are ignored		
 DANGER	Personal injury	Death or serious injuries	
 WARNING		Possible death or serious injuries	
 CAUTION		Possible moderate or minor injuries	
NOTE	Damage to property	Possible damage to components, the product and/or its functions or an object in its vicinity	

1.6 Requirements for personnel

During the individual life cycle phases of the product, different people carry out work on the product. The work requires different qualifications.

1.6.1 Qualification of personnel

Personnel	Prerequisites
User	<ul style="list-style-type: none"> • No special expertise required • Knowledge of the tasks assigned • Knowledge of possible dangers in case of inappropriate behaviour • Knowledge of the necessary protection devices and protective measures • Knowledge of residual risks
Owner/operator/operating company	<ul style="list-style-type: none"> • Product-specific expertise • Knowledge of statutory regulations on work safety and accident prevention
Qualified specialist <ul style="list-style-type: none"> • Electrical engineering • Sanitary engineering (HVAC) • Transport 	<ul style="list-style-type: none"> • Professional training • Knowledge of relevant standards and regulations • Knowledge of detection and prevention of potential hazards • Knowledge of statutory regulations on accident prevention
Technical service (Grünbeck's technical service/authorised service company)	<ul style="list-style-type: none"> • Extended product-specific expertise • Trained by Grünbeck

1.6.2 Authorisations of personnel

The table below describes which tasks may be carried out by whom.

	User	Owner/ operator/ operating company	Qualified specialist	Technical service
Transport and storage		X	X	X
Installation and mounting			X	X
Commissioning			X	X
Operation and handling	X	X	X	X
Cleaning	X	X	X	X
Inspection		X	X	X
Maintenance	annually		X	X
Troubleshooting		X	X	X
Repair				X
Decommissioning and recommissioning			X	X
Dismantling and disposal			X	X

1.6.3 Personal protective equipment

- ▶ As an owner/operator/operating company, make sure that the required personal protective equipment is available.

The components below fall under the heading of personal protective equipment (PPE):



Protective gloves



Protective footwear

2 Safety

2.1 Safety measures

- Only operate your product if all components are installed properly.
- Obey the local regulations on drinking water protection, accident prevention and occupational safety.
- Do not make any changes, alterations, extensions or program changes on your product.
- Only use genuine spare parts for maintenance or repair.
- Keep the premises locked to prevent unauthorised access and to protect endangered or untrained persons from residual risks.
- Observe the maintenance intervals (refer to chapter 8.2). Failure to comply can result in the microbiological contamination of your drinking water system.
- Be aware of a possible risk of slipping due to leaking water on the floor.

2.1.1 Mechanical hazards

- You must never remove, bridge, or otherwise tamper with safety equipment.
- For all work on the product that cannot be carried out from the ground, use stable, safe and self-standing access aids (e.g. stepladders).
- Make sure that the product is set up or fixed in a way that it is tilt-resistant and fall-resistant and that the product stability is guaranteed at all times.

2.1.2 Pressure-related hazards

- Components can be under pressure. There is a risk of injuries and damage to property due to escaping water and unexpected movement of components. Check the product's pressure lines for leaks at regular intervals.
- Before starting repair and maintenance work, make sure that all affected components are depressurised.

2.1.3 Electrical hazards

There is an imminent danger to life from electric shock when touching live components. Damage to the insulation or single components can be life-threatening.

- Only have qualified electricians carry out electrical work on the product.
- In case of damage to live components, switch off the voltage supply immediately and arrange for repair.
- Switch off the voltage supply before working on electrical components.
- Before starting work on enabled product components, ensure that they are de-energised and remain de-energised for the duration of the work.
- Ensure that the socket outlet has a protective earth connection. If necessary, retrofit the socket outlet with an adapter with an earthing contact.

- Never bridge electrical fuses. Do not disable fuses. Use the correct current ratings when replacing fuses.
- Keep moisture away from live components. Moisture can cause short-circuits.
- The mains cable of the product must be laid free of kinks and mechanical tension. Do not wind up or squeeze the mains cable.

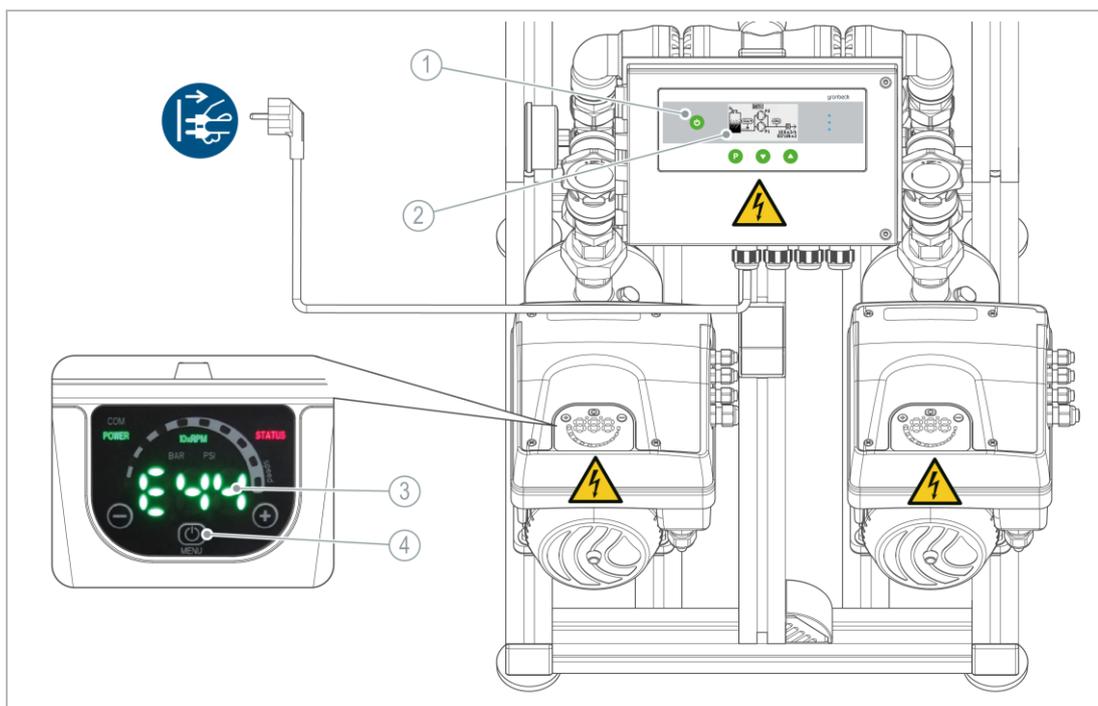
2.1.4 Group of persons requiring protection

- This product must not be used by persons (including children) with limited capabilities, lack of experience or knowledge.

2.2 Product-specific safety instructions

- Route all lines and hoses, mains cables and electrical connection cables away from any walkway areas to prevent tripping and tearing.
- Mark possible tripping hazards, if necessary.

2.2.1 Signals and warning devices



Designation

- | | |
|---|---------------------------------------|
| 1 | On/off switch on the control unit |
| 2 | Visual indication of the control unit |

Designation

- | | |
|---|---|
| 3 | Visual indication of the centrifugal pump |
| 4 | START/STOP key on the centrifugal pump |

2.2.2 Safety devices



Safety devices must be replaced by original spare parts only.

▶ Have the safety devices and wearing parts replaced by a qualified specialist (refer to chapter 8.6).

- Dry-run protection of the centrifugal pump
- Non-return valve

Labels on the product



Risk of electric shock



Hot surface



The affixed information and pictograms must be clearly legible.

They must not be removed, dirty, or painted over.

- ▶ Comply with all warnings and safety instructions.
- ▶ Immediately replace illegible or damaged symbols and pictograms.

2.3 Conduct in emergencies

2.3.1 In case of water leaks

1. Disconnect the product from mains. Disconnect the mains plug.
2. Locate the leak.
3. Eliminate the cause of the water leak.

2.3.2 In case of control failure

1. Disconnect the product from mains. Disconnect the mains plug.
2. Contact customer service.

2.3.3 In the event of smoke/a smouldering smell

1. Switch off the power supply to the product immediately if there is a smell of smouldering. Disconnect the mains plug.
2. Ventilate the installation site. Ensure a complete exchange of air.
3. Contact customer service.

3 Product description

3.1 Intended use

- The GENO-FU-X and GENO-HR-X pressure booster systems are used for supplying water to small and medium-sized distribution networks in buildings with raw water, softened water and partially demineralised water (permeate originating from reverse osmosis systems).
- The pressure booster systems are designed for 100% continuous operation.

Intended use

- The FU-X and HR-X pressure booster systems are designed exclusively for use in industrial and commercial applications.
- The FU-X and HR-X pressure booster systems are suitable for the low-noise water supply of small and medium-sized distribution networks in buildings.
- The FU-X **N** and HR-X **N** pressure booster systems are suitable for conveying raw water, softened water or partially demineralised water from a reverse osmosis system, ultrafiltration system or nanofiltration system.
- The FU-X **NE** pressure booster system is suitable for use in combination with the electrodeionisation system EDI-X as well as downstream of two-stage reverse osmosis systems.

3.1.1 Admissible media to be pumped

Admissible media to be pumped	Type N	Type NE
Raw water, soft water	suitable	suitable
Permeate (= pure water of an RO system)	suitable	suitable
Diluate (= ultra-pure water from EDI)	not suited	suitable

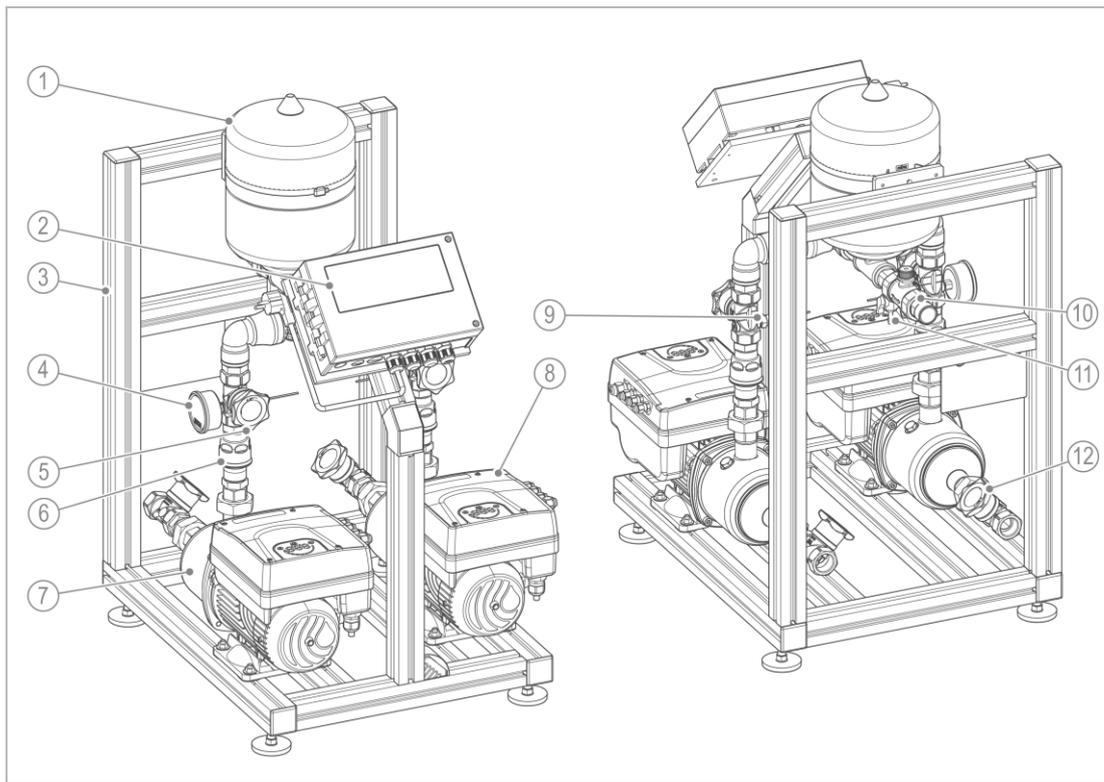
3.1.2 Foreseeable misuse

- Conveying liquids containing solids, fibrous or abrasive substances
- Conveying liquids or aggressive media

3.2 Product components

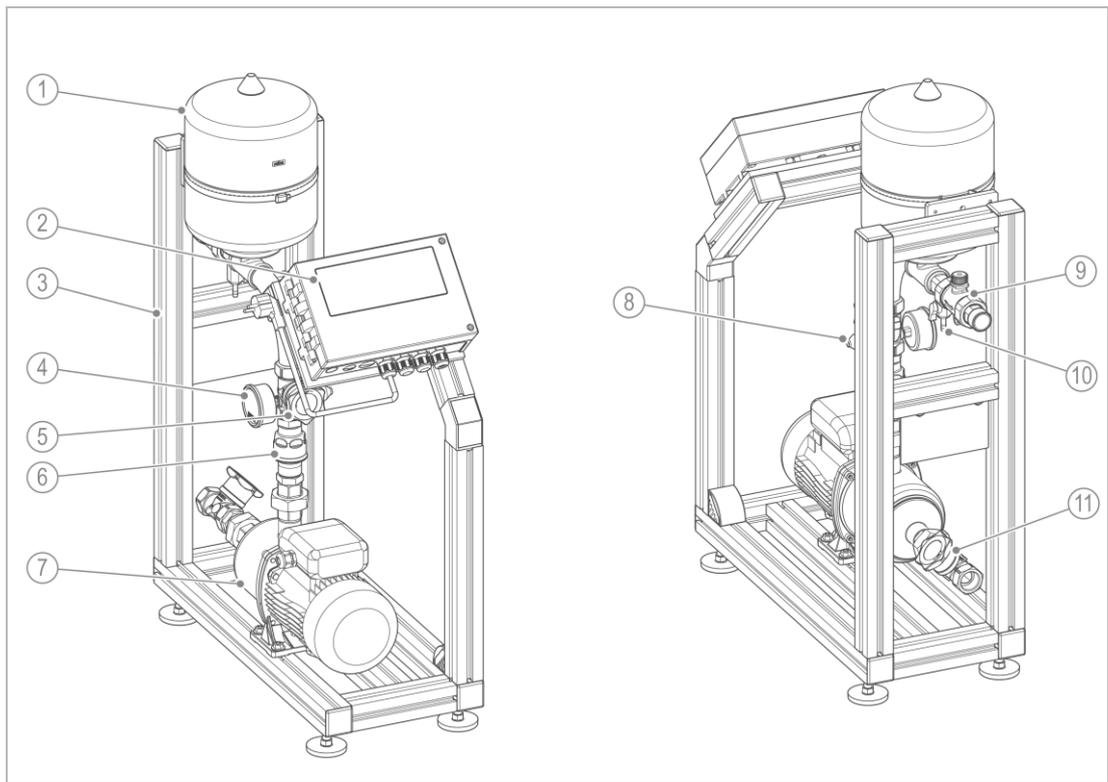
The product components apply to all versions of the pressure booster systems. The GENO-FU-X (twin) and GENO-HR-X (single) systems are used here as representative examples.

3.2.1 FU-X (e-SM-Drive system)



Designation	Functions/characteristics
1 Diaphragm expansion tank	with forced flow
2 Control unit	with connection line and shock-proof plug
3 System rack	made of aluminium with adjustable levelling feet
4 Pressure gauge	for analogue pressure reading
5 Shut-off valve	downstream of the centrifugal pump (pressure side)
6 Non-return valve	prevents water backflow
7 Centrifugal pump	multi-stage, normal suction
8 Frequency converter	with control and operating panel (e-SM drive)
9 Pressure sensor	for pressure measurement of the outlet pressure and pump pressure control
10 Contact water meter	to record the water quantity (pressure side)
11 Draining valve	for venting the line in the output
12 Shut-off valve	upstream of the pump in the inlet (suction side)

3.2.2 HR-X

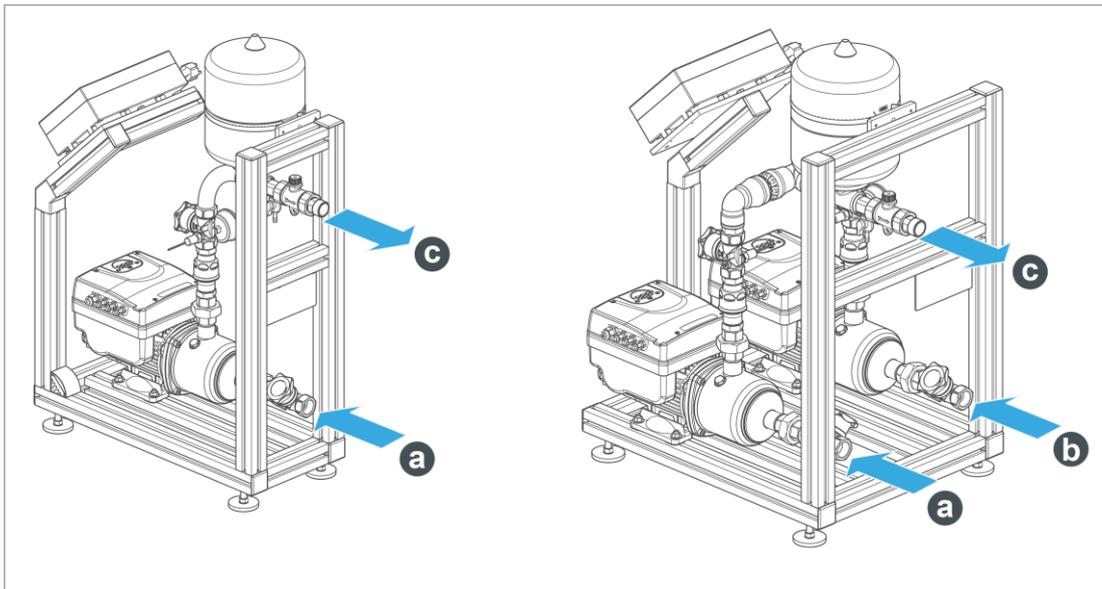


Designation	Functions/characteristics
1 Diaphragm expansion tank	with forced flow
2 Control unit	with connection line and shock-proof plug
3 System rack	made of aluminium with adjustable levelling feet
4 Pressure gauge	for analogue pressure reading
5 Shut-off valve	downstream of the centrifugal pump (pressure side)
6 Non-return valve	prevents water backflow
7 Centrifugal pump	multi-stage, normal suction
8 Pressure switch	for pressure measurement of the outlet pressure and pressure control via the contact water meter
9 Contact water meter	To record the water quantity (pressure side)
10 Draining valve	for venting the line in the output
11 Shut-off valve	upstream of the pump in the inlet (suction side)

3.3 Connections



For connection dimensions, see technical specifications (refer to chapter 12).



Designation

- a Medium inlet to pump 1 (suction side)
- b Medium inlet to pump 2 (suction side)

Designation

- c Medium outlet to the consumer (pressure side)

3.4 Functional description

3.4.1 Pressure booster system RU-X

- The FU-X pressure booster system is speed-controlled via a pressure sensor and keeps the set delivery head constant to a large extent. Smooth start-up and run-down of the pump prevent water hammer. In addition, a diaphragm expansion tank operating with forced flow, absorbs pressure fluctuations in case of major changes in the delivery rate and reduces the switching frequency in case only small amounts are withdrawn.
- In case of "0" delivery rate, the integrated, special pressure controller initiates the time-delayed switch-off of the pump.
- The display and LEDs on the frequency converter control/operating panel provide information about the voltage supply, centrifugal pump state and operating state.

e-SM-Drive system

The e-SM-Drive system consists of the components below:

- 1 centrifugal pump with permanent magnet motor IE5
- 1 frequency converter
- 1 pressure sensor

Function of the centrifugal pump

- Start and stop of the centrifugal pump depend on the adjustable setpoint (operating pressure) of the frequency converter.
- Upon request by the consumer (opened water tap), water flows from the diaphragm expansion tank.
- If the line pressure drops below the start setting, the centrifugal pump starts. The motor speed is controlled in such a way that the pressure remains constant even when consumer demand increases.
- If consumer demand decreases, the centrifugal pump runs slower at first, fills the diaphragm expansion tank and then stops if the setpoint (operating pressure) is reached.

3.4.2 Pressure booster system HR-X

- The HR-X pressure booster system is switched on via the freely adjustable pressure switch and is switched off with a time delay at flow rate "0" via the contact water meter.
- The pressure at switch-off corresponds to the max. delivery pressure (shut-off head) of the pump.
- Before the pump shuts down, the forced flow diaphragm expansion tank is filled with water. In the event of high flow fluctuations, this decreases the pump switching operations.

3.4.3 Twin pressure boosters FU-X, HR-X (cascade operation)

In twin pressure booster systems, the switchover between the centrifugal pumps is controlled either via time or in the event of a centrifugal pump failure.

This achieves a steady centrifugal pump load and a redundancy of 100% for twin pressure booster systems.

Adjustable cascade operation is possible with twin pressure booster systems. The pump capacity can be virtually doubled.

4 Transport, installation and storage

4.1 Dispatch/delivery/packaging



NOTE

Improper transport

- Damage to product parts due to components falling down
- The product does not feature any lifting points for lifting by means of a crane and a lifting strap.
- ▶ Do not lift the product with a crane or lifting device.
- ▶ Load/unload the product or product parts secured on a pallet with a forklift and suitable pallet forks.

The product is fixed on a pallet at the factory and secured against tipping.

- ▶ Upon receipt, immediately check for completeness and transport damage.
- ▶ In case of visible transport damage, proceed as follows:
 - Do not accept the delivery or only accept it under reserve.
 - Take note of the extent of damage on the transport documents or on the carrier's delivery note.
 - Initiate a complaint.
- ▶ Load and unload the product using a forklift truck. A pallet truck may only be used on completely flat surfaces.
- ▶ Note the centre of gravity of the product and the specified pick-up direction.
- ▶ Set down the product on a level and stable surface. Take the weight of the product into account.
- ▶ Dispose of the packaging material in an environmentally sound and appropriate manner only after installation of the product (refer to chapter 11.2).

4.2 Transport/installation to/at the installation site

NOTE

Comply with the ambient conditions at the installation site

- Adverse effects on the function of the product due to cold, heat or humidity (formation of condensation)
- Reduced service life and damage to the product
- ▶ Check the ambient conditions on site.
- ▶ Instruct the operating company that the following ambient conditions must be permanently maintained:
 - Temperature: 5 °C – 40 °C (optimal 20 °C)
 - Relative humidity (non-condensing) ≤ 70 %
- ▶ Transport the product to the installation site (longer distances) using a forklift truck in its original packaging only and secured on a pallet.
- ▶ Use protective shoes and gloves during transport.
- ▶ Transport the unpacked product (without pallet) in close vicinity of the final installation site only.
- ▶ Set down the product on a level and stable surface. Take the weight of the product into account.



CAUTION

Transport over stairs and inclines

- Crushing due to slipping and falling of the product
- ▶ Only transport the product to the installation site over inclines using suitable transport equipment (e.g. forklift).
- ▶ Do not use any self-rolling transport equipment (e.g. lift trucks, trolleys).
- ▶ Keep unauthorised persons away when transporting and installing the product.

4.3 Storage

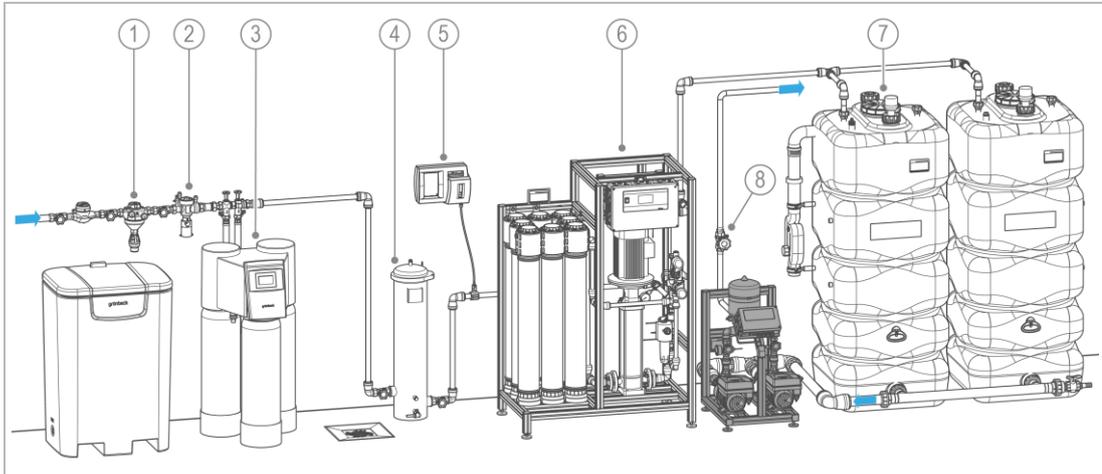
- ▶ Store the product protected from the following effects:
 - Dampness, moisture
 - Environmental impacts such as wind, rain, snow, etc.
 - Frost, direct sunlight, severe heat exposure
 - Chemicals, dyes, solvents and their vapours

5 Installation



The installation of the product must be carried out by a qualified specialist only.

Installation example



Designation	Designation
1 Drinking water filter MR	5 Hardness control measuring device softwatch
2 Euro system separator GENO-DK-2	6 Reverse osmosis system GENO-OSMO-X
3 Water softener softliQ:LB	7 GT-X pure water tank
4 AKF 4500 activated carbon filter	8 Output shut-off valve

5.1 Requirements for the installation site

Observe the local installation directives, general guidelines and technical specifications.

- Protection from frost, severe heat exposure and direct sunlight
- Protection from chemicals, dyes, solvents and their vapours
- Ambient temperature and radiation temperature in the immediate vicinity $\leq 40\text{ °C}$
- Protection from heat sources (e.g. heating systems, boilers and hot water pipes)
- Access for maintenance work (take required space into consideration)
- Sufficiently illuminated as well as aerated and ventilated
- Horizontal installation surface with sufficient load-bearing capacity to support the operating weight of the product



The pipe upstream and downstream of the pressure booster system must be made of corrosion-resistant material.

Space required

- There must be a clearance of at least 800 mm in front of the product for operation.
- To set up/install and service the product, comply with the recommended foundation dimensions (refer to Chapter 12).

Water installation

- Shut-off valve immediately downstream of the pressure booster system
- Floor drain or corresponding safety device with water stop function
- External float or pressure switch, if not networked with the reverse osmosis system control unit to protect the pressure booster system against running dry
- Additional diaphragm expansion tank if required, e.g. if the pressure drop is to be kept low at a rapid start of withdrawal and a high flow rate

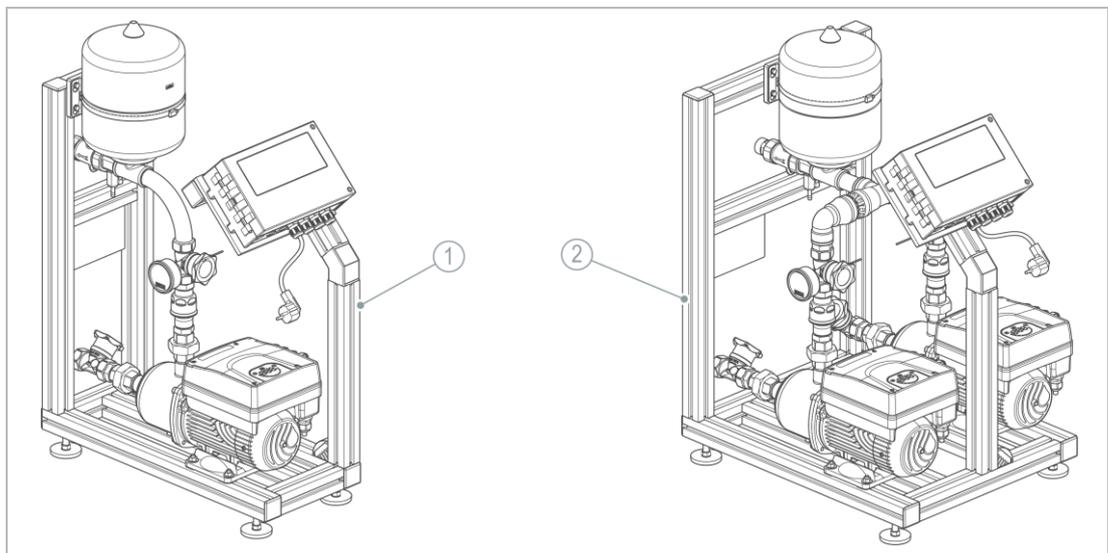
Electrical installation

- Power supply 230 V/50 Hz
- Residual current device (RCD) using all-current sensitive RCD with 30 mA response threshold

5.2 Checking the scope of supply



The corresponding version of the pressure booster system, which is ready for connection, is available on a wooden pallet with cardboard casing.



Designation
 1 Pressure booster system, e.g. GENO-FU-X-1

Designation
 2 Pressure booster system, e.g. GENO-FU-X-2

- ▶ Check the scope of supply for completeness and damage.

5.3 Water installation



If the installation location of the pressure booster system is 1000 m or more above sea level, the performance losses of the centrifugal pump must be taken into account.

5.3.1 System installation



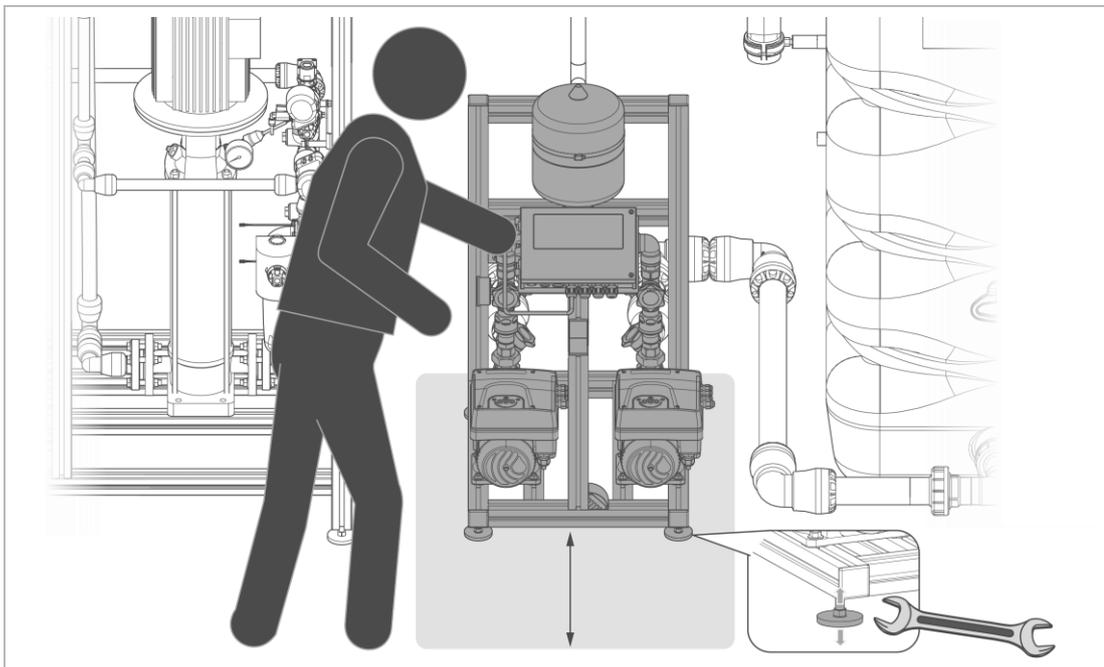
Comply with the safety instructions regarding transport (refer to chapter 4).

1. Set up the system securely in the predetermined location.
 - a Take note of the transport and installation indications (refer to chapter 4.2)
 - b Observe the dimensions of the system (see corresponding product data sheet).

NOTE

Condensation when temperature difference is too high

- Possible malfunction of the control unit during initial commissioning due to moisture formation on electronic components.
 - ▶ Unpack the product before installation and leave it unused at the installation site for 1 hour.
 - » Any possible moisture precipitation on electronic components inside the control unit can dry off.
2. Release the system pedestal from the transport lock.
 3. Remove the pallet.



4. Set up the system securely in the predetermined location.
 - a Observe the necessary space required for operation of min. 800 mm.
5. Level out any uneven floors with the adjustable feet.

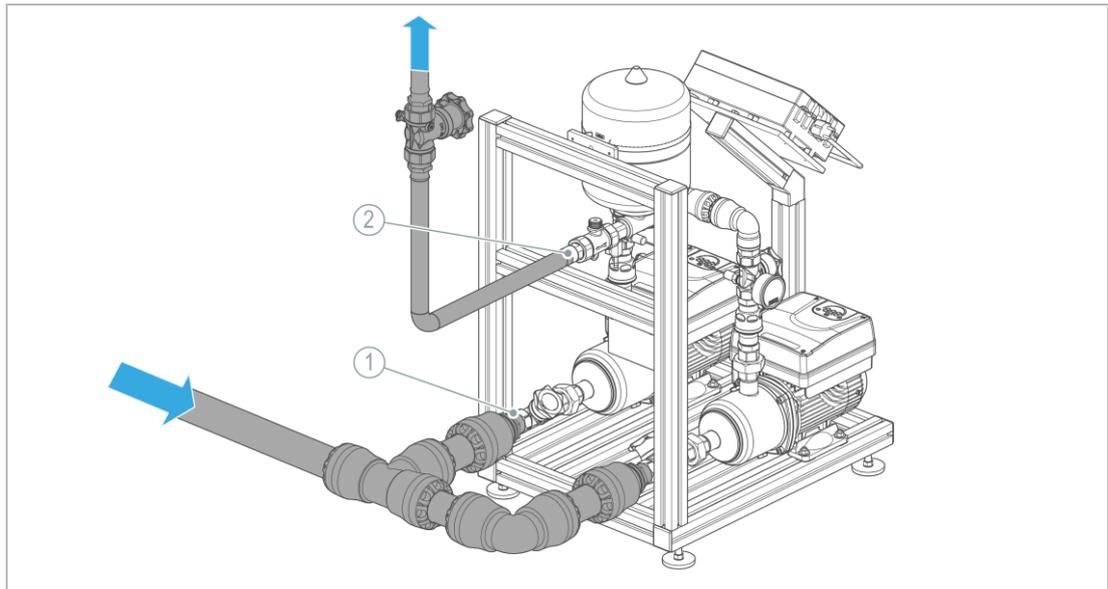
5.3.2 Connecting the system hydraulically



Pipes provided by the client on site must be made of corrosion-resistant material.

► Please note the following points during the installation:

- Shut-off valve on the pressure side downstream of the system
- Matching the nominal connection diameter of the pipe on the suction and pressure sides with the system size



Designation

1 Suction side connection (input)

Designation

2 Pressure side connection (output)

1. Install the pipe(s) on the suction side at the input to the centrifugal pump(s).
2. Install the pipe on the pressure side to the water meter output.

5.4 Electrical installation



The electrical installation must be carried out by a qualified electrician only.



Carry out the electrical installation according to the electric circuit diagram.



DANGER Life-threatening voltage



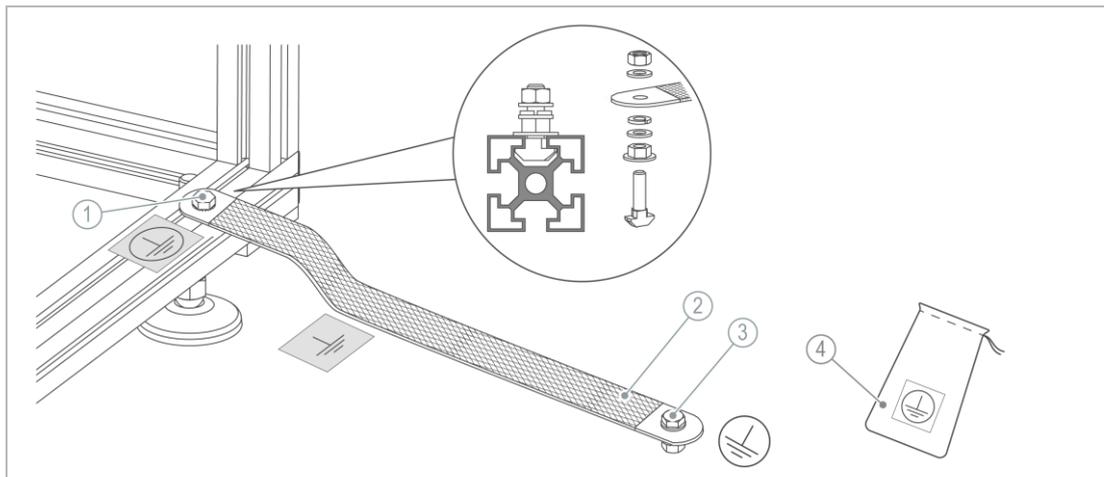
- Risk of severe burns, cardiovascular failure, fatal electric shock
- ▶ Only have qualified electricians carry out electrical work.
- ▶ Check the system for proper condition before start-up/commissioning.
- ▶ Have damaged mains cables replaced by a qualified electrician.

5.4.1 Establishing potential equalisation



In proper operation, the speed-controlled centrifugal pump can have a ground leakage current of > 10 mA.

- Connection to the potential equalisation provided by the client on site is required
- The protective conductor must have a minimum cross-section of 6 mm² Cu or 10 mm² Al.



Designation	Designation
1 Grounding point on the aluminium rack	3 Grounding point for on-site potential equalisation
2 Grounding tape	4 Bag with connection material

1. Establish the grounding point on the aluminium rack – use the connection material: Hammer nut, hexagon head screw M8x25 and serrated washer.
2. Attach the "Grounding" label.
3. Connect the protective conductor to the on-site potential equalisation – use the connection material: Hexagon head screw M8x20, washer and spring washer.

5.4.2 Opening the PBS control unit



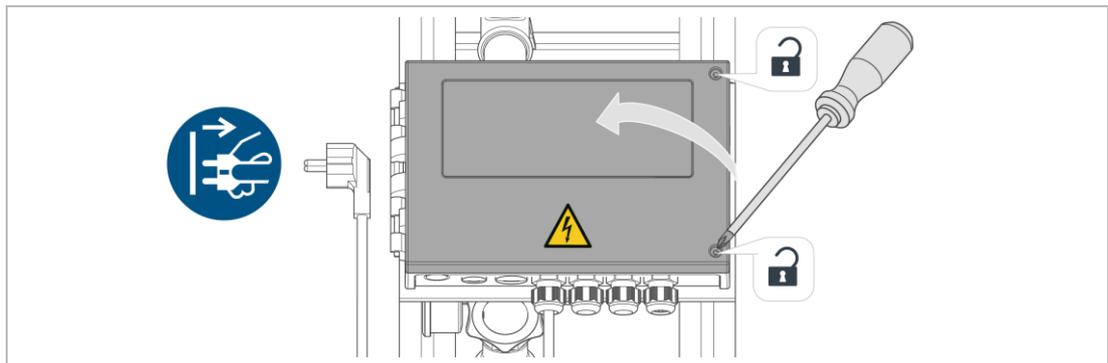
WARNING

External voltage at voltage-free contacts and on the main circuit board

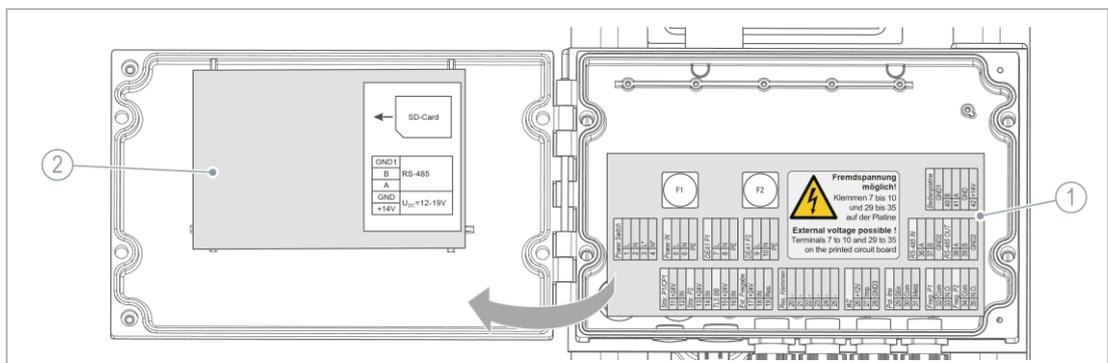
- Risk of electric shock when connected to 230 V
- ▶ Do not open any switch boxes or other parts of the electrical equipment if you are not a qualified electrician.
- ▶ Disconnect the system from the mains before working on the electrical components.
- ▶ Observe the warning labels and the general safety information (refer to chapter 2.1.3).



The memory card (SD card) for archiving and creating a system data printout is included at the factory.



1. Unfasten the two screws on the PBS control unit.

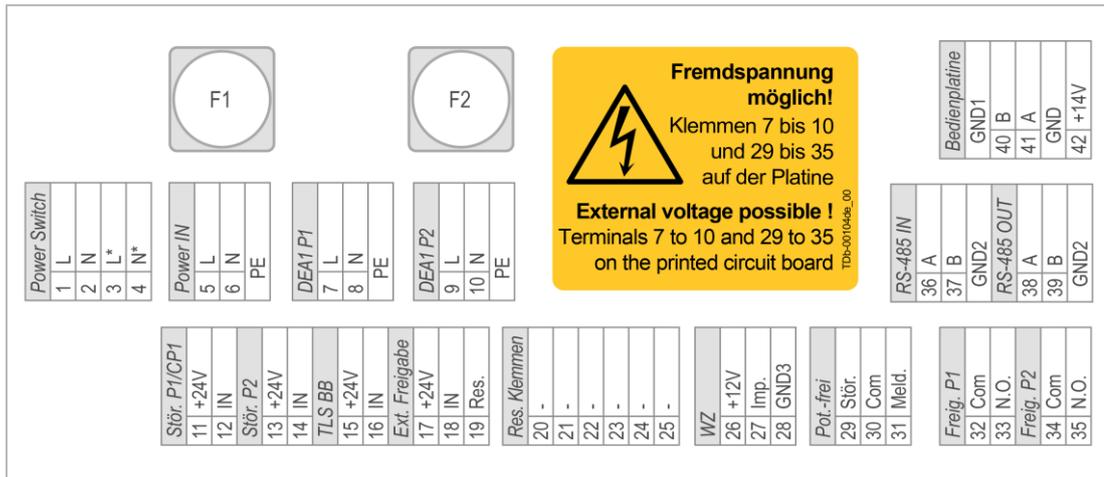


Designation	
1	Main circuit board

Designation	
2	Operating board

2. Open the control unit.
3. Wire the required connections (voltage-free signal and fault signal contacts, data cable to reverse osmosis system) accordingly.
4. Check that all connecting lines have been laid properly and are undamaged.

5.4.3 Terminal configuration of the PBS control unit



Designation	System type	F1 = F2
F1 Fuse DEA1P1	FU-X (all versions) HR-X (2/40-x N)	T10 A T 4 A
F2 Fuse DEA1P2	HR-X (4/40-x N)	T 5 A

Terminals PBS	Function/ by component	Signal	Terminal Colour	Line	Comments
1	Power switch		L	H05VV-F	Phase 230 V~ / 50 Hz
2	Control unit mains supply Mains switch (all-pole disconnecting)		N	5G1.0 mm ²	Neutral conductor
3	Connection to terminals	5	L*		
4		6	N*		
* If the PBS control unit is networked with the OSMO-X, this signal can be omitted because the dry-run protection information is transmitted by the OSMO-X control unit via the RS485 serial port.					
5	Power IN		L (BN)	H05VV-F	Phase 230 V~
6	Mains supply line		N (BU)	3G0.75 mm ²	Neutral conductor
PE	(if coupled with OSMO-X, from power distribution terminals where applicable)		(GN-YE)		Protective conductor
7	DEA1P1		L	H05RN-F	Phase 230 V~
8	Feed line centrifugal pump P1		N	3G1.5 mm ²	Neutral conductor
PE			PE		Protective conductor
9	DEA1P2		L	H05RN-F	Phase 230 V~
10	Feed line centrifugal pump P2		N	3G1.5 mm ²	Neutral conductor
PE			(GN-YE)		Protective conductor

System type FU-X					
11	Fault P1/CP1	+ 24 V	4	LiYY 2x0.5 mm ²	C – Error signal
12	Centrifugal pump P1		IN 5		NO – Error signal
13	Fault P2	+ 24 V	4	LiYY 2x0.5 mm ²	C – Error signal
14	Centrifugal pump P2		IN 5		NO – Error signal

System type HR-X					
11	Pressure switch CP1	+ 24 V	1	LiYY 2x0.5 mm ²	NO = Contact is open when the cut-out pressure is reached
12			IN 2		

Terminals PBS	Function/ by component	Signal	Terminal Colour	Line	Comments
External and component connections					
15	TLS BB	+ 24 V		LiYcY	CL1.4 opens if level falls below minimum = PBS off (*)
16	Dry-run protection BB1 (*)	IN		3x0.25 mm ² (*)	
17	Ext. Release	+ 24 V			External operational release, voltage-free contact on site (closed for operation)
18		IN			
19	Res.				unassigned
20	Res. terminals				unassigned
21					
22					
23					
24					
25					
26	WZ	+ 12 V=	WH	LiYY	
27	Water meter	Pulse	GN	3x0.25mm ²	
28		GND3	BN		
29	Voltage- free	Fault			Collective fault
30	active signal, each max.	Com			Common root
31	250 V~ / max. 3 A	Sign.			Signal contact
Voltage-free signals (for on-site evaluation)					
32	Released P1	Com			Max. switching power
33	Release P1 signal	N.O.			48 V= / 1 A
34	Released P2	Com			Max. switching power
35	Release P2 signal	N.O.			48 V= / 1 A
Data cable input					
36	RS-485 IN	A		LiYcY	
37	Interface	B		3x0.25 mm ²	
GND2		GND			
Data cable output to networked subsystems (OSMO-X/osmoliQ reverse osmosis)					
38	RS-485 OUT	A	96	LiYcY	Bus line to OSMO-X/osmoliQ control unit
39	Interface (*)	B	97	3x0.25 mm ² (*)	
GND2		GND	98		
Data cable to PBS operating board					
GND1	Communication	GND-RS	WH	LiYY	Connection of operating board to main circuit board within the PBS control unit
40		B (RS-485)	GN	5x0.34 mm ²	
41		A (RS-485)	GN		
GND		GND	YE		
42		+ 14 V=	BN		

* With cable length < 20 m:

Connect screen at one end in OSMO-X/osmoliQ controller or IONO-matic³ WE/PBS control unit to a free PE terminal.

* With cable length > 20 m: Engage terminating resistors, refer to technical service manual.

5.4.4 e-SM-Drive frequency converter (FU-X)



For further information on the electrical connections and electrical values of the e-HME pump range, refer to the manufacturer's instructions.

NOTE

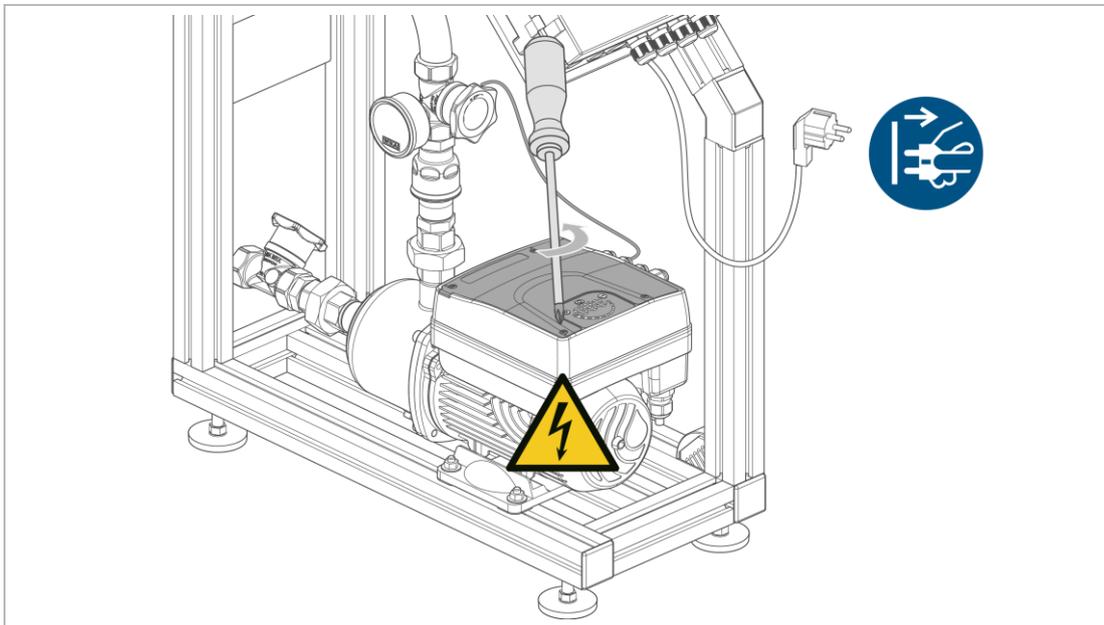
Operating the frequency converter

- The frequency converter can cause faults in the residual current circuit breaker installed in the mains supply line
- ▶ Use an all-current sensitive RCD with 30 mA response threshold (RCD type B).

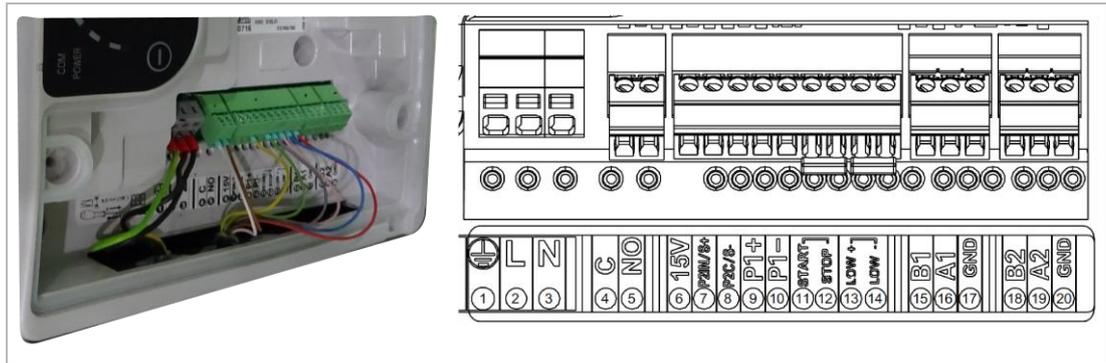
The factory cable connections given below must not be changed or removed.



- Pressure sensor on the P1+P1 connecting terminals (terminals 9/10)
- Jumpers on the Start/Stop connection terminals (terminals 11/12)
- Jumpers on the Low+/Low- connection terminals (terminals 13/14)



1. Make sure that the frequency converter is de-energised.
 - a Wait for at least 5 minutes for any residual voltage to be discharged.
2. Remove the cover of the frequency converter.
 - a Unfasten the 4 screws.
3. Check the wiring and terminal configuration.
 - a Attach the optional external connections if required.
4. Check that all cables have been laid properly and are undamaged.
5. Close the frequency converter cover after the work has been completed.



Connection	No.	Terminal	Description/function	Comments
Feeder cable	1	PE	Protective conductor	
	2	L	Phase 230 V~ / 50 Hz	
	3	N	Neutral conductor	
Error signal	4	C	COM – error status relay	
	5	NO	NO – error state relay	
Auxiliary voltage supply	6	15 V	Additional auxiliary voltage	+ 15 VDC, Σ max. 100 mA
Analogue 0-10 V	7	P2IN/S+	Actuator mode 0-10V input	0 – 10 VDC
	8	P2C/S-	GND for 0–10 V input	GND, earthing (for S+)
External pressure sensor (differential pressure)	9	P1+	External power supply sensor	+ 15 VDC, Σ max. 100 mA
	10	P1-	External sensor input	4-20 mA
External start/stop	11	START	External ON/OFF input reference	Short-circuit default setting, centrifugal pump ready to run
	12	STOP	External ON/Off input	
External lack of water	13	LOW+	Water low input	Short-circuit default setting, lack of water detected, enabled
	14	LOW-	Low water reference	
Communication bus	15	B1	RS485 port 1: RS485-1N B (-)	ACT, HCS control mode: RS485 port1 for external communication; MSE, MSY control mode: RS485 port 1 for multi-circuit pump systems
	16	A1	RS485 port 1: RS485-1P A (+)	
	17	GND	GX, earth	
Communication bus	18	B2	RS485 port 2: RS485-2N B (-) only active with optional module	RS485 port 2 for external communication
	19	A2	RS485 port 2: RS485-2P A (+) only active with optional module	
	20	GND	GX, earth	

5.4.5 Check electrical installation



The electrical installation must have been set up and tested in accordance with the applicable regulations specified in DIN EN 60204.

▶ Check that the on-site installation is safe in accordance with DIN EN 60204.

1. Check all electrical connections and screw connections.
 - a Retighten the cable screw connections.
 - b Check that all contact screws are firmly attached.
 - c Seal using cable putty if required.
2. Check all electrical connections to the components.
 - Frequency converter
 - Centrifugal pump
 - Sensor technology (pressure sensor)
 - Accessories (voltage-free contact points)
3. Check the potential equalisation on the racks and components.
4. Check the on-site AC/DC sensitive ground fault circuit interrupter (30 mA).

▶ Record the test performed.

6 Commissioning



The initial start-up of the product must be carried out by technical service personnel only.



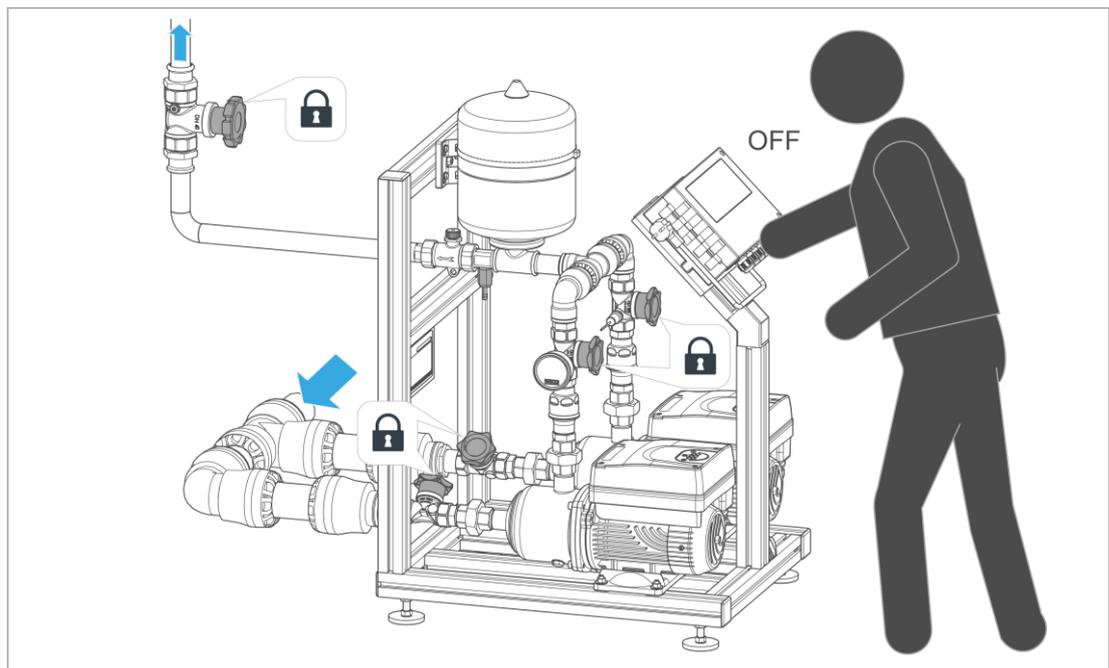
- ▶ Document the initial commissioning in the operation log.
- ▶ Fill in the commissioning log.

6.1 Preliminary work



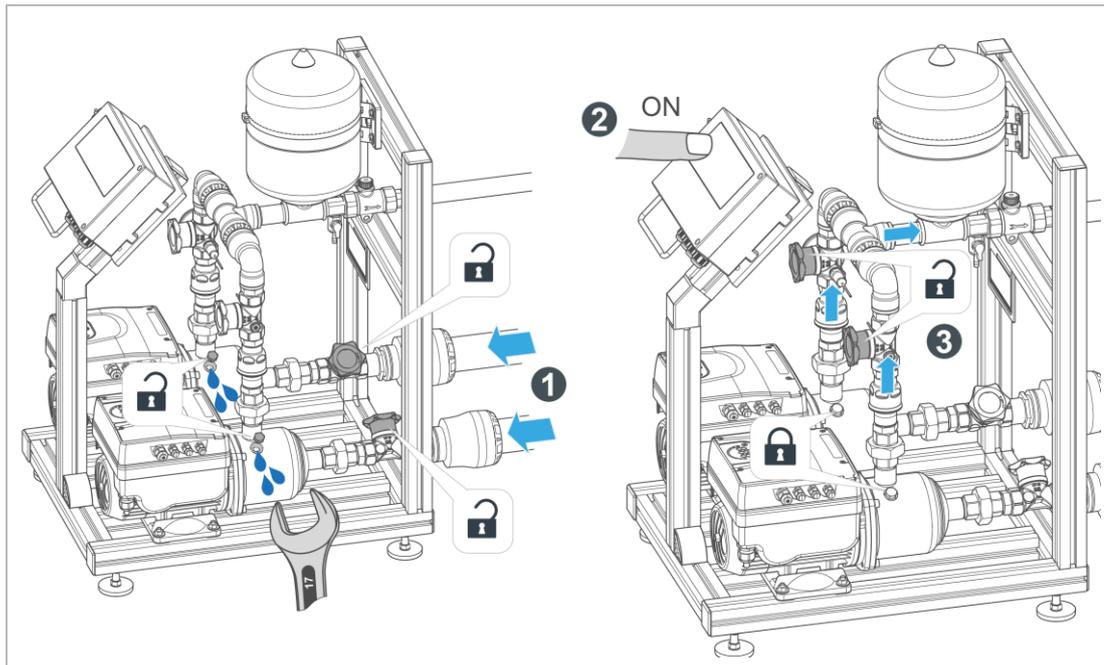
Risk of centrifugal pump running dry due to entrapped air.

The power supply of the system must not be connected or switched on until the centrifugal pump has been filled and vented.



1. Switch off the PBS control unit if it is switched on.
2. Connect the shut-off valves on the suction and pressure sides of the pressure booster system.
3. Close the discharge valve, if open.

6.2 Commissioning



1. Fill the centrifugal pump(s).
 - a Unscrew the filling and vent screw(s) on the centrifugal pump.
 - b Slowly open the shut-off valves (suction side) on the pressure booster system.
 - c Assemble the filling and vent screw(s) as soon as water comes out of the centrifugal pump continuously.
 - » The centrifugal pump(s) is/are filled and vented.
2. Establish the power supply of the pressure booster system.
 - a Switch on the PBS control unit.
 - » The centrifugal pump(s) run on and the pressure is built up.
3. Slowly open the shut-off valves (pressure side) and the shut-off valve provided by the client on site downstream of the pressure booster system.
4. Vent the downstream installation via a withdrawal point.

6.3 Check the pressure settings



During commissioning, certain parameters may need to be adjusted to adapt to the conditions on site. The settings may only be adjusted by customer service.



Any change to the pressure booster system must be recorded.
 ► Document every change in the operation log (refer to chapter 13).

6.3.1 Set pressure (operating pressure) for FU-X



The set pressure (operating pressure) is preset at the factory to **4 bar**.
 A change in the set pressure (operating pressure) requires an adjustment of the diaphragm expansion tank.

Always target pressure values (operating pressure) which correspond to the delivery characteristic curve range of the centrifugal pump. For double systems, the target pressure (operating pressure) must be set for each centrifugal pump in manual mode.

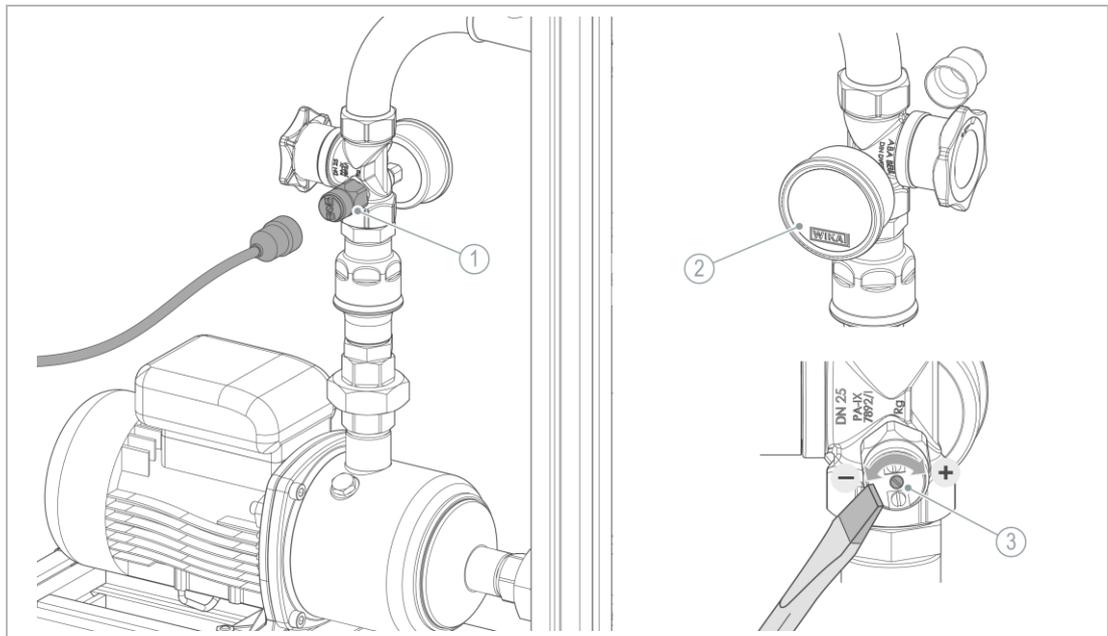
1. Check the set pressure (operating pressure) on the operating panel of the frequency converter (refer to chapter 7.2).
2. Adjust the set pressure on the frequency converter if required.
 - a Readjust the parameters for sensor configuration.

6.3.2 Switch-on pressure for HR-X



The switch-on pressure is factory-set to **4 bar**.

► Check the switch-on pressure and adjust it if necessary:



Designation	
1	Pressure switch
2	Pressure gauge

Designation	
3	Adjusting screw

Increase switch-on pressure

- ▶ Use a screwdriver to turn the adjusting screw.

Decrease switch-on pressure

- ▶ Unscrew the adjusting screw using a screwdriver.
- » The pressure switch must switch over at the required pressure.
- ▶ If necessary, correct the switching pressure by turning the adjusting screw.

6.3.1 Check/set preload pressure in the diaphragm expansion tank



The preload pressure level depends largely on the following points:

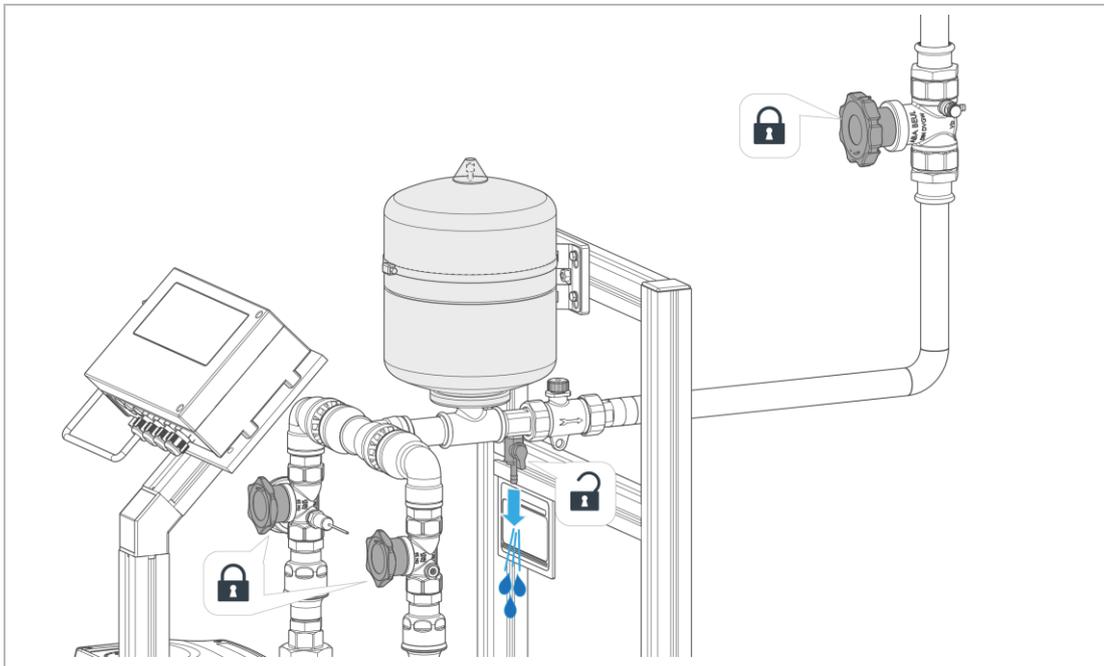
- Accepted volume flow
- Pressure to be supplied
- Switch-on and switch-off levels
- Pipe network resistance values

The diaphragm expansion tank must be adjusted to a preload pressure which corresponds to **90%** of the centrifugal pump set point (operating pressure).



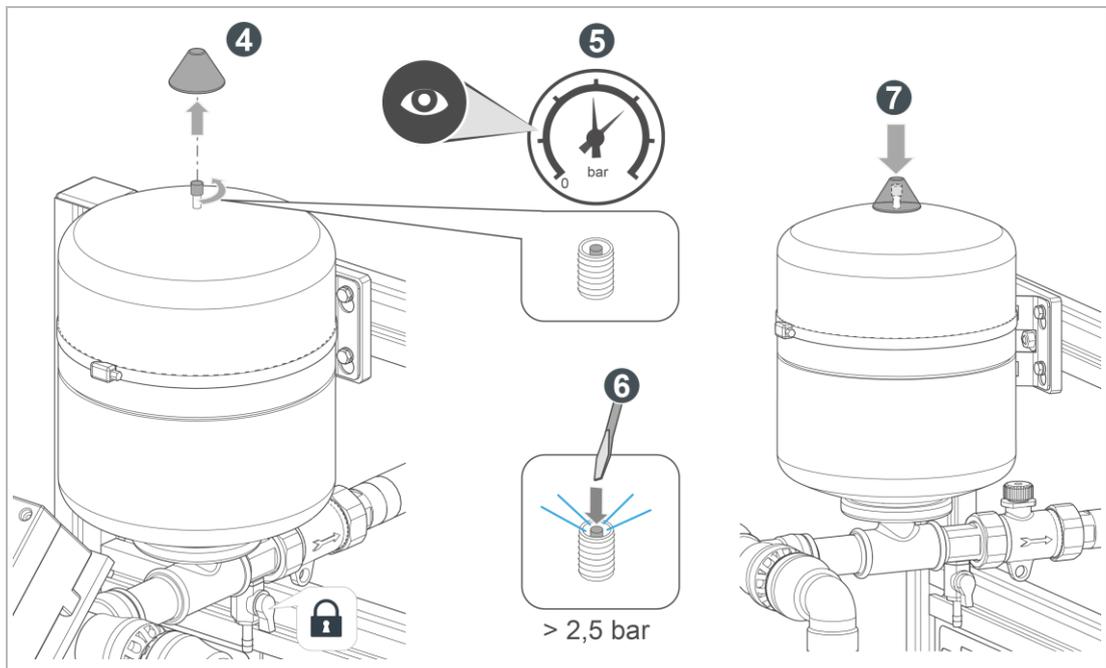
The preload pressure must be checked and adjusted with an empty diaphragm expansion tank without pressure on the water side.

- The preload pressure is present at the factory to **2.5 bar**.
- ▶ Use a battery pump or a hand-held measuring device (order no. 100075560001) to check the pressure.
- ▶ Only use DVGW-approved nitrogen as the filling gas.
- ▶ Check the preload pressure on the diaphragm expansion tank as follows.



1. Close the shut-off valves upstream and downstream of the diaphragm expansion tank.

2. Release the pressure in the diaphragm expansion tank.
 - a Open the draining valve.
3. Close the vent valve downstream of the pressure relief.



4. Open the filling valve on the diaphragm expansion tank.
 - a Remove the cover.
 - b Unfasten the cap.
5. Check the preload pressure using a battery pump or a hand-held measuring device.
 - a If the preload pressure is too low ($< 2.5 \text{ bar}$) – top up nitrogen using a pressure device to the set pressure 2.5 bar.
6. If the preload pressure is too high ($> 2.5 \text{ bar}$) – release pressure.
 - a Carefully press in the pin in the filling valve with a narrow object/tool and release pressure.
 - b Check the inlet pressure again.
7. Close the filling valve.
 - a Unscrew the cap.
 - b Fit the cover.
8. Open the shut-off valves upstream and downstream of the diaphragm expansion vessel.

6.4 Check the system for function/leak tightness

1. Test the function of the dry-run protection (float switch or pressure switch).
2. Check the system for leaks.
3. Check the preset operating parameters of the FU-X frequency converter (refer to chapter 7.2).
4. Set the operating parameters in the PBS control unit (refer to chapter 7.1.4).
5. Record the commissioning in the commissioning log (refer to chapter 13).

6.5 Handing over the product to the owner/operator/operating company

- ▶ Explain how the product works to the owner/operator/operating company.
- ▶ Use the manual to brief the owner/operator/operating company and answer their questions.
- ▶ Inform the owner/operator/operating company regarding the need for inspections and maintenance.
- ▶ Hand over all documents to the owner/operator/operating company for safekeeping.

6.5.1 Disposal of packaging

- ▶ Dispose of packaging material as soon as it is no longer needed (refer to chapter 11.2).

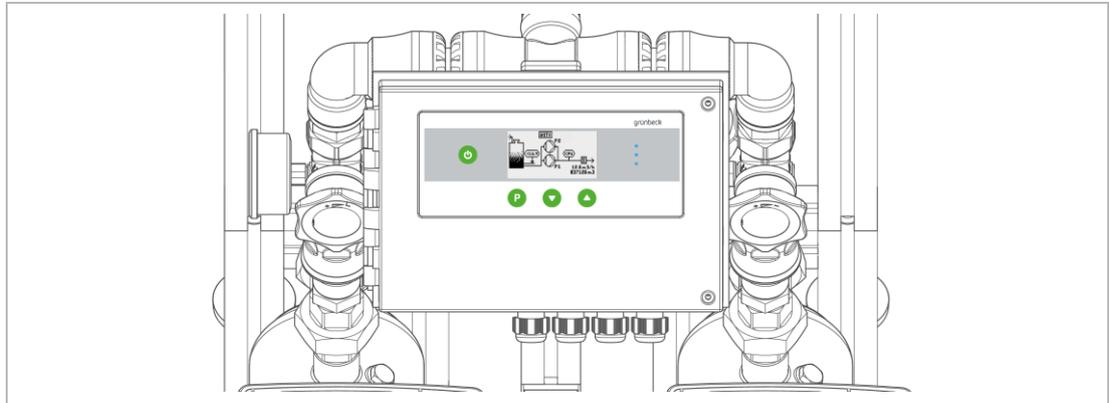
6.5.2 Storage of accessories

- ▶ Keep the accessories supplied for the product in a safe place.

7 Operation/handling

7.1 Operating the PBS control unit

The pressure booster system is operated and monitored via the operating panel of the PBS control unit.



By default, the display is switched off.

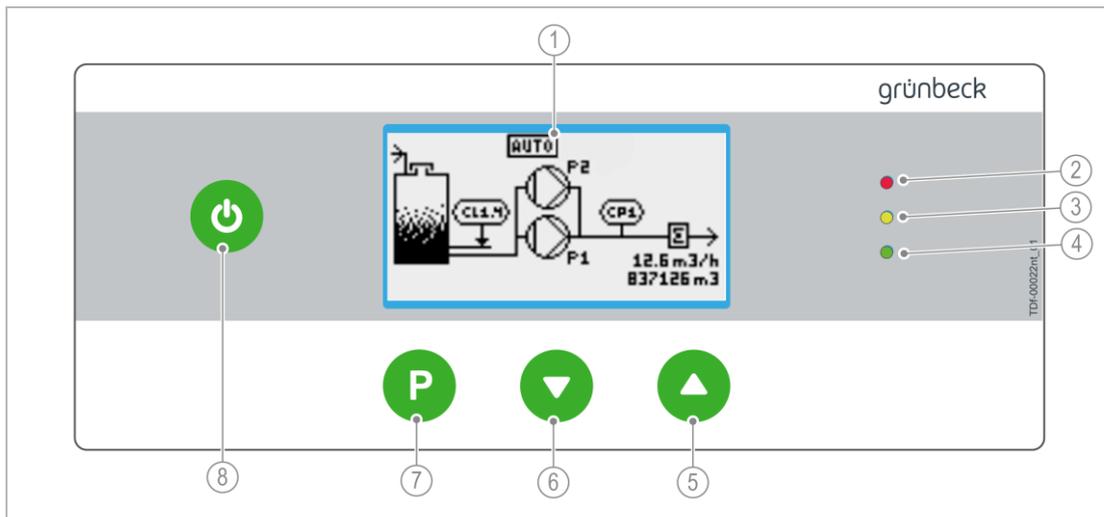
- Pressing any key activates the display.
- If there is no operation for 5 minutes, the control unit returns to the basic display.
 - » Parameters that have not been saved are discarded.
- If there is no operation for 10 minutes, the display switches off.

7.1.1 Menu structure

The PBS control unit has the menu structure below:

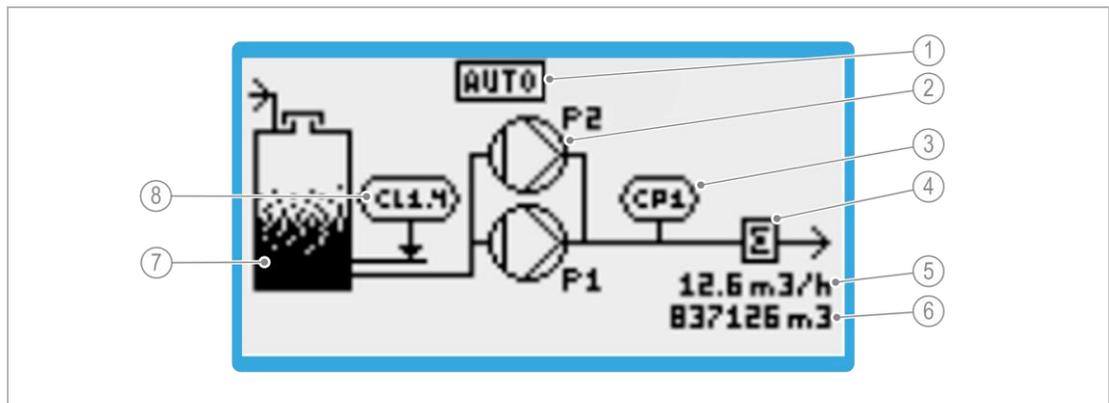
- User level
 - Read operating data
 - Setting the operating parameters
- Programming levels:
 - Installer level (Code 113)
 - Technical service level (Code )

7.1.2 Operating panel



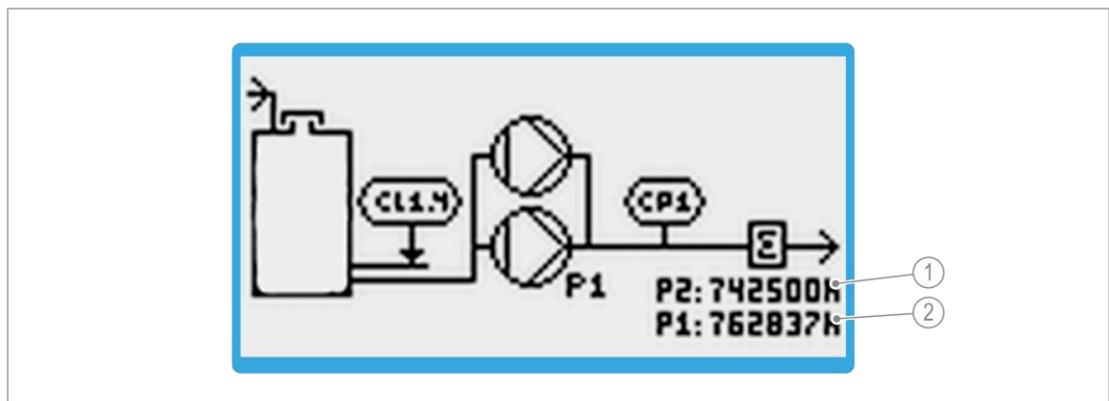
Designation		Meaning/function	
1	Display		Basic display
2	LED	red	Fault
3	LED	yellow	Warning
4	LED	green	OK (standard mode)
5	Operating key		In the basic display: <ul style="list-style-type: none"> Read off pump operating hours In the programming level: <ul style="list-style-type: none"> Switch to the previous parameter Increase the numerical value of a parameter (display value flashes)
6	Operating key		In the basic display: <ul style="list-style-type: none"> Read off pump operating hours In the programming level: <ul style="list-style-type: none"> Switch to the next parameter Reduce the numerical value of a parameter (display value flashes)
7	Operating key		In the basic display: <ul style="list-style-type: none"> Change to the user level (press and hold for > 1 s) Acknowledge signals/faults In the programming level: <ul style="list-style-type: none"> Open parameter for editing (display value is flashing) Save parameter (display value stops flashing)
8	Operating key		Switch PBS control unit on and off
9	Key combination		In the basic display: <ul style="list-style-type: none"> Access to programming level (Code request c 000)
10	Key combination		In the programming level: <ul style="list-style-type: none"> Close open parameter without saving (previous display value is retained) Return to basic display

7.1.3 Basic display



Designation	Meaning/function
1 Selected operating mode	Off/Manual P1/Manual P2/Auto/Bus
2 Centrifugal pump	Centrifugal pump P1 Centrifugal pump P2 (for twin systems) (When the pump is in operation, the water flow is displayed as "flowing")
3 CP1	Pressure sensor
4 Water meter	records the water volume that has flowed through
5 Current flow rate	indicates the current water flow
6 Water volume	displays the previous total water volume
7 BB1	Feed tank on site
8 CL1.4	Sensor for dry-run protection (in the event of lack of water, the supply tank is displayed empty)

Read operating data



Designation	Meaning/function
1 Operating hours of centrifugal pump P2	
2 Operating hours of centrifugal pump P1	

- ▶ Switch the display by pressing the keys and .
- ▶ If no key is operated for a period of 5 minutes, the basic display reappears automatically.

7.1.4 Setting the operating parameters

In this user level, at least the basic parameters below must be set:

- Operating mode
- Data logging
- Language
- Time
- Date

▶ Press the key **P** in the basic display for > 1 sec.

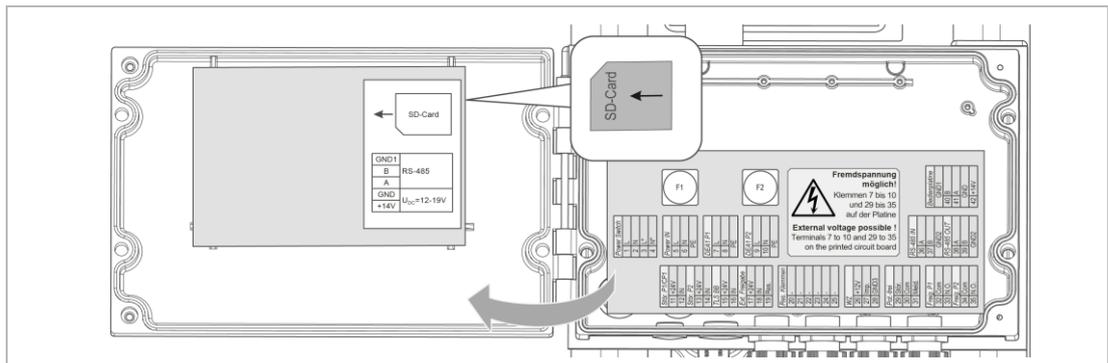


In the tables below, the factory settings are **greyed out**.

Parameters		Setting range	Remarks
Operating mode		Off Hand P1 Hand P2 Auto Bus	Off: Pressure booster system is switched off Manual P1: for single systems Manual P2: for twin systems Auto: only available for HR-X and for twin systems Manual Px = the centrifugal pump runs – depending on the water withdrawal – until the operating mode is changed or a malfunction occurs. For twin systems, there is no automatic switchover to the other centrifugal pump Auto = the centrifugal pump runs – depending on the water withdrawal – until there is a switchover to the other centrifugal pump due to a time interval. With automatic fault changeover to the other centrifugal pump Bus = automatic + "Request system" signal the centrifugal pumps run dependent on the "Request system" signal
Data logging		No/yes	on internal SD card
Interval	min	1 ... 60 ... 999	Time interval for data logging
Language		German/English/French/Dutch/Italian/Spanish/Russian	
Time		00:00 ... 23:59	Only required when data logging is active
Date		XX.XX.XXXX	

1. Navigate to the corresponding parameters using the and keys.
2. Press the **P** key for > 2.5 seconds.
 - » The **value** starts flashing.
3. Change the value using and .
4. Save the value using **P**.
 - » The **value** stops flashing.
5. Return to the basic display – simultaneously press and .

Data logging on SD card



The SD card socket is integrated in the operating unit of the control unit.

The measured values are logged on the SD card as a *.txt file, the values are separated from one another by semicolons.

You can read the file with MS-Excel, for instance.

► End the data logging with **No** first before you remove the SD card.



The SD card used must be FAT32 formatted.

Recommendation: Carry out a full formatting process, not quick formatting

If set to **Yes**, the information below is recorded at the set interval:

- Operating state (Off/Manual P1/Manual P2/Automatic)
- Current flow (Q m³/h)
- Operating hours (P1 h, P2 h)
- Total water quantity (V m³)
- Time to service due (S d)



When the SD card is full, a warning appears on the PBS control unit.

7.1.5 Programming level



This programming level contains parameters that might have to be adapted to the conditions on site during the start-up.

The settings described here must be made by a qualified specialist (installer) only.



In the tables below, the factory settings are **greyed out**.

Access to the programming level is started from the basic display. You need a code for access.

1. Activate the programming level.
 - a Simultaneously press the two keys **P** and **▼** in the basic display.
2. Enter the respective code xxx using **▼** and **▲**.
3. Confirm with **P**.

7.1.5.1 Installer level (Code 113)

The following assignment applies to the input logic of the input signals:

- 0 = Normally open contact
- 1 = Normally closed contact

Parameters		Setting range	Remarks
Enable signal		0 ... 1	
Dry-run protection		0 ... 1 ... 3	2 = pressure booster is networked to OSMO-X and obtains the TLS signal from there 3 = pressure booster is networked to OSMO-X and obtains the TLS signal from there via Profibus/BACNet or Modbus
Fault signal P1		0 ... 1	Used for FU-X pressure booster system
Fault signal P2		0 ... 1	
Pressure switch CP1		0 ... 1	Used for FU-X pressure booster system
restart		No/yes	Restart after power failure
Fault signal contact		One/both	With twin pressure booster: <ul style="list-style-type: none"> • One = fault signal contact is opened when there is a fault on the centrifugal pump • Both = fault signal contact is opened when there is a fault on both centrifugal pumps
Overrun time HR	s	1 ... 3 ... 99	Pressure booster system HR-X: <ul style="list-style-type: none"> • When the switch-off criterion 0 m³/h is reached, the centrifugal pump then runs on briefly

7.1.5.2 Software version (Code 999)

Display of the software version of the main circuit board and operating board of the control unit.

- Display of software version **VX.XX**
- Software version of main circuit board **VX.XX**



A software update must be carried out by technical service personnel only (refer to technical service manual).

7.1.5.3 Technical service level (🔒)



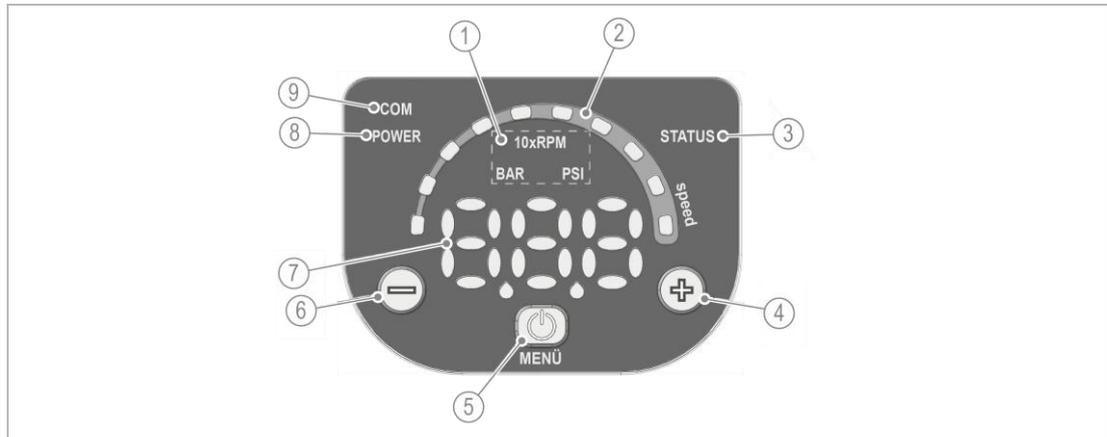
Settings in the technical service levels must only be implemented by Grünbeck's technical service or a qualified specialist trained by Grünbeck (refer to technical service manual).

7.2 Operating the e-SM-Drive frequency converter (FU-X)



Settings on the frequency converter must only be implemented by technical service personnel (refer to the technical service manual).

7.2.1 Operating panel



Designation	Function
1 Measuring unit LEDs 10xRPM/BAR/PSI	Information on the measuring unit: see speed LED strip and display
2 Rotational speed LED strip	Display of the current speed in 10 % steps (Depending on the set min./max. rotational speed)
3 STATUS-LED	Indication of the operating state Main view • Increase value for selected control mode
4 Plus key	Parameters menu • Increase displayed parameter directory Parameter display/edit • Increase parameter value Zero pressure auto calibration (P44) • Calibrate pressure sensor automatically
5 START/STOP key MENU	Main view • Start/stop pump manually Parameters menu • Change to parameter display/edit Parameter display/edit • Save parameter value
6 Minus key	Main view • change to parameters menu Parameters menu • change to main view Main view • Decrease value for selected control mode Parameters menu • Decrease displayed parameter directory Parameter display/edit • Decrease parameter value Zero pressure auto calibration (P44) • Calibrate pressure sensor automatically

Designation	Function
 +   + 	Main view • change between speed and delivery head units of measure • hold for 3 seconds to lock and unlock
7 Display	Indication of parameters/menu
8 POWER LED	Information on power supply
9 COM-LED	Information on type of communication

7.2.2 Display of the LEDs and display



POWER

At ON (Power) the centrifugal pump is supplied with electrical current and the system is ready for operation.

LED		Description
	Off	Pause centrifugal pump
	Continuous green light	Centrifugal pump in operation
	Flashing green/orange light	Non-locking alarm during operation of the centrifugal pump (warning)
	Continuous orange light	Non-locking alarm when the centrifugal pump is stopped (warning)
	Continuous red light	Locking fault – the centrifugal pump cannot be started

STATUS

The status LED indicates the operating state of the centrifugal pump(s) and signals any malfunctions.

LED		Description
	Off	Pause centrifugal pump
	Continuous green light	Centrifugal pump in operation
	Flashing green/orange light	Non-locking alarm during operation of the centrifugal pump (warning)
	Continuous orange light	Non-locking alarm when the centrifugal pump is stopped (warning)
	Continuous red light	Locking fault – the centrifugal pump cannot be started

SPEED (speed LED strip)

The LEDs represent the speed range between parameter P27 (min. speed) and parameter P26 (max. speed) in stages between 10 and 100%.

LED strip	Description
On	Motor in operation: Speed corresponds to the percentage stages of the displayed LEDs • e.g.: 3 LEDs = speed 30 %
First LED flashes	Motor in operation: the speed is below the absolute minimum value (P27)
Off	Motor stopped

Measuring units

The measuring unit LED displays which measurement is active.

LED on	Measurement	Description
10xRPM	Impeller rotational speed	The display shows the speed in 10xRPM
BAR	Hydraulic delivery head	The value of the delivery head is shown on the display in bar
PSI		The value of the delivery head is shown on the display in PSI

COM (communication)

The Com LED shows the status depending on the following conditions.

Condition 1		
<ul style="list-style-type: none"> The communication bus protocol is Modbus RTU; parameter P50 is set to the Modbus value. No optional communication module is used. 		
LED		Description
	Off	The unit does not recognise any valid Modbus signals at the terminals intended for the communication bus
	Continuous green light	The unit has detected a communication bus at the respective terminals and detected the correct addressing
	Flashing green light	The unit has detected a communication bus at the relevant terminals, but has not been addressed correctly
	from continuous green light to Off	The unit has not detected a valid Modbus RTU signal for at least 5 seconds
	from continuous green light to green flashing light	The unit has not been properly addressed for at least 5 seconds
Condition 2		
<ul style="list-style-type: none"> The communication bus protocol is BACnet MS/TP; parameter P50 is set to the BACnet value. No optional communication module is used. 		
LED		Description
	Off	The unit has not received any valid requests from other BACnet MS/TP devices for at least 5 seconds
	Continuous green light	Information is exchanged between the unit and another BACnet MS/TP device
Condition 3		
<ul style="list-style-type: none"> A multi-pump control mode is selected (e.g. MSE or MSY). No optional communication module is used. 		
LED		Description
	Off	The unit has not received any valid requests from other BACnet MS/TP devices for at least 5 seconds
	Continuous green light	Information is exchanged between the unit and another BACnet MS/TP device

Condition 4		
<ul style="list-style-type: none"> The optional RS485 communication module is used. 		
LED		Description
	Off	RS485 or wireless connection faulty
	Flashing green light	Information is being exchanged between the unit and the communication module

7.2.3 Main view display

The display indicates operating state, operating values, menu and fault codes.

Operating state

Display	Mode	Description
OFF	Off	Centrifugal pump switched off Contacts 11/12 are not short-circuited Display priority is lower than the STOP mode
StP	STOP	Centrifugal pump stopped manually To stop: Press  once If the centrifugal pump is switched on after setting P04 = OFF, it is stopped, the motor is not in operation and StP flashes (StP → StP)
ON	On	Centrifugal pump switched on To start: Press  once ON appears for several seconds if contacts 11/12 are short-circuited the motor starts depending on the control mode followed by an indication of the delivery head (4.20 BAR) or speed (200 10xRPM)
SbY	Standby	Standby mode <ul style="list-style-type: none"> on the analogue input is configured as the speed setting (P40 = ISP or USP), the read value is in the standby range and P34 = StP Display priority is lower than the STOP mode
-0-	Lock	To lock: Press for 3 seconds  +  <ul style="list-style-type: none"> -0- appears shortly after locking if a key (except ) is pressed after locking The  key is disabled with START/STOP function the keys are locked on Start if they were locked when previously switched off
()	Unlock	To unlock: Press for 3 seconds  +  <ul style="list-style-type: none"> () appears shortly after locking the keys are enabled on Start if they were unlocked when previously switched off

Alarm/error codes

Explanation of the alarm and error codes (refer to chapter 9.2.2 and 9.2.3).

Display (examples)	Mode	Description
A01 → 3.56 (BAR) A02 → 285 (10xRPM)	Alarm	In the event of an alarm, the corresponding code is displayed alternately with the main display.
E01 E02	Error	If an error occurs, the corresponding code number is shown on the display.

Parameters menu view

Parameters	Description
Power on	After switching on, the Parameters menu view is accessible with P23 = ON, P20 flashes: P20 → P20 <ul style="list-style-type: none"> Enter the password to display and change the parameters
Password timeout	If no key is pressed for more than 10 minutes from the last time the Parameters menu was displayed when P23 = ON, viewing and editing the parameters is deactivated.
Parameters menu	If P23 = OFF or after password input (P20), the parameters can be displayed and edited. <ul style="list-style-type: none"> the display shows the selected parameters: P01 → P01 ... P69 → P69 If the parameter is flashing, selection is possible
Edit/display parameters	The value of a parameter can be changed using the keys or the Modbus and BACnet communication protocol. When you return to the Parameters menu, the displayed parameter list is automatically increased. Example 1: (P20) from 000 to 066: P20 → P20 → (P) → 000 → 000 → (+) ... to ... → 066 → 066 <ul style="list-style-type: none"> (P) sets the desired value → P21 → P21 Example 2: (P26) from 360 to 300: P26 → P26 → (P) → 360 → 360 → (-) ... to ... → 300 → 300 <ul style="list-style-type: none"> (P) sets the desired value → P26 → P26

7.2.4

Software parameters

The parameters are coded differently depending on the type.

Coding	Description
–	None applies to all units
	Global applies to all centrifugal pumps of a multi-pump system
	Eye Parameter is write-protected

Parameter status

No.	Parameters	Unit	Comments
P01 	Required value	bar psi rpmx10	SOURCE and VALUE of the required active value. The display changes every 3 seconds: SOURCE: <ul style="list-style-type: none"> SP: Internally required setpoint, which refers to the selected control mode VL: Externally required speed setpoint, which refers to input 0-10V VALUE: <ul style="list-style-type: none"> display according to the control mode, speed or a delivery head For delivery head, the measuring unit is determined by parameter P41
P02 	Required RMS value	bar psi	Required active value, calculated on the basis of parameters P58 and P59. <ul style="list-style-type: none"> only effective in control mode MSE or MSY

No.	Parameters	Unit	Comments
P03 	Factory setting for restart [0÷100]	%	Determines the value for starting after a centrifugal pump stop as a percentage of the value P01. If the required value has been reached and there is no more consumption, the centrifugal pump stops. The centrifugal pump restarts when the pressure falls below P03. • P03 is valid if: • other than 100% (100%=Off) • Control mode HCS, MSE or MSY
P04 	Auto-start [OFF-ON]		If P04 = ON, the centrifugal pump starts automatically after shut-down of the power supply. If the centrifugal pump is switched on after setting P04 = OFF, the centrifugal pump is stopped • the motor is not running and STP is flashing (StP → StP)
P05 	Operating time in months	months	Total operating time in months since start-up – in addition to P06
P06 	Operating time in hours	h	Total operating time in hours since start-up – in addition to P05
P07 	Motor run time in months	months	Run time of the motor in months – in addition to P08
P08 	Motor run time in hours	h	Run time of the motor in hours – in addition to P07
P09 	1st error		Saves the last error that occurred in chronological order. The display switches between the values: • (Exx): xx reports the error code • (Hyy): yy is the value of hours in relation to P05-P06 when the error Exx occurred • (Dww): ww is the value of days in relation to P05-P06 when the error Exx occurred • (Uzz): zz is the value of weeks in relation to P05-P06 when the error Exx occurred Display examples: E04 → H10 → d03 → U15
P10 	2nd error		Saves the penultimate error in chronological order
P11 	3rd error		Saves the third-from-last error in chronological order
P12 	4th error		Saves the fourth-from-last error in chronological order
P13 	Temperature of the power module	°C	Temperature of the power module
P14 	Inverter current	A	Actual current value supplied by the frequency converter
P15 	Inverter voltage	V	Estimated current input voltage value of the frequency converter
P16 	Motor speed	rpmx10	Current motor speed
P17 	Software version		Software version of the control unit

Settings

No.	Parameters	Comments
P20 –	Password input [0+999]	Password for access to the parameters <ul style="list-style-type: none"> • must match the system password stored under P22 • after entering the password, the system remains locked for 10 minutes
P21 –	Jog mode [MIN+MAX]	Deactivates the internal control of the unit and forces the current control mode (ACT): <ul style="list-style-type: none"> • The motor starts and the value P21 is the temporary ACT setpoint • It can be changed by entering a new value for P21 without confirmation; otherwise it causes the temporary control to be exited immediately
P22 –	System password [1+999]	System password <ul style="list-style-type: none"> • must match the password entered with P20
P23 –	Locking function [OFF/ON]	Lock or enable the parameter input in the main menu <ul style="list-style-type: none"> • if set to ON, enter the password P20 to be able to change the parameters

Drive configuration

No.	Parameters	Unit	Comments
P25 –	Control mode [ACT, HCS, MSE, MSY]		Setting control mode
	<p>ACT: Actuator mode</p> <p>A single centrifugal pump always runs at a certain speed at any delivery volume.</p> <ul style="list-style-type: none"> • ACT attempts to minimise the difference between the speed setpoint and the actual rotational speed of the motor • When a 0-10V signal arrives at terminals 7/8, the centrifugal pump automatically switches to ACT mode according to the external signal • If the external signal is missing, the centrifugal pump remains in ACT mode and uses the value entered on the display as the setpoint 		
	<p>HCS: Hydrovar: control mode for the single centrifugal pump</p> <p>The centrifugal pump maintains a constant pressure at any delivery volume:</p> <ul style="list-style-type: none"> • The Hydrovar algorithm based on the input of parameters P26 to P37 is implemented • The HCS mode must be set in conjunction with an absolute pressure sensor installed in the hydraulic circuit, which gives the unit the pressure feedback signal: • HCS always tries to minimise the difference between the pressure setpoint and the pressure feedback signal 		
	<p>MSE: Hydrovar: control mode for multi-pump systems in serial cascade</p> <p>The centrifugal pumps are connected in series:</p> <ul style="list-style-type: none"> • Only the last activated centrifugal pump modulates the speed to the set pressure, while all other centrifugal pumps in operation run at maximum speed • The various centrifugal pumps connected to each other via the multi-pump protocol maintain a constant pressure at any delivery volume: • The Hydrovar algorithm based on the input of parameters P26 to P37 is implemented <p>The MSE mode must be set in conjunction with absolute pressure sensors, one per centrifugal pump, which provide the pressure feedback signal to the centrifugal pump unit:</p> <ul style="list-style-type: none"> • MSE always tries to minimise the difference between the pressure set point and the pressure feedback signal • When using the multi-pump protocol, up to 3 centrifugal pumps of the same type and capacity can be connected 		
	<p>MSY: Hydrovar: control mode for multi-pump systems in synchronous cascade</p> <p>The centrifugal pumps are synchronised:</p> <ul style="list-style-type: none"> • The centrifugal pumps maintain the set pressure and run at the same speed • For other properties, refer to MSE mode 		
P26 G	Max. speed setting [ACT setting - Max.]	pmx10	Adjustment of the max. centrifugal pump speed
P27 G	Min. speed setting [ACT setting - Min.]	pmx10	Adjustment of the min. centrifugal pump speed
P28 G	Ramp 1 [1+250]	s	controls the time for rapid acceleration <ul style="list-style-type: none"> • The centrifugal pump control in HCS, MSE and MSY mode is affected

No.	Parameters	Unit	Comments
P29 	Ramp 2 [1÷250]	s	controls the time for rapid delay <ul style="list-style-type: none"> The centrifugal pump control in HCS, MSE and MSY mode is affected
P30 	Ramp 3 [1÷999]	s	controls the slow acceleration <ul style="list-style-type: none"> determines the Hydrovar adjustment speed with small changes in the delivery rate determines the constant outlet pressure The ramp depends on the system to be controlled and influences the centrifugal pump control in HCS, MSE and MSY mode.
P31 	Ramp 4 [1÷999]	s	controls the time for slow delay <ul style="list-style-type: none"> Other characteristics: refer to ramp 3
P32 	Min. acceleration, ramp speed [2.0÷25.0]	s	determines the time for rapid acceleration <ul style="list-style-type: none"> represents the acceleration ramp used by the Hydrovar control until the centrifugal pump reaches its minimum rotational speed (P27) The centrifugal pump control in HCS, MSE and MSY mode is affected
P33 	Min. delay, ramp speed [2.0÷25.0]	s	determines the time for rapid delay <ul style="list-style-type: none"> represents the deceleration ramp used by the Hydrovar control until the centrifugal pump reaches its minimum rotational speed (P27) The centrifugal pump control in HCS, MSE and MSY mode is affected
P34 	Configuration at min. speed (minimum speed) [STP, SIM]		The behaviour of the Hydrovar speed control as soon as the minimum rotational speed of the centrifugal pump (P27) is reached: <ul style="list-style-type: none"> STP: As soon as the specified pressure has been reached and there is no further demand, the centrifugal pump speed drops to the selected value P27: Hydrovar continues to run according to the selected time period (P35) and then stops automatically SIM: As soon as the specified pressure has been reached and there is no further demand, the centrifugal pump speed drops to the selected value P27: Hydrovar continues to run at the same speed This parameter affects the centrifugal pump control in HCS, MSE and MSY mode
P35 	S _{min} time (minimum speed duration) [0÷100]	s	A time delay before switching off is entered under P27 <ul style="list-style-type: none"> Used by Hydrovar speed control only with P34 = STP The centrifugal pump control in HCS, MSE and MSY mode is affected
P36 	Setting window [0÷100]	%	Used to enter the ramp control interval as a percentage of the pressure setpoint <ul style="list-style-type: none"> It is used to determine the pressure range near the setpoint where the Hydrovar speed control uses slow acceleration and deceleration ramps instead of fast ones The centrifugal pump control in HCS, MSE and MSY mode is affected
P37 	Hysteresis [0÷100]	%	specifies the hysteresis for the slow ramp as a percentage of P36 <ul style="list-style-type: none"> It is used to determine the pressure range near the setpoint at which the Hydrovar speed controller moves from the slow acceleration ramp (P28) to the slow deceleration ramp (P29) The centrifugal pump control in HCS, MSE and MSY mode is affected
P38 	Speed increase [0÷MAX]	rpmx10	determines the speed limit after which the linear increase of the actual value (P02) starts and continues until the total increase (P39) to the maximum speed (P26)
P39 	Increase value [0÷200]	%	determines the increase in the actual value (P02) to the maximum speed (P26), measured as a percentage of the specified value (P01) <ul style="list-style-type: none"> determines the increase in the preset pressure setting, which is used to compensate for flow resistance at high delivery volumes

Sensor configuration

No.	Parameters	Unit	Comments
P40 –	Sensor selection [P1, ISP, USP]		Configuration of the analogue input <ul style="list-style-type: none"> • P1 Absolute pressure sensor • ISP 4-20 mA input as speed reference • USP 0-10 V input as speed reference
P41 	Pressure sensor measuring unit [BAR, PSI]	bar/psi	Set the measuring unit for the pressure sensor <ul style="list-style-type: none"> • affects the parameter for the LED display
P42 	Full scale value for pressure sensor 1 4-20 mA [0.0+25.0 BAR] / [0.0+363 PSI]	bar/psi	determines the full scale value of the pressure sensor 4÷20 mA connected to analogue inputs 9 and 10 <ul style="list-style-type: none"> • affects the parameter for the LED display
P44 –	Zero pressure Auto calibration	bar/psi	the user can carry out the initial auto calibration of pressure sensor P1 <ul style="list-style-type: none"> • used to compensate the offset signal of the sensor at zero pressure due to the tolerance of the sensor <p>Procedure:</p> <ul style="list-style-type: none"> ▶ At 0 pressure of the hydraulic system (no water contained) or when the pressure sensor is disconnected from the pipes, switch to P44: the actual value for 0 pressure is displayed. ▶ Start auto calibration by pressing  or  ▶ When the auto-calibration is completed, the 0 (zero) pressure or the signal "----" (---) is displayed if the sensor signal is outside the permissible tolerance range
P45 	Minimum pressure limit [0+42]	bar/psi	Setting the minimum pressure limit value <ul style="list-style-type: none"> • If the system pressure drops below this limit value over the time set with P46, the low-pressure error E14 occurs
P46 	Minimum pressure limit - delay time [1+100]	s	Setting the delay time <ul style="list-style-type: none"> • during which the unit runs empty at a system pressure below P45 before the low-pressure error E14 occurs
P47 	Minimum pressure limit - automatic error reset [OFF, ON]		Activation/deactivation attempts of the automatic unit in case of a low-pressure error
P48 –	No water flow (Lack of water switching input) [DIS, ALR, ERR]		activates/deactivates the control of the lack of water input <ul style="list-style-type: none"> • determines the behaviour of the unit when the "Lack of water" input is activated and the switch is open: • DIS: The unit does not process the information coming from the "Lack of water" input • ALR: The unit reads the "Lack of water" input (activated) and reacts by indicating the corresponding alarm A06 on the display when the switch is opened, while the motor continues to run • Err: The unit reads the "low water" input (activated) and reacts when the switch is opened by stopping the motor and generating the corresponding error E11. The error condition is then exited when the switch closes again and the motor restarts.

RS485 interfaces

No.	Parameters	Unit	Comments
P50 –	Communication protocol [MOD, BAC]		Selects the protocol on the communication port <ul style="list-style-type: none"> • MOD: Modbus RTU • BAC: BACnet MS/TP
P51 –	Communication protocol - address [1+247] / [0+127]		Depending on the protocol selected in P50, used to enter the desired address for the unit when it is connected to an external device: <ul style="list-style-type: none"> • MOD: any value in the range 1 – 247 • BAC: any value in the range 0 – 127

No.	Parameters	Unit	Comments
P52 -	Communication protocol - BAUDRATE [4.8, 9.6, 14.4, 19.2, 38.4, 56.0, 57.6 KBPS]	kbps	Determines the desired baud rate for the communication port
P53 -	Offset value BACnet de- vice ID [0+999]		Used to enter the hundreds, tens and ones of the BACnet de- vice ID Standard: 002
P54 -	Communication protocol - configuration [8N1, 8N2, 8E1, 8o1]		Used to enter the length of the data bits, the parity and the length of the stop bits

Multi-pump configuration

These parameters affect the MSE and MSY control modes.

No.	Parameters	Unit	Comments
P55 -	Multi-pumps address [1+3]		determines the address of each centrifugal pump based on the criteria below: <ul style="list-style-type: none"> • Each centrifugal pump needs its own pump address (1 – 3) • Each address can only be assigned once
P56 	Multi-pumps - max. units [1+3]		Determines the maximum number of centrifugal pumps that can operate simultaneously
P57 	Multi-pumps switching interval [0+250]	h	Determines the switching interval for automatic switching of the main pump and the auxiliary pumps <ul style="list-style-type: none"> • As soon as the specified time has elapsed, the next centrifu- gal pump becomes the main pump and the counter starts again • This ensures a balanced distribution of operating hours among all centrifugal pumps
P58 	Multi-pumps - increase of actual value [0.0+25.0 BAR] / [0.0+363 PSI]	bar/psi	influences the calculation of P02 in order to improve the multi- pump control
P59 	Multi-pumps - decrease of actual value [0.0+25.0 BAR] / [0.0+363 PSI]	bar/psi	influences the calculation of P02 in order to improve the multi- pump control
P60 	Multi-pumps - release speed [P27-P26]	rpmx10	Specifies the speed that a centrifugal pump must reach before the next auxiliary pump starts after the system pressure has dropped below the differential value between P02 and P59 Standard: depending on the type of centrifugal pump used
P61 	Multi-pumps - speed limit [P27-P26]	rpmx10	Used to enter the speed limit at which the first auxiliary pump stops when the speed falls below this limit Standard: depending on the type of centrifugal pump used
P62 	Multi-pumps - synchron- ism – window [0-100]	rpmx10	Used to enter the speed limit for stopping the next auxiliary pump
P63 	Multi-pumps - priority		represents the priority value of the centrifugal pumps in a multi-pump system <ul style="list-style-type: none"> • displays the information below: Pr1 .. Pr3 or Pr0 In this case: <ul style="list-style-type: none"> • Pr1 .. PR3 indicates that the centrifugal pump communica- tes with other centrifugal pumps and that its priority order corresponds to the number displayed • Pr0 indicates that the centrifugal pump does not detect any communication with other centrifugal pumps and is detected as stand-alone in the multi-pump bus
P64 	Multi-pumps - revision		Displays the revision value used in the multi-pump protocol

Test run configuration

The test run is a function used to start the centrifugal pump after the last stop to prevent it blocking.

No.	Parameters	Unit	Comments
P65 G	Test run – start time [0-100]	h	Used to set the time that must elapse after the last stop of the centrifugal pump for a test run to be started
P66 G	Test run – rotational speed [Min-Max]	rpmx10	Specifies the pump's rotational speed for the test run <ul style="list-style-type: none"> • minimum and maximum speeds depend on the centrifugal pump type Standard: 250 rpmx10
P67 G	Test run – duration [0-180]	s	Specifies the duration of the test run

Special parameters

No.	Parameters	Unit	Comments
P68 –	Restores the default values [NO, rES]		If set to rES , returns to the factory settings on confirmation <ul style="list-style-type: none"> • the default parameter values are re-loaded
P69 –	Avoid frequent parameter saves [NO, YES]		Reduces the frequency at which the unit stores the required value P02 in the EEPROM memory to extend its lifetime. <ul style="list-style-type: none"> • This can be particularly advantageous for applications with BMS control units, as they require constant value changes for fine adjustment

7.2.5 Required RMS value (example)

Activation of centrifugal pumps in cascade mode

1. Control centrifugal pump reaches P60 (activate speed).
2. Actual value drops to the switch-on value of the first auxiliary pump.
 - » First auxiliary pump switches on automatically.
 - Switch-on value = P01 (required value) – P59 (actual value reduction)
3. New required value, P02 (actual required value) is calculated after start.

Calculation of the actual required value in serial cascade mode (MSE)

- K = Number of active centrifugal pumps
- Pr = Priority of centrifugal pumps
- $P02 \text{ (actual required value)} = P01 \text{ (required value)} + (K - 1) * P58 \text{ (actual value increase)} - (Pr - 1) * P59 \text{ (actual value reduction)}$

Calculation of the actual required value in synchronous cascade mode (MSY)

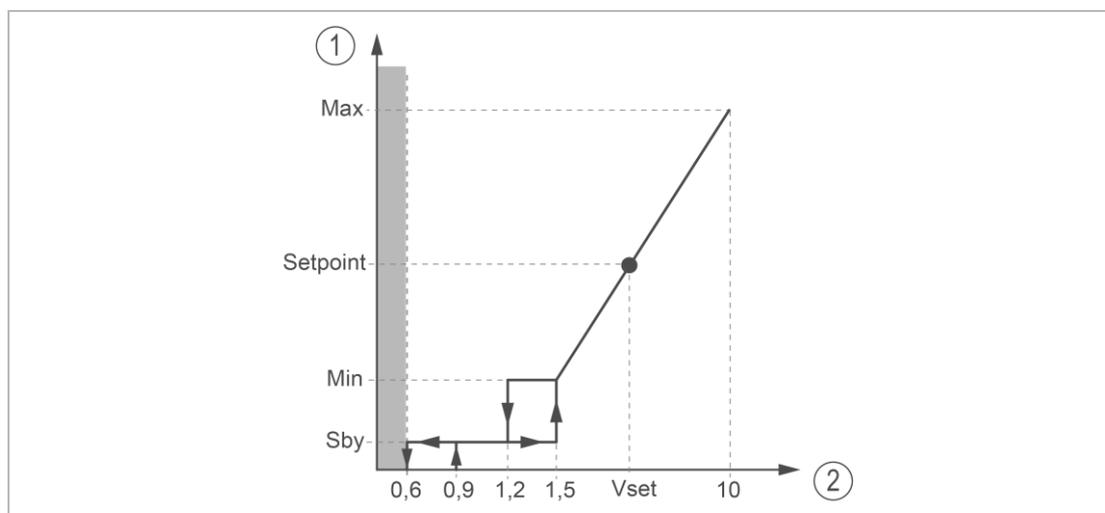
- K = Number of active centrifugal pumps ($K \geq Pr$)
- $P02 \text{ (actual required value)} = P01 \text{ (required value)} + (K - 1) * (P58 - P59)$

Behaviour of P58 (actual value increase) and P59 (actual value reduction)

- If $P58 \text{ (actual value increase)} = P59 \text{ (actual value reduction)}$
 - » Pressure constant, regardless of the number of centrifugal pumps in operation.
- If $P58 \text{ (increase of actual value)} > P59 \text{ (reduction of actual value)}$
 - » Pressure increases when the auxiliary pump starts.
- If $P58 \text{ (actual value increase)} < P59 \text{ (actual value reduction)}$
 - » Pressure drops when the auxiliary pump starts.

7.2.6 Settings for ACT control mode

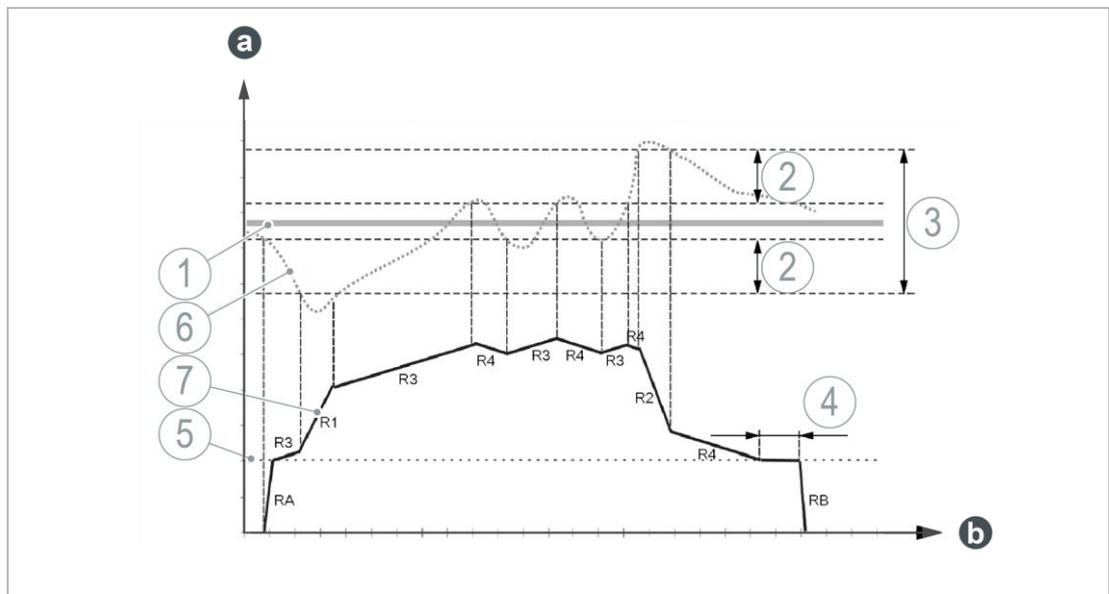
Example: ACT control mode with analogue input 0-10V



Designation		Designation
1	Speed in rpm	2 V_{in} in V

Display	Unit	Comments
Grey area		Limit value for input voltage detection missing
Speed	rpm	Actual speed • relative to the analogue input voltage value 0-10 V
Max		P26 Max. RPM setting
Min		P27 Min. RPM setting
Setpoint (target value)		actual speed • relative to a specific V_{set} voltage value
Sby		Input voltage at which the motor goes into standby
V_{in}	V	Input voltage value • Various limit values are controlled by the centrifugal pump, from non-detection to maximum speed

Example: Ramp setting



Designation	
a	Delivery head (H in bar)

Designation	
b	Time (t in s)

Designation	
1	P01 required value
2	P37 Control hysteresis in % of P36 setting window
3	P36 Setting window in % of P01 required value
4	P35

Designation	
	Minimum speed duration
5	P27 Minimum speed
6	Actual delivery head
7	Actual speed

Designation	
RA	P32 Acceleration ramp at start
RB	P32 Deceleration ramp at switch-off
R1	P28 (ramp 1) Quick start-up ramp

Designation	
R2	P29 (ramp 2) Quick deceleration ramp
R3	P30 (ramp 3) Slow start-up ramp
R4	P31 (ramp 4) Slow deceleration ramp

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8 Maintenance and repair

Maintenance and repair includes the cleaning, inspection and maintenance of the product.



The responsibility for inspection and maintenance is subject to local and national requirements. The owner/operator/operating company is responsible for compliance with the prescribed maintenance and repair work.



By concluding a maintenance contract you ensure that all maintenance work is performed on time.

- ▶ Only use genuine spare and wearing parts from Grünbeck.

8.1 Cleaning



Only allow cleaning work to be carried out by persons who have been instructed on the risks and dangers that can arise from the product.



WARNING Damp cleaning of live components

- Risk of electric shock, sparking due to short-circuit
- ▶ Switch off the voltage supply – as well as any external voltage – before starting the cleaning work.
- ▶ Wait for 5 minutes and make sure that the components do not carry any voltage.
- ▶ Do not open any switch cabinets.
- ▶ Do not use any high-pressure equipment for cleaning and do not spray electrical/electronic devices with water.

NOTE

Do not clean the product with cleaning agents containing alcohol/solvents.

- Plastic components will suffer damage.
- Varnished surfaces are affected.
- ▶ Use a mild/pH-neutral soap solution.
- ▶ Use personal protective equipment.
- ▶ Only clean the outside of the product.
- ▶ Do not use any strong or abrasive cleaning agents.
- ▶ Wipe the surfaces with a damp cloth.
- ▶ Dry the surfaces with a cloth.

8.2 Intervals



DIN EN 806-5 recommends semi-annual and annual maintenance to ensure trouble-free and hygienic operation of the product.

- ▶ As the owner/operator/operating company, determine which components have to be inspected and maintained at which intervals (load-dependent). These intervals are subject to the actual conditions, e.g.: Water condition, degree of contamination, environmental influences, consumption, etc.

The interval table below shows the minimum intervals for the activities to be carried out.

Activity	Interval	Tasks
Inspection	2 months	<ul style="list-style-type: none"> • Visually check for leaks • Check PBS control unit for error messages • Check the function of the frequency converter (FU-X)
Maintenance	annually	<p>System in general</p> <ul style="list-style-type: none"> • Check system for damage, corrosion and stability from the outside • Check all connections for leaks and damage • Check the non-return valve for leaks • Check mains cable, mains plug and electrical lines for damage and a tight fit <p>Operating values</p> <ul style="list-style-type: none"> • Check the setting of the PBS control unit • Read out operating values • Read out error memory <p>Functional check</p> <ul style="list-style-type: none"> • Test function of the dry-run protection • Check setting pressure (operating pressure) of the centrifugal pump(s) on the pressure gauge and readjust if required <p>Diaphragm expansion tank</p> <ul style="list-style-type: none"> • Check the diaphragm expansion tank for damage and corrosion • Perform diaphragm check for leaks • Check setting pressure (preload pressure) and correct if required
	load-dependent	<ul style="list-style-type: none"> • See "annually"
Repair	5 years	<ul style="list-style-type: none"> • Recommendation: Change wearing parts

8.3 Inspection

You as owner/operator/operating company can carry out the regular inspections yourself. We recommend inspecting the product at shorter intervals initially and then as required.

- ▶ Conduct an inspection at least every 2 months.
 1. Visually check for leaks.
 - a Pay attention to leaks and puddles on the floor.
 2. Check the PBS control unit for error messages.
 3. Check the function of the frequency converter FU-X.
 - a Read out the error messages if necessary.

8.4 Maintenance



WARNING

Dangerous voltage



- Risk of severe burns, cardiovascular failure, fatal electric shock
- ▶ Prior to any intervention, make sure that all electrical connections (even those without voltage) are de-energised.
- ▶ Ensure that the frequency converter of the centrifugal pump is disconnected from the mains.
- ▶ Wait for at least 5 minutes after disconnection from mains before carrying out any work on the frequency converter (e-SM Drive System) to ensure that the capacitors on the internal circuit are discharged.
- ▶ Have damaged mains cables replaced by a qualified electrician

8.4.1 Annual maintenance



Annual maintenance work requires expert knowledge. This maintenance work may only be carried out by technical service personnel.

System in general

1. Check the outside of the system for damage, corrosion and stability.
2. Check all connections for leaks and damage.
3. Check the non-return valve for leaks.
4. Check the mains cable, the mains plug and all electrical lines for damage and a tight fit.

Read out operating values



A system data printout is possible via the memory card (SD card) interface of the PBS control unit.

5. Check the PBS control unit settings.
6. Read the operating values.
7. Read out the error memory.

Functional check

8. Test the function of the dry-run protection.
9. Check the setting pressure (operating pressure) of the centrifugal pump(s) on the pressure gauge.
 - a Readjust the setting pressure if necessary.

Diaphragm expansion tank

10. Check the diaphragm expansion tank for damage and corrosion.
11. Perform a diaphragm check for leak tightness.
12. Check the setting pressure (preload pressure) of the diaphragm expansion tank (refer to chapter 6.3.1).
 - a Top up nitrogen if required.

Final work

13. Create a system data printout.
14. Reset the maintenance interval.
15. Document the maintenance work in the operation log.

8.5 Spare parts

For an overview of the spare parts, refer to our spare parts catalogue at www.gruenbeck.com. You can obtain the spare parts from the Grünbeck representative responsible for your area.

8.6 Wearing parts



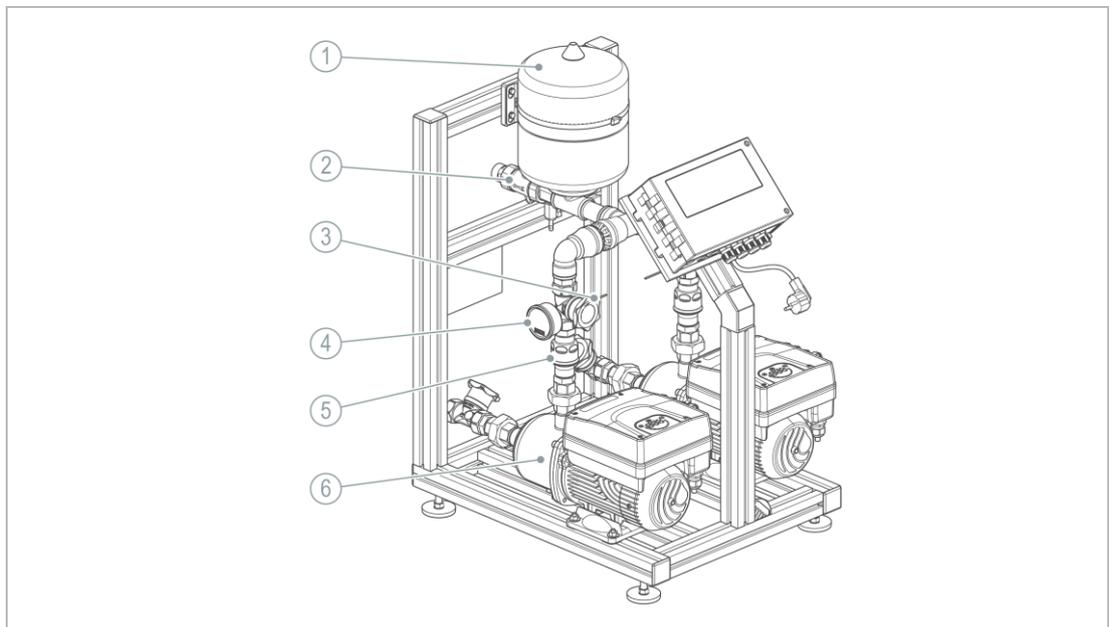
Wearing parts must be replaced by qualified specialists only.



It is only permitted to change wearing parts by technical service personnel (refer to the technical service manual).

Wearing parts are listed below:

- Seals



Designation		Designation	
1	Diaphragm expansion tank	4	Pressure gauge
2	Push-in turbine of the water meter	5	Non-return valve
3	Pressure sensor or pressure switch	6	Centrifugal pump



A faulty centrifugal pump must be replaced as a complete assembly.

A faulty pressure sensor can be replaced individually.

- ▶ Have the seals replaced in the event of leaks, damage or distortions.
- ▶ Have defective or worn components replaced.

9 Fault



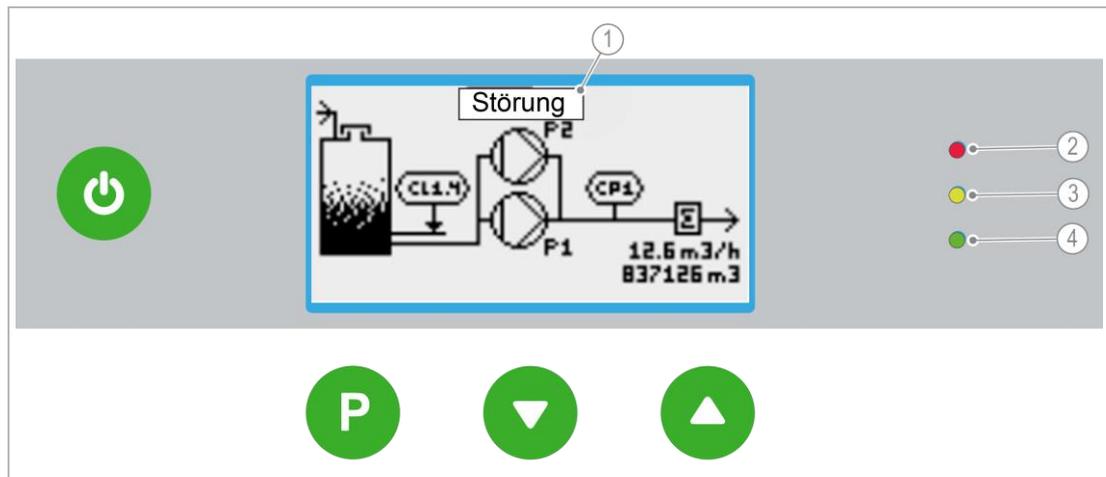
WARNING

Contaminated drinking water due to stagnation

- Infection due to bacterial growth
- ▶ Have faults remedied immediately.

9.1 PBS control unit

The PBS control unit shows messages as a warning or fault on the display.



Designation	Meaning/function
1 Display	Display of the message or fault
2 red 	Fault <ul style="list-style-type: none"> • Fault P1 • Fault P2
3 yellow 	Warning <ul style="list-style-type: none"> • Servicing due • Dry-run protection • Ext. operational release missing • Power failure > 24 h
4 green 	OK <ul style="list-style-type: none"> • Standard operation

1. Read off the active message.
2. Eliminate any potential fault.
3. Acknowledge the message using the  key.
4. If the message reoccurs, compare this with the tables below for warnings and faults.

9.1.1 Warnings

Display	Explanation	Remedy
Maintenance interval	The maintenance interval of the system has expired	► Contact technical service and have maintenance performed
Ext. operational release missing	On-site voltage-free contact is open	► Check wiring
Dry-run protection BB1 CL1.4	Insufficient water in supply tank	► The signal is acknowledged automatically as soon as water is available again
Power failure > 24 h	Power supply interrupted	► Check the power supply

9.1.2 Faults

Display	Explanation	Remedy
FU-X		
Fault P1	Frequency converter alarm relay opened	► Observe status LED of the frequency converter
Fault P2	Only with twin systems	
HR-X		
Fault P1	After the centrifugal pump starts, the minimum flow rate is not exceeded after a delay time has elapsed and no pressure has been built up	► If the fault occurs again after acknowledgement – contact technical service ► Check the water meter ► Check the pressure switch
Fault P2	Only with twin systems	

9.1.3 Other observations

Observation	Explanation	Remedy
System is switched off	Voltage supply not connected	▶ Establish voltage supply
	Switch is on OFF	▶ Set switch to ON
The motor does not start	Power supply not connected	▶ Connect the power supply
	Triggering of the motor overload protection	▶ Rectify fault and reset switch
	Motor defective	▶ Have the motor repaired or replaced
Frequent starts and stops	Diaphragm expansion tank defective	▶ Have diaphragm expansion tank repaired or replaced
	Incorrect preload pressure of the diaphragm expansion tank	▶ Set the correct preload pressure of the diaphragm expansion tank
	Supply tank is empty	▶ Check supply tank for water feed
Centrifugal pump speed increases and decreases without stopping, and without water consumption (consumers closed)	Water losses through the non-return valve	▶ Check hydraulic system and replace non-return valve if necessary
	Too small or damaged diaphragm expansion tank	▶ Have diaphragm expansion tank repaired or replaced
The motor is running, but no water is being pumped	No water on the suction side or in the centrifugal pump	▶ Fill the centrifugal pump or suction line ▶ Open ON/OFF valves
	Air in suction line or centrifugal pump	▶ Vent centrifugal pump and check suction connections
	Pressure loss on the suction side	▶ Check the NPSH and change the system if necessary
	Shut-off valve blocked	▶ Clean shut-off valves
	Suction line clogged	▶ Clean suction line
Loss of water at the centrifugal pump	Mechanical seal worn	▶ Have mechanical seal replaced
	Excessive mechanical stress on the centrifugal pump	▶ Shore up pipes and remove the mechanical load on the centrifugal pump
Centrifugal pump very noisy	Water runs back when the centrifugal pump is at a standstill	▶ Check non-return valve
	Cavitation	▶ Check suction
	Centrifugal pump rotation blocked	▶ Check centrifugal pump for excessive mechanical load



If a fault cannot be rectified, further measures can be taken by technical service personnel.

- ▶ Contact technical service (for contact details, refer to the inside cover sheet).
- ▶ Keep your equipment data ready (see chapter 1.2).

9.2 e-SM-Drive frequency converter (FU-X)



Designation	Designation
1 Code display	2 Status LED lights up red

In the event of an alarm or error, the display of the pump indicates a code and the status LED lights up.

- Alarms and errors are stored with date and time.
- Alarms and errors can be reset by switching the centrifugal pump off for at least one minute.

9.2.1 Behaviour of the centrifugal pump in the event of failure

Observation	Explanation	Remedy
Standstill of the centrifugal pump if there is no water during suction	No water in the supply tank <ul style="list-style-type: none"> • the system only starts automatically if the operation is enabled by the float switch or pressure switch 	<ul style="list-style-type: none"> ▶ Check supply tank for sufficient water feed
Standstill of the centrifugal pump due to other causes	The system resumes operation after 20 seconds. <ul style="list-style-type: none"> • If the cause for the failure remains, the system stops after 3 start attempts. • Should at least 10 minutes elapse without any further disturbance following an alarm, the alarm counter is reset and another 3 start attempts are possible. 	<ul style="list-style-type: none"> ▶ If the system does not restart after 3 attempts: Disconnect the system from the power supply for at least 1 minute
Info: If two or more alarm situations occur at the same time (e.g. overtemperature of the motor and lack of water), only the alarm that is the first to send the corresponding signal to the monitoring card will be indicated.		

9.2.2 Alarm codes

Code	Meaning	Cause	Remedy
A03	Loss of power	Temperature too high	<ul style="list-style-type: none"> ▶ Lower the room temperature ▶ Lower the water temperature ▶ Reduce the load
A05	Data memory alarm	Data logger damaged (if P48 = ALR)	▶ Contact technical service
A06	LOW alarm	Lack of water detected	▶ Check water level in water tank
A15	EEPROM	Data memory corrupted	▶ Stop the centrifugal pump for 5 min and then restart it
A20	Internal alarm		If the problem persists: ▶ Contact technical service
A30	Multi-pump connection alarm	Multi-pump connection faulty	<ul style="list-style-type: none"> ▶ Check the condition of the connection cables ▶ Check that there are no discrepancies in the addresses
A31	Loss of multi-pump connection	Loss of multi-pump connection	▶ Check the condition of the connection cables

9.2.3 Error codes

Code	Meaning	Cause	Remedy
E01	Internal communication error	Lack of internal communication	▶ Stop the centrifugal pump for 5 min and then restart it
E02	Motor overload error	High motor voltage • Current consumption of motor too high	If the problem persists: ▶ Contact technical service
E03	DC-bus overvoltage error	DC-bus overvoltage • External causes condition pump operation via generator	<ul style="list-style-type: none"> ▶ Check system configuration ▶ Check position of the non-return valves ▶ Check non-return valves for damage
E04	Rotor blocked	Motor standstill • Rotor synchronicity is lacking, or rotor is blocked by foreign matter	<ul style="list-style-type: none"> ▶ Make sure that there is no foreign matter that prevents the centrifugal pump from rotating ▶ Stop the centrifugal pump for 5 min and then restart it If the problem persists: ▶ Contact technical service
E05	EEPROM data memory error	EEPROM data memory corrupted	▶ Stop the centrifugal pump for 5 min and then restart it If the problem persists: ▶ Forward fault signal to technical service
E06	Lattice voltage error	Voltage supply outside the operating range	<ul style="list-style-type: none"> ▶ Check voltage ▶ Check electrical connection

Code	Meaning	Cause	Remedy
E07	Error motor winding temperature	Thermal contactor motor tripped	<ul style="list-style-type: none"> ▶ Check if there are impurities near the impeller and the rotor ▶ Remove any impurities ▶ Check condition of installation as well the water and air temperature ▶ Wait until the motor has cooled down If the problem persists: <ul style="list-style-type: none"> ▶ Stop the centrifugal pump for 5 min and then restart it If the problem persists: <ul style="list-style-type: none"> ▶ Contact technical service
E08	Power module temperature error	Thermal contactor frequency converter tripped	<ul style="list-style-type: none"> ▶ Check status of installation and air temperature
E09	General hardware error	Hardware error	<ul style="list-style-type: none"> ▶ Stop the centrifugal pump for 5 min and then restart it If the problem persists: <ul style="list-style-type: none"> ▶ Contact technical service
E11	LOW error	Detection of lack of water (if P48 = ERR)	<ul style="list-style-type: none"> ▶ Check water level in water tank
E12	Pressure sensor error	Missing pressure sensor (not available for ACT mode)	<ul style="list-style-type: none"> ▶ Check status of the sensor and connection cable
E14	Low-pressure error	Pressure below minimum limit (not available for ACT mode)	<ul style="list-style-type: none"> ▶ Check settings of parameters P45 and P46
E15	Loss of phase	Loss of one of the 3 phases (only in case of 3-phase versions)	<ul style="list-style-type: none"> ▶ Check connection to mains
E30	Multi-pump protocol error	Incompatible multi-pump protocol	<ul style="list-style-type: none"> ▶ update all centrifugal pumps to the same firmware version

10 Decommissioning

10.1 Temporary standstill

1. Close the shut-off valves (pressure side) and the shut-off valve provided by the client on site downstream of the system.
2. Keep the system connected to the voltage supply.
3. Switch off the PBS control unit.
 - » The system is shut down temporarily and remains in the permissible operating state.

10.1.1 Recommissioning

1. Open the shut-off valves (pressure side) and the shut-off valve provided on site downstream of the system.
2. Switch on the PBS control unit.
3. Check the operating parameters and system function.

10.2 Decommissioning

If a relatively long downtime of the system is planned, decommissioning must be carried out.



The activities described here must be performed by qualified specialists only.

1. Switch off the PBS control unit.
2. Close the suction side and pressure side shut-off valves upstream and downstream of the system.
3. Completely drain the system.
4. Mark the system as "Out of service".

10.2.1 Recommissioning

- Put the system into operation again (refer to chapter 6).

10.3 Final shutdown

- Have a qualified specialist dismantle the system (refer to chapter 11).

11 Dismantling and disposal

11.1 Dismantling



The activities described here must be performed by qualified specialists only.

1. Switch off the PBS control unit and disconnect the system from the mains.
2. Close all shut-off valves upstream and downstream of the system.
3. Completely drain the system.
4. Disconnect the system from the water installation.
5. Disconnect the electrical connections to subsystems installed downstream.
6. Disconnect the potential equalisation (grounding) provided by client on site.
7. Remove the individual components.
8. Transport the system secured on a pallet.

11.2 Disposal



Danger to the environment due to incorrect disposal.

- ▶ Comply with the applicable national and local regulations.

Packaging

- ▶ Dispose of the packaging in an environmentally sound manner.

Product



If this symbol (crossed-out wheeled bin) is on the product, this product or its electrical and electronic components, must not be disposed of as household waste.

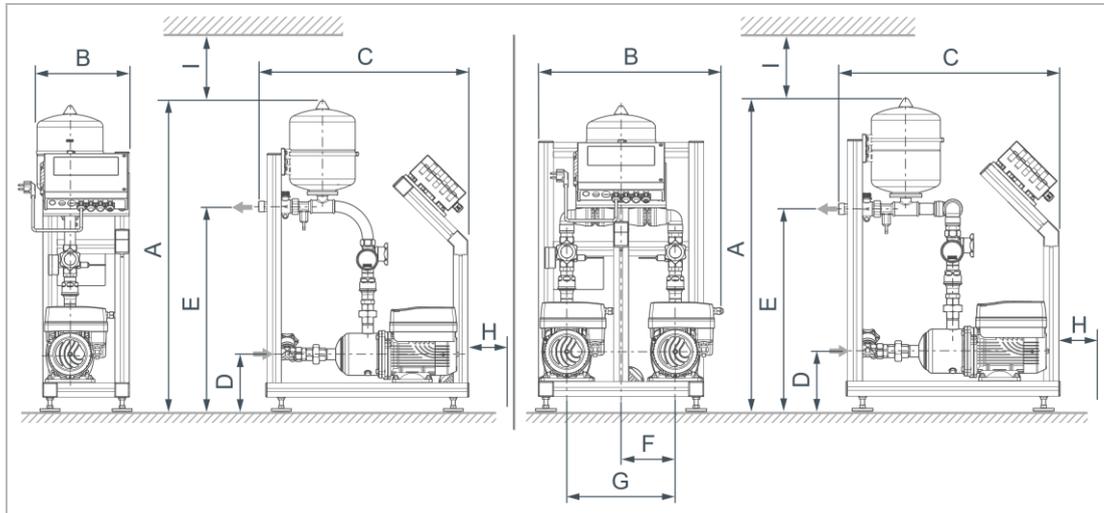
- ▶ Dispose of electrical and electronic products or components in an environmentally sound manner.
- ▶ Find out about local regulations on the separate collection of electrical and electronic products.
- ▶ If your product contains batteries or rechargeable batteries, dispose of them separately from your product.



For more information on take-back and disposal, go for www.gruenbeck.com.

12 Technical specifications

12.1 FU-X (N, NE)



Dimensions and weights			2/40-1	2/40-2	4/40-1	4/40-2
A	Height	mm	985	940	985	940
B	Width	mm	300	560	300	560
C	Depth	mm	660	660	680	680
D	Inlet connection height (intake side)	mm	180	180	180	180
E	Outlet connection height (pressure side)	mm	650	610	650	610
F	Centre distance (system centre – centrifugal pump)	mm	–	163	–	163
G	Centre distance (centre centrifugal pumps)	mm	–	325	–	325
H	Clearance for motor fan	mm	≥ 200			
I	Service clearance	mm	≥ 200			

		FC-X N			
Empty weight	kg	26	39	27	41
Operating weight	kg	36	49	37	51

		FC-X NE			
Empty weight	kg	29	45	29	45
Operating weight	kg	39	55	39	55

Connection data		2/40-1	2/40-2	4/40-1	4/40-2
Suction side nominal diameter		DN 25 (1" female thread)		DN 32 (1¼" female thread)	
Pressure side nominal diameter		DN 25 (1" male thread)		DN 25 (1" male thread)	
Electrical power input	kW	≤ 0.7	≤ 1.4	≤ 1.4	≤ 2.7
Mains connection voltage	VAC	210 – 240			
Mains connection frequency	Hz	50 – 60			
Protection/protection class		IP55/⊕			

Performance data		2/40-1	2/40-2	4/40-1	4/40-2
Pump capacity (optimal pump efficiency)	m³/h	3.4		6.25	
Delivery rate	m³/h	0.8 – 5.2		1.4 – 10.2	
Delivery head	m	56 – 16		67 – 17	
Max. delivery head	m	55		66	
Max. speed	rpm	3600			
Nominal pressure		PN 10			
Operating pressure (inlet)	bar	0 – 4		0 – 3.5	
Suction characteristics		standard suction			
Diaphragm expansion tank content	l	8			

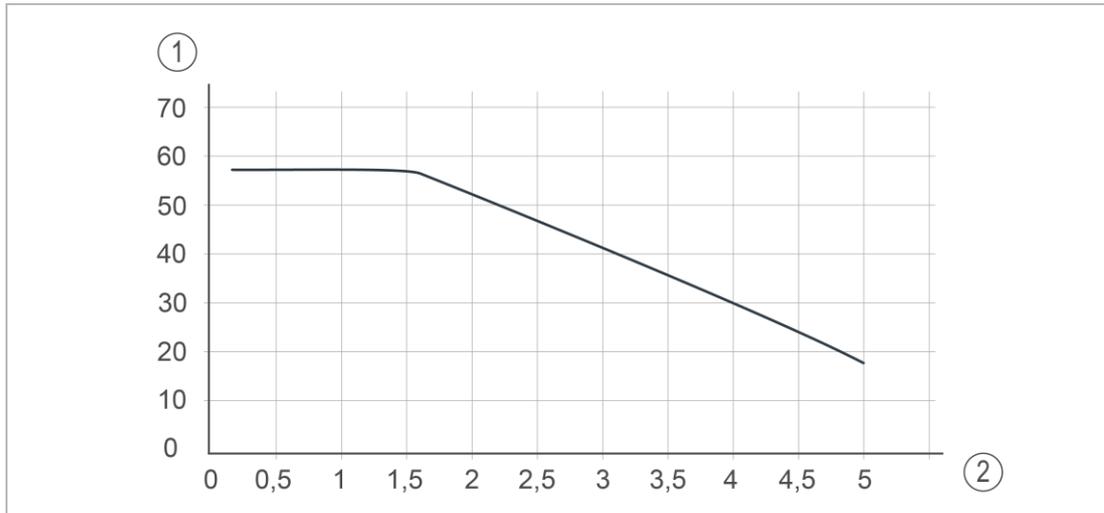
Centrifugal pump material		2/40-1	2/40-2	4/40-1	4/40-2
Impellers		Type N: 1.4301 Type: NE 1.4404			
Diffuser		Type N: 1.4301 Type: NE 1.4404			
Pump housing		Type N: 1.4301 Type: NE 1.4404			
Shaft		Type N: 1.4301 Type: NE 1.4404			
Floating ring seal		Type N: ceramic/ carbon/ EPDM Type NE: ceramic/ carbon/ EPDM			

Admissible media to be pumped		2/40-1	2/40-2	4/40-1	4/40-2
Raw water, soft water		Type N: suitable Type NE: suitable			
Permeate (= pure water of an RO system)		Type N: suitable Type NE: suitable			
Diluate (= ultra-pure water from EDI)		Type N: not suitable Type NE: suitable			

General		2/40-1	2/40-2	4/40-1	4/40-2
Media temperature	°C	5 – 40			
Ambient temperature	°C	5 – 40			
Air humidity (non-condensing)	%	≤ 70			
Order no.	Type N	730 640	730 641	730 642	730 643
Order no.	Type NE	730 790	730 791	730 792	730 793

12.1.1 Characteristic curves

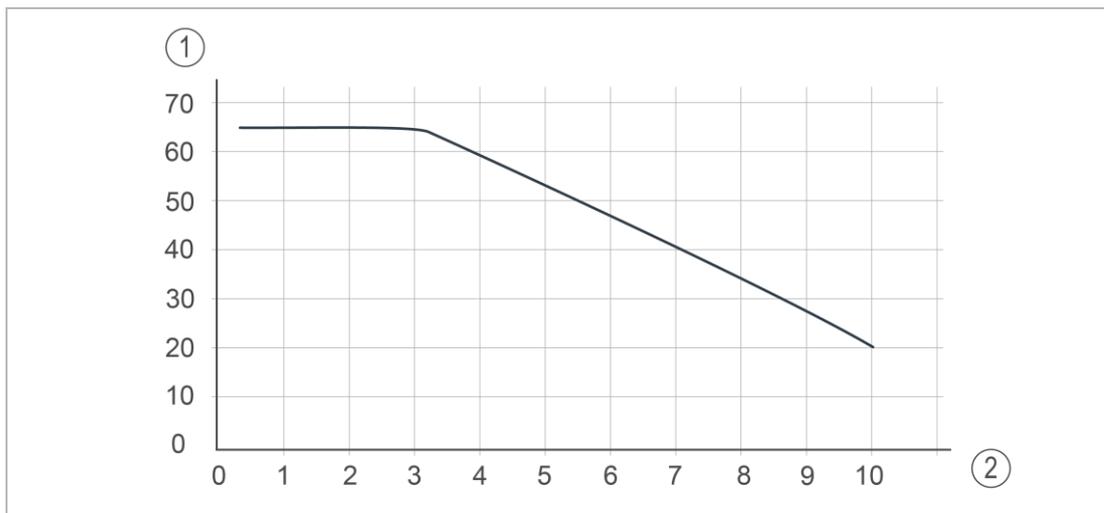
FU-X 2/40 (N, NE)



Designation
 1 Delivery head in m

Designation
 2 Pump capacity in m³/h

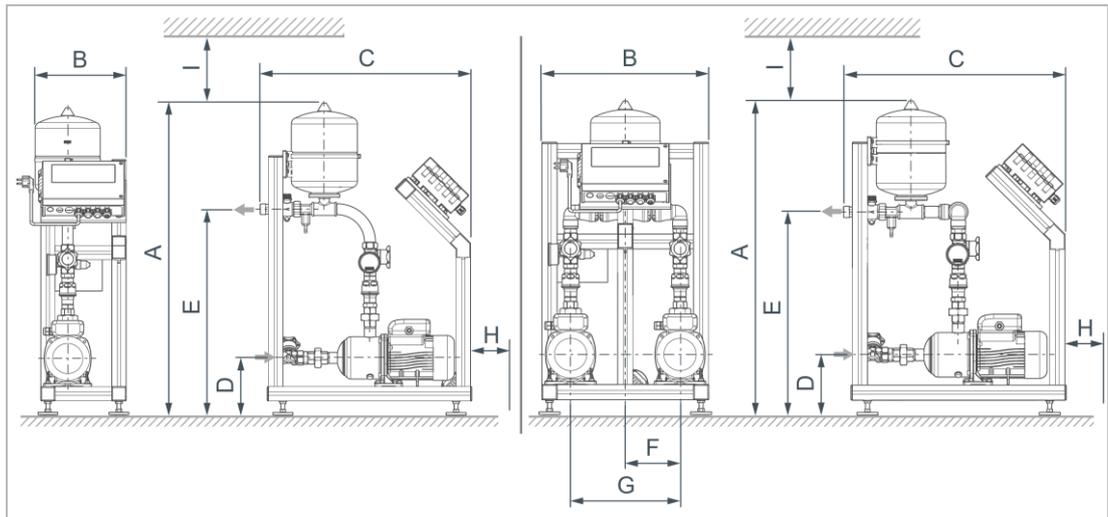
FU-X 4/40 (N, NE)



Designation
 1 Delivery head in m

Designation
 2 Pump capacity in m³/h

12.2 HR-X (N)

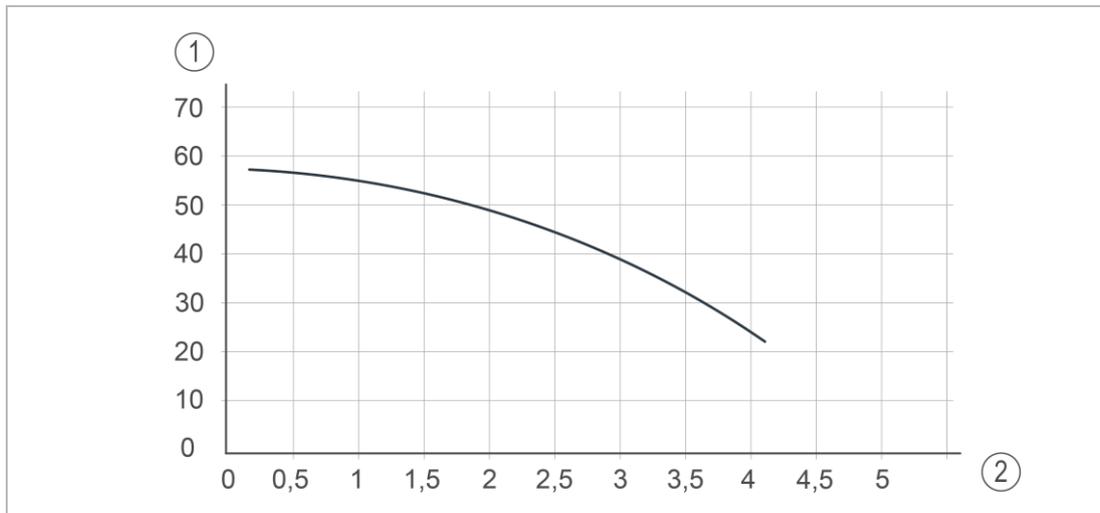


Dimensions and weights			2/40-1	2/40-2	4/40-1	4/40-2	
A	Height	mm	960	920	960	920	
B	Width	mm	290	495	290	495	
C	Depth	mm	670	670	670	670	
D	Inlet connection height (intake side)	mm	180	180	180	180	
E	Outlet connection height (pressure side)	mm	625	585	625	585	
F	Centre distance (system centre – centrifugal pump)	mm	–	163	–	163	
G	Centre distance (centre centrifugal pumps)	mm	–	325	–	325	
H	Clearance for motor fan	mm	≥ 200				
I	Service clearance	mm	≥ 200				
Empty weight			kg	25	38	26	40
Operating weight			kg	35	48	36	50
Connection data			2/40-1	2/40-2	4/40-1	4/40-2	
Suction side nominal diameter			DN 25 (1" female thread)		DN 32 (1¼" female thread)		
Pressure side nominal diameter			DN 25 (1" male thread)		DN 25 (1" male thread)		
Electrical power input	kW		≤ 2.1	≤ 1.4	≤ 2.7	≤ 2.1	
Mains connection voltage	VAC		230				
Mains connection frequency	Hz		50				
Protection/protection class			IP55/⊕				

Performance data		2/40-1	2/40-2	4/40-1	4/40-2
Pump capacity (optimal pump efficiency)	m ³ /h	2.0		4.0	
Delivery rate	m ³ /h	1.2 – 4.2		2.4 – 7.2	
Delivery head	m	52 – 23		50 – 16	
Max. delivery head	m	58		60	
Max. speed	rpm	2900			
Nominal pressure		PN 10			
Operating pressure (inlet)	bar	0 – 4			
Suction characteristics		standard suction			
Diaphragm expansion tank content	l	8			
Centrifugal pump material		2/40-1	2/40-2	4/40-1	4/40-2
Impellers		technical polymer			
Diffuser		1.4301			
Pump housing		1.4301			
Shaft		1.4301			
Floating ring seal		ceramic/ carbon/ EPDM			
Admissible media to be pumped		2/40-1	2/40-2	4/40-1	4/40-2
Raw water, soft water		suitable			
Permeate (= pure water of an RO system)		suitable			
Diluate (= ultra-pure water from EDI)		not suited			
General		2/40-1	2/40-2	4/40-1	4/40-2
Media temperature	°C	5 – 40			
Ambient temperature	°C	5 – 40			
Air humidity (non-condensing)	%	≤ 70			
Order no.	Type N	730 460	730 461	730 462	730 463

12.2.1 Characteristic curves

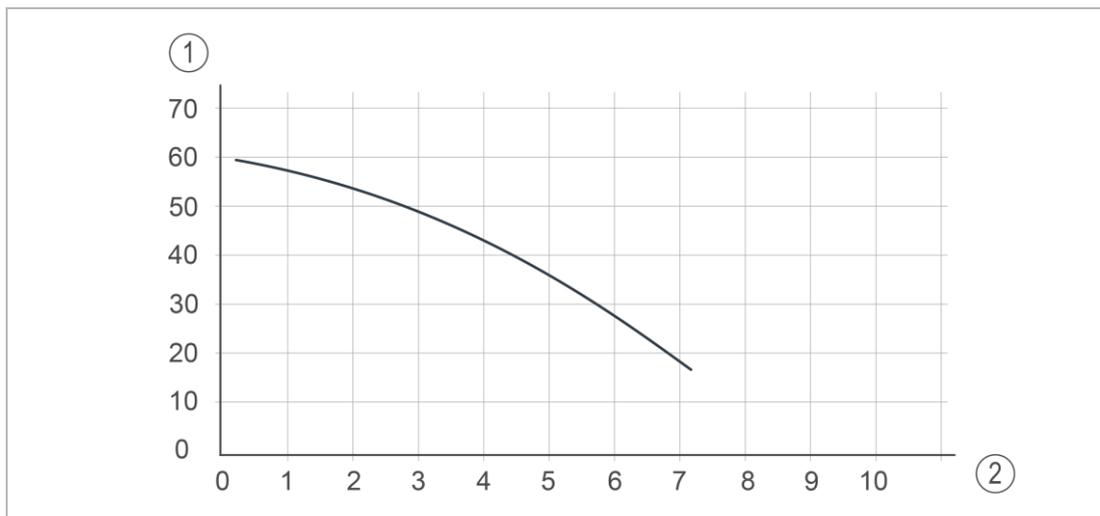
HR-X 2/40 (N)



Designation
 1 Delivery head in m

Designation
 2 Pump capacity in m³/h

HR-X 4/40 (N)



Designation
 1 Delivery head in m

Designation
 2 Pump capacity in m³/h

13 Operation log



- ▶ Document the initial start-up and all maintenance activities.
- ▶ Copy the maintenance report.

Pressure booster system | _____

Serial no.: _____

13.1 Commissioning log

Customer	
Name	_____
Address	_____
Installation location	_____
Installation by/date	_____
Installation/accessories	
Products installed upstream (make, type)	Water tank (BB): _____
	Reverse osmosis (RO): _____
	Activated carbon filter (AKF): _____
	Softening (NX): _____
	Filter (FIL): _____
Products installed downstream (make, type)	_____

Floor drain available	<input type="checkbox"/> Yes <input type="checkbox"/> No
Metallic pipework earthing provided	<input type="checkbox"/> yes <input type="checkbox"/> no
Water pipes (material)	<input type="checkbox"/> Galvanised steel <input type="checkbox"/> Copper <input type="checkbox"/> Plastic <input type="checkbox"/> Stainless steel
Operating values	
Operating pressure (set pressure) for FU-X	bar _____
Switch-on pressure for HR-X	bar _____
Preload pressure on the diaphragm expansion tank	bar _____
Room temperature	°C _____
Water meter reading	m ³ _____
Flow (max. delivery rate)	m ³ /h _____
e-SM-Drive controller mode (FU-X)	<input type="checkbox"/> ACT <input type="checkbox"/> HCS <input type="checkbox"/> MSE <input type="checkbox"/> MSY
Drive configuration	_____
Cascade control for multi-pump systems	<input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> yes
changed parameters on e-SM-Drive from factory settings	_____

BA_730960009900_en_154_GENO-FU-X_HR-X.docx

Remarks

Start-up confirmation

Person	
Name/date	
Position	
Signature	

Instructed persons

Person(s)	
Instructed person(s)	

Contact data

Person(s)	Name	Phone/email
Owner/operator/operating company		
Signature/date		
HVAC and plumbing engineer		
Electrical engineer		
Technical service		

Maintenance no.: _____



Enter all maintenance work carried out according to the intervals.
Observe the chapter "Maintenance and repair".

Intervals			
<input type="checkbox"/> as required: _____			<input type="checkbox"/> Repair work
<input type="checkbox"/> 2 months	<input type="checkbox"/> 6 months	<input type="checkbox"/> 12 months	<input type="checkbox"/> After standstill

► Record the values before and after maintenance work.

Operating values		before	after
Operating mode (Off / Manual P1 / Manual P2 / Auto / Bus)			
Data logging enabled			
Set pressure (switch-on pressure)	bar		
Water meter reading	m ³		
Operating hours of centrifugal pump P1	h		
Operating hours of centrifugal pump P2	h		

► Read out the error memory of the PBS control unit.

	Error message	Date	Time
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Maintenance work	yes	no
Visual check		
Product checked for damage, corrosion and stability	<input type="checkbox"/>	<input type="checkbox"/>
Product and all connections checked for leak tightness	<input type="checkbox"/>	<input type="checkbox"/>
Non-return valve checked for leaks	<input type="checkbox"/>	<input type="checkbox"/>
Mains cable, mains plug and electrical lines checked for damage and a tight fit	<input type="checkbox"/>	<input type="checkbox"/>
Product checked for hygienic condition	<input type="checkbox"/>	<input type="checkbox"/>
Read out operating values		
Settings of the PBS control unit checked	<input type="checkbox"/>	<input type="checkbox"/>
Software version of the control unit checked for relevance	<input type="checkbox"/>	<input type="checkbox"/>
Software updated	<input type="checkbox"/>	<input type="checkbox"/>
Operating values read out	<input type="checkbox"/>	<input type="checkbox"/>
Error memory read out	<input type="checkbox"/>	<input type="checkbox"/>
Settings of the e-SM-Drive (FU-X) checked	<input type="checkbox"/>	<input type="checkbox"/>
Functional check		
Function of the dry-run protection checked	<input type="checkbox"/>	<input type="checkbox"/>
Setting pressure (operating pressure) of the centrifugal pump(s) on the pressure gauge checked	<input type="checkbox"/>	<input type="checkbox"/>
Setting pressure re-adjusted if necessary	<input type="checkbox"/>	<input type="checkbox"/>

Maintenance work	yes	no
Diaphragm expansion tank		
The diaphragm expansion tank checked for damage and corrosion	<input type="checkbox"/>	<input type="checkbox"/>
Diaphragm check for leaks carried out	<input type="checkbox"/>	<input type="checkbox"/>
Setting pressure (preload pressure) checked	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Nitrogen refilled	<input type="checkbox"/>	<input type="checkbox"/>
Final work		
System data printout created	<input type="checkbox"/>	<input type="checkbox"/>
Maintenance interval reset	<input type="checkbox"/>	<input type="checkbox"/>

Remarks

Maintenance confirmation

Person	
Name	
Date	
Position	
Signature	

EU Declaration of Conformity



This is to certify that the system designated below complies with the safety and health requirements of the applicable European Directives in terms of its design, construction and execution.

This certificate becomes void if the system is modified in any way not approved by us.

Manufacturer:	Grünbeck Wasseraufbereitung GmbH Josef-Grünbeck-Str. 1 89420 Hoechstädt Germany
Responsible for documentation:	Markus Pöpperl
System designation:	Pressure booster system
System type:	GENO-FU-X, GENO-HR-X
Serial no.:	Refer to type plate
Applicable guidelines:	Machinery (2006/42/EC) EMC (2014/30/EU)
Applied harmonised standards, in particular:	EN 809:2012-10, EN 61000-6-1:2007-10, EN 61000-6-3:2011-09, EN 60335-2-41:2010-11
Applied national standards and technical specifications, in particular:	
Place, date and signature	
	Hoechstädt; Germany, pp 11/07/2018
Function of the signatory:	Head of Technical Product Design



M. Pöpperl
Dipl.-Ing. (FH)

Publisher's information

Technical documentation

If you have any questions or suggestions regarding this operation manual,
please contact the Technical Documentation
Department at Grünbeck AG

Email: dokumentation@gruenbeck.de

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