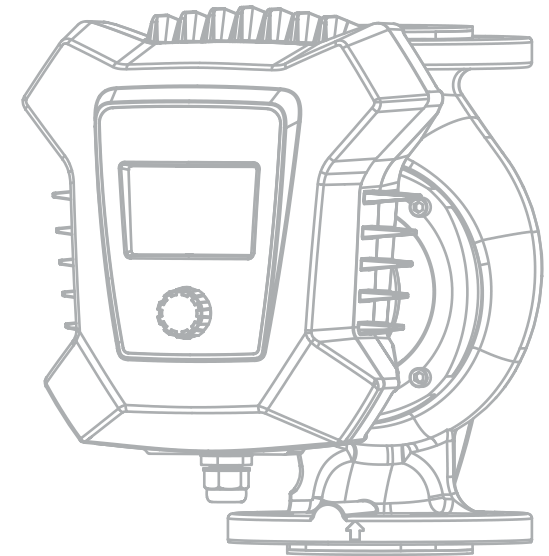




GB USER'S MANUAL
CIRCULATION PUMP



CIRCULATION PUMP

Read this manual carefully before installation. The product can not be used for medical industry which have the potential to cause personal injury, also can not be used for pumping other liquids than water.

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1.Instructions for use

Dear users, thank you for your trust and support. You are welcome to use our company's GEM series variable frequency shielded circulation pump (hereinafter referred to as pump) and we will wholeheartedly provide you with excellent service. Please carefully check whether the received product is consistent with the ordered product, whether the accessories and instruction manuals are complete, and whether there is any damage during transportation. If you find the above situation, please contact our sales department or local dealer in time.

In order to ensure the long-term stable operation of the product, before you install, operate, overhaul or maintain, please read this manual carefully, so as to fully understand the relevant safety issues and the technical parameters and operation methods of the pump.



Warning

Indicates a clause that there is a possibility of endangering personal safety and must be strictly observed.



Attention

Indicates a clause that requires special attention to prevent damage to the pump.



This warning label indicates that there may be a risk of electric shock. When wiring, repairing, or maintaining, please disconnect the



This warning label indicates that please do not touch the pump while the pump is running and when the temperature of the entire pump is still very high after the operation is stopped.



This warning label indicates that the piping inside the pump contains high-pressure liquid, and the valves on both sides need to be closed before operation during maintenance and disassembly.



Attention

Before using this product, please be sure to read this manual carefully and follow the product operating procedures. Please note that the product (including the instruction manual) is subject to any future changes without notice.

2.Cautions

In order to ensure personal safety, please read the following information carefully before you install, operate, repair or maintain.



Warning

The power supply used must be consistent with the power supply identified on the product. The user must confirm that only qualified personnel with professional certification and proficiency in this manual can install and maintain this product.



Warning

When checking and repairing the pump, the power must be cut off before operation. This can avoid electric shock or sudden start of the pump, which may cause injury or death.



Warning

Before starting the pump, the motor must be effectively grounded and a properly rated motor protection switch must be connected.



Warning

The pump must not be installed in a wet or potentially splashable area.



Attention

To facilitate maintenance, a shut-off valve should be installed on each side of the pump.



Warning

The heating pipes should not be filled with non-softened water frequently to avoid the increase of calcium content in the circulating water in the pipes and blocking the impeller.



Attention

The operating ambient temperature of the pump is 0~40°C. Storage ambient temperature is 0~70°C



Attention

In summer or in hot environments, ventilation must be ensured to avoid possible failures caused by condensation.



Attention

The liquid may be high temperature and high pressure, and the system must be completely drained of liquid or the valves on both sides must be closed before moving and dismantling the pump.



Attention

Do not start the pump without fluid.



Attention

In winter, when the pump system does not work or the ambient temperature drops below 0°C, the liquid in the system should be completely emptied to avoid freezing and cracking of the pump body.



Attention

If the pump is not used for a long time, close the pump inlet and outlet pipe valves and disconnect the power supply.



Attention

If the cable is damaged, it must be replaced by qualified personnel.



Attention

If the pump overheats, close the pump inlet valve and cut off the power immediately. If you find that the motor is abnormal, please contact your supplier or service center immediately.



Attention

If the fault cannot be solved according to the manual, please immediately close the inlet and outlet valves of the pump, cut off the power supply, and contact the supplier or service center immediately.



Attention

This product should be placed out of the reach of children. After installation, take isolation measures to avoid children's proximity.



Attention

This product should be stored in a dry, well-ventilated place with low temperature.

3.Product Overview

GEM series variable frequency shielded circulation pump(hereinafter referred to as electric pump), the electric pump is mainly composed of four parts: motor, pump, seal and controller. The motor is a shielded motor with a permanent magnet rotor, and the drive is controlled by a special inverter. The water pump and the motor are sealed by a shielding sleeve, and a rubber sealing ring is used for static sealing at the sealing part of the fixed stop. This product is suitable for the following systems:

Stable variable flow heating system

Variable temperature pipeline heating system

HVAC system

Industrial circulation system

Domestic heating and domestic water supply system

The pump is equipped with a control panel and knob on the front for user-friendly operation.

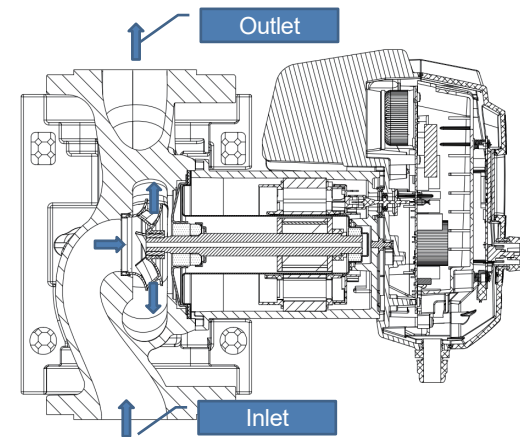
Pumped liquids

The pump is suitable for pumping liquids with easy flow, small viscosity, clean, non-corrosive and non-explosive, and the liquid must not contain solid particles or fibers that can cause mechanical or chemical damage to the pump.

Outline structure diagram



Internal structure diagram



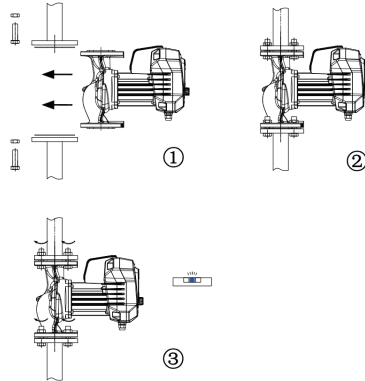
4. Product Installation

4.1 Installation location

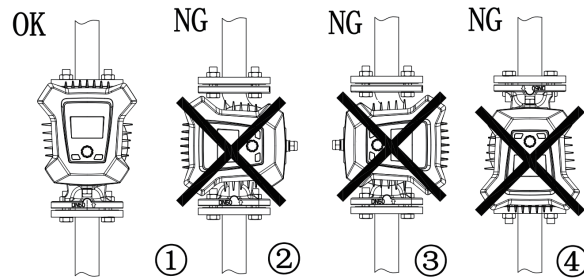
The pump should be installed indoors.

4.2 Installation

When installing a circulation pump, the arrow on the pump casing indicates the direction of flow of the liquid through the pump. When installed, the shaft of the electric pump must be horizontal.



4.3 Installation direction



Warning

The pumped liquid may be high temperature and high pressure. Before removing the socket head cap screws, the liquid in the system must be drained or the valves on both sides of the electric pump must be closed.

Warning

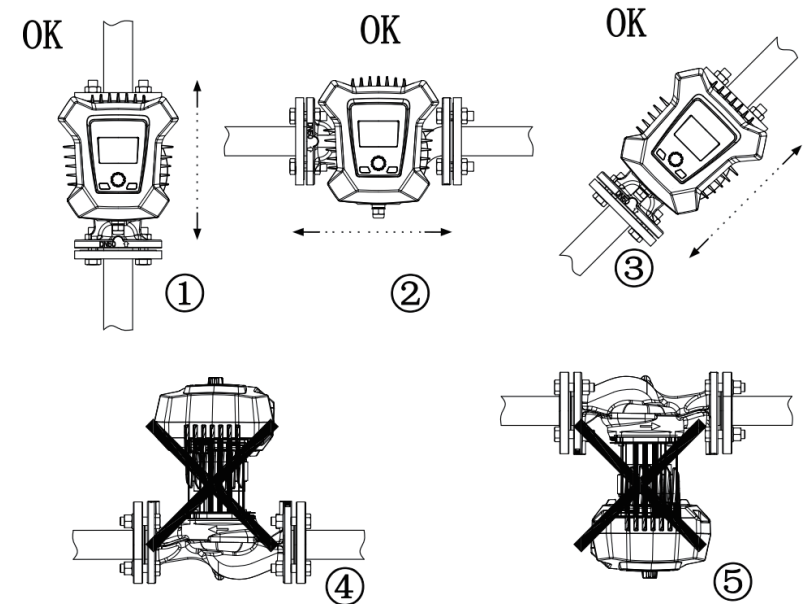
When changing the position of the junction box, the electric pump can only be started after the system is full of pumped liquid or the valves on both sides of the electric pump are open.

4.4 Control box position

Junction box can be rotated within 90°

The procedure for changing the position of the junction box is as follows:

- Close the inlet and outlet valves and relieve pressure;
- Unscrew and remove the four socket head cap screws securing the pump body;
- Rotate the motor to the desired position and align the four screw holes;
- Reinstall the screws and tighten them diagonally clockwise;
- Open the inlet and outlet valves.



4.5 Electrical installation

Attention

Perform electrical connection and protection according to local regulations. Check that the supply voltage and frequency values match those listed on the nameplate.

Warning

Electric shock

Death or serious personal injury

-Connect the pump to an external power switch with a minimum contact gap of 3mm between the electrodes.

-Ground or electrical neutralization can be used for protection against non-direct contact.

Make sure the pump is connected to the external main switch.

The pump does not require an external motor switch.

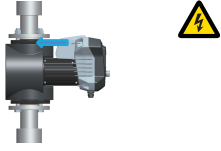
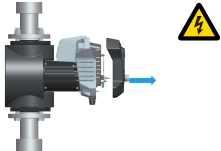
The motor is equipped with thermal protection device to avoid slow overload and stall.

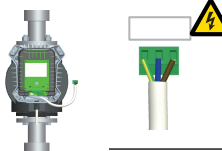
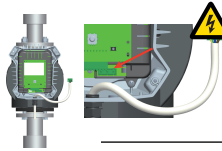
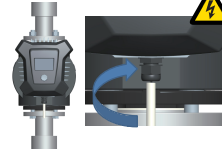
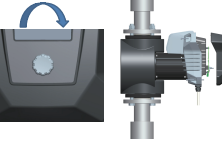
After powering up the pump, the pump will start in about 5 seconds.

Supply voltage

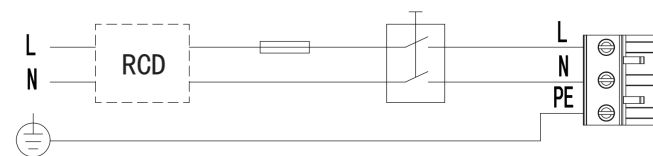
1x230V±10%, 50/60Hz, PE.

The voltage tolerance is only for the variation range of the power supply voltage, and the pump must not be operated at a voltage other than the voltage indicated on the nameplate.

Step	Measures	Illustrations
1	Remove the screws from the housing and cover	
2	Removing the cover	

Step	Measures	Illustrations
3	Strip the cable conductor according to the diagram and connect the cable conductor to the plug.	
4	Insert the power plug into the female socket in the control box.	
5	Fasten the cable connector and reassemble the cover.	
6	Rotate the knob slowly, after the knob hole on the mask is aligned with the control rod, fasten the cover with the housing screw.	

Wiring Diagram

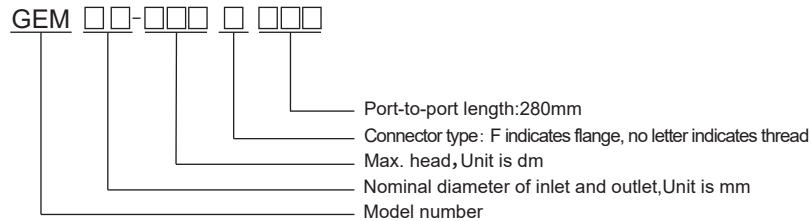


Example diagram of a plug-connected motor with mains switch, backup fuse and additional protective equipment

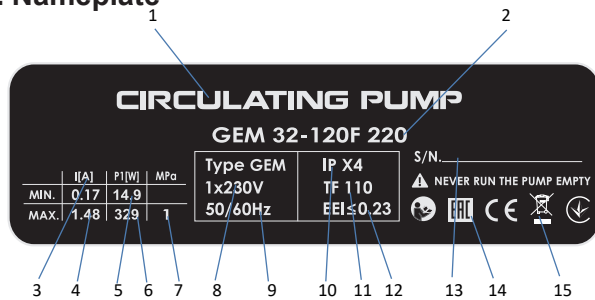
5. Product introduction

5.1 Model composition and meaning

Example: GEM50-120F 280



5.2 Nameplate



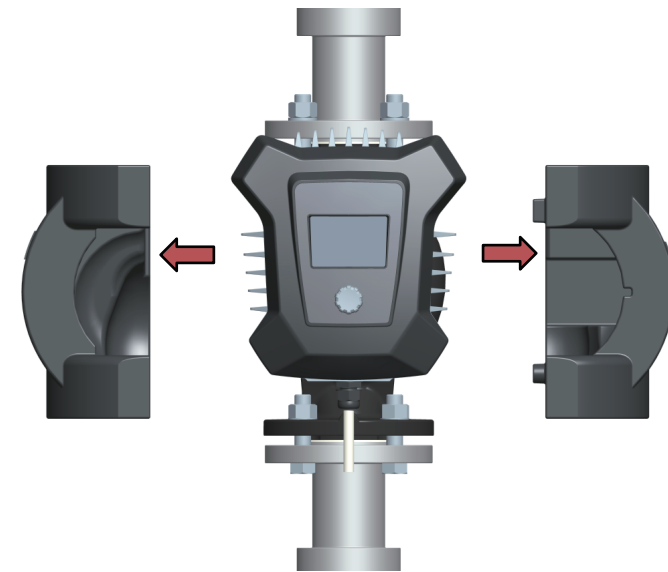
No	Name
1	Product Name
2	Model
3	Minimum current(A)
4	Maximum current(A)
5	Minimum power(W)
6	Maximum power(W)
7	Maximum system pressure
8	Voltage(V)
9	Frequency(Hz)
10	Enclosure protection grade
11	Ambient temperature
12	Energy Efficiency Index, EEI
13	Serial number
14	CE mark and approvals
15	Environmental Label

5.3 Insulation foam



Attention

Limit heat loss from the pump body.
Reduce heat loss from the pump by physically isolating the pump casing from the surrounding environment.



The water pump foam for the heating system is attached with the pump. Before installing the water pump, remove the heat insulating foam, and then put the foam on the pump body after the installation is completed.

5.4 Control function(Take GEM50-120 as an example)

Proportional pressure curve(0~12m)

The application of Proportional pressure control: the pump performance is adjusted according to the actual system heat demand. The pump head increases proportionally to the flow rate of the system. The pump performance depends on the required pump curve and the pump pressure is set in the range 0 to 12m.

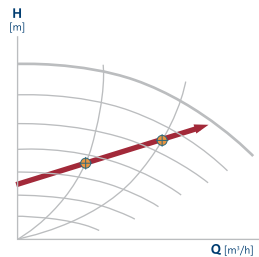


Figure1 Proportional pressure curve/setting

Choosing the correct proportional pressure setting depends on the characteristics of the heating system and the actual heat demand.

Constant pressure curve

Constant pressure control is used to adjust pump performance based on actual system heat demand, but the pump performance curve will depend on the desired pump curve. The pressure setting range of the pump is 0-12m, which can be set by yourself.

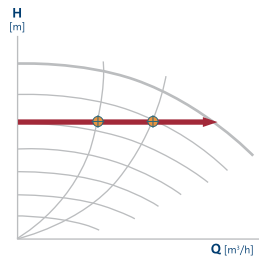


Figure2 Constant pressure curve/setting

Choosing the correct constant pressure setting depends on the characteristics of the heating system and the actual heat demand.

Constant speed curve

At constant speed, the pump operates at a constant speed, independent of the actual flow demand of the system, and the pump performance is determined according to the desired performance curve. Pump speed setting range 1200-4200rpm, 60rpm/grid, can be set by yourself.

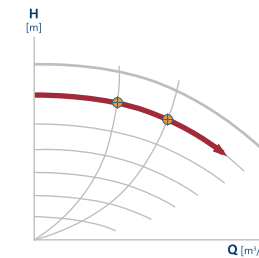


Figure3 Constant speed curve/setting

Choosing the correct constant speed setting depends on the characteristics of the heating system.

Adaptive curve

In AUTOADAPT mode, the system can adjust the pump performance according to the current flow rate of the customer demand, the pump is also in proportional pressure control mode. This mode mainly adjusts the performance of the water pump adaptively within a certain area to make it work in a state of relatively high efficiency.

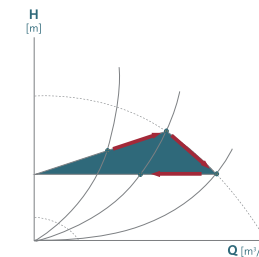


Figure4 Adaptive curve

In adaptive mode, the optimal proportional pressure curve (shaded part) is selected based on the system operating data collected over a period of time, which is used to analyse the current demand on the system.

5.5 External interface



Warning

Motor



Slight or moderate personal injury



The wires connected to the power supply terminals, output Y0, COM and start/stop inputs must be separated from each other by reinforced insulation.

5.5.1 Analog input (under development)

0-10V(1-way pressure sensor) or 4-20mA (2-way temperature sensor) control signal. Used for external control of water pumps or as a sensor input for external set-point control. The analog inputs can also be used as external control signals for building management systems or similar control systems.

- When the input is used for thermal monitoring, a temperature sensor must be installed in the return pipe.
- If the water pump is installed in the return pipe of the system, the sensor must be installed in the outlet pipe.
- If the thermostatic control mode has been enabled and the pump is installed in the system's outlet pipe, the sensor must be installed in the return pipe.
- If the water pump is installed in the system return pipe, a built-in temperature sensor can be used. The selected sensor type can be changed on the operation panel: pressure sensor (0-10V) or temperature sensor.

5.5.2 Digital input

Can be used to externally control pump start/stop. When the external switch is on, the pump is running. When the external switch is closed, the pump stops.

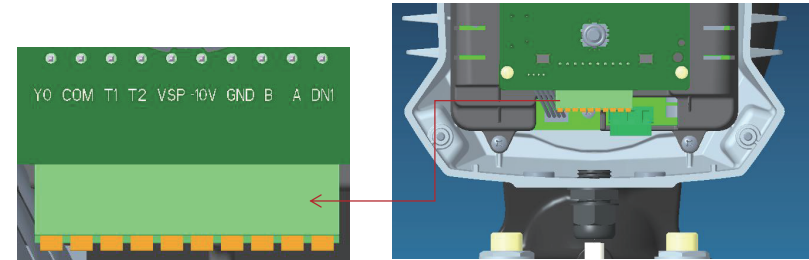
5.5.3 Fault relay output

Relay outputs passive switching contacts for external fault indication. When in the open state, the pump is fault; when closed, the pump is normal.

5.5.4 communication protocol

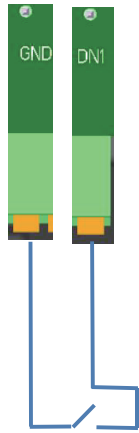
External communication is RS485, this protocol is based on the MODBUS-RTU protocol ("remote terminal unit" mode)

5.6 Signal line wiring method



Symbols	Description
Y0	Used in conjunction with COM to output on-off signals, which can be used as fault output signals
COM	Used in conjunction with Y0, it outputs on-off signals and can be used as fault output signals
T1	Temperature sensor connector, can be accessed 4-20mA output temperature sensor
T2	Temperature sensor connector, can be accessed 4-20mA output temperature sensor
VSP	Pressure sensor connector, can be accessed 0-10V analog output pressure sensor
+10V	10V output, can output 50mA load capacity
GND	ground
B	RS485-
A	RS485+
DN1	Digital inputs that can receive active or passive on/off signals

5.6.1 Digital input wiring method



Digital input

Digital input: Can be used to externally control pump start/stop.

When the external switch is on, the pump is running



Digital input

When the external switch is closed, the pump is stopped



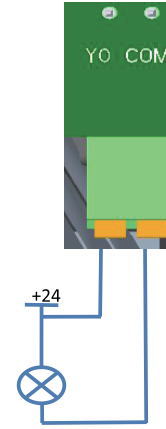
Digital input

5.6.2 Relay output

Relay output for passive switching of external fault indication.

When disconnected, the pump is fault;

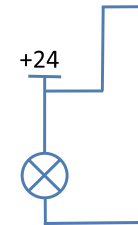
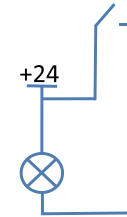
When it is closed, the pump is normal.



Relay output

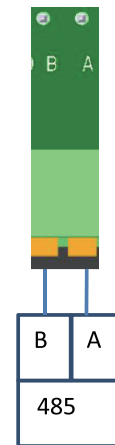
When the relay is disconnected, the pump is fault;

When it is closed, the pump is normal.



5.6.3 External communication is RS485 and the protocol is Modbus RTU.

The communication line of the water pump needs to correspond to the A and B signals of the external controller.



6. Initial startup and operation

6.1 Before start




Warning

Before starting the electric pump, make sure the system is full of liquid, air has been completely removed, and the inlet of the electric pump must reach the minimum inlet pressure.

6.2 Evacuate the pump

The electric pump is vented through the system, which must be vented at the highest point. The air in the electric pump can be noisy, which will disappear after a few minutes of operation.





6.3 Start-up products

Step	Measures	Illustrations
1	Turn on the power of the water pump, the water pump will start after about 5 seconds.	
2	After the factory, the LCD display needs to select the language setting for the first start-up, but no need to select for later start-ups.	
3	This menu allows you to return to the default settings, which set the control mode to AUTO ADAPT	

6.4 Product Setup

6.4.1 Operation Panel

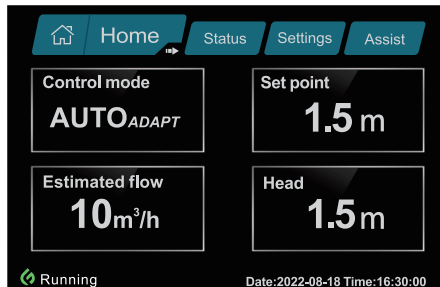


Button	Function
	Back to "Home" interface
	Return to the previous menu
	Navigate between the main menu, submenus, and numbers, adjust the numbers
	Press to save the changed settings and expand the menu

6.4.2 Menu Overview

Home	Status	Settings	Assist
Control Mode	Running Status	Running mode	Date Time set
Set point	Control Mode	Normal	Date set
Estimated flow	Motor speed	Stop	Time set
Head	Estimated flow	Min speed	Control mode instructions
	Head	Max speed	AUTOADAPT
	Power and power consumption	Control Mode	FlowADAPT
	Warning and Alarms	AUTOADAPT	Proportional pressure
	Current Failure	FlowADAPT	Constant pressure
	Fault Log	Proportion pressure	Constant speed
	Fault Code	Constant pressure	Constant temperature
		Constant speed	Differential temperature
		Constant temperature	Assisted fault advice
		Differential temperature	F0,F6,F8,F12,F14
		Language	F1,F2,F3,F7,F13
		Default set	F9,F10,F11
		LCD off time	F4
		Night mode	F5,F15
		External sensor input port	F16
		Temperature sensor	Version
		Constant temperature control	
		Differential temperature control	
		Pressure control	
		Master slave mode	
		Local mode	
		Remote mode	

6.4.3 "Home"



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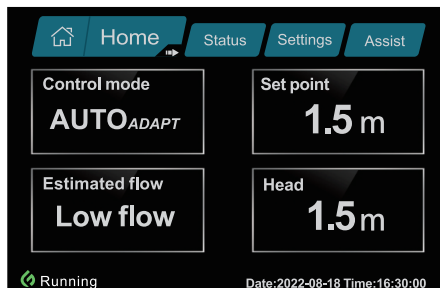
"Home"

Press Open the "Home" menu

This menu provides the following functions

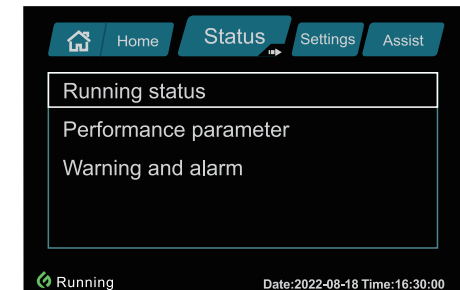
- "Control mode"
- "Set point"
- "Estimated flow"
- "Head"

"Low flow indication"



The pump may experience low flow due to, for example, closed valves. In the case of flow below 3m³/h, it will be displayed in the "Home" menu due to the large measurement error of the pump's algorithm. The speed is below the low flow indication indicating that the pump is still running. When the flow is high enough for the pump to measure, the "home" display will return to normal.

6.4.4 "Status"



Index

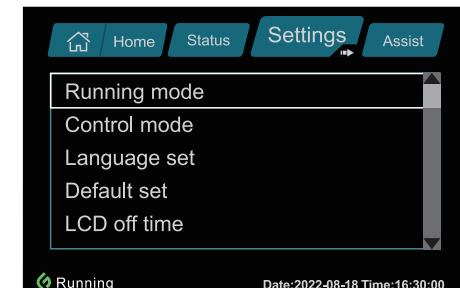
"Home">"Status"

Press and turn the knob clockwise to enter the "Status"

This menu provides the following functions

- "Running status"
- "Performance parameter"
- "Warning and alarm"

6.4.5 "Settings"



Index

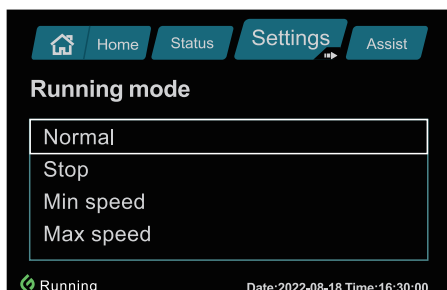
"Home">"Status"

Press and turn the knob clockwise to enter the "Status"

This menu provides the following functions

- "Running mode"
- "Control mode"
- "Language set"
- "Default set"
- "LCD off time"
- "Night mode"
- "External sensor input port"
- "Master slave mode"

Operation mode



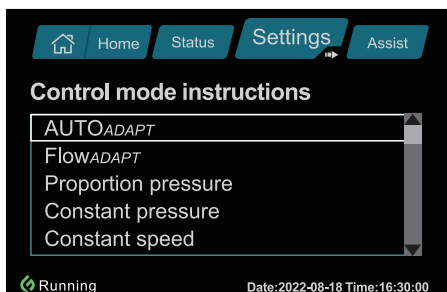
Index

"Home">"Settings">"Operation mode"

This menu provides the following functions

- "Normal"
- "Stop"
- "Min speed"
- "Max speed"

Control mode



Index

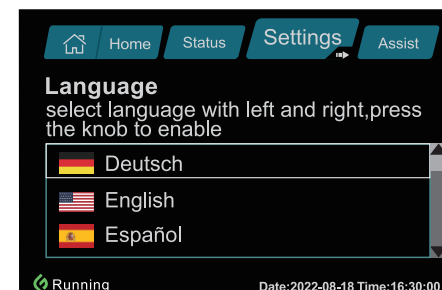
"Home">"Settings">"Control mode"

Press  and turn the knob clockwise to enter the "Status"

This menu provides the following functions

- "AUTO_{ADPT}"
- "Flow_{ADPT}"
- "Proportion pressure"
- "Constant pressure"
- "Constant speed"
- "Constant temperature"
- "Differential temperature"

Language setting



Index

"Home">"Set">Language setting

This menu provides the following functions

- "中文"
- "Deutsch"
- "English"
- "italiano"
- "Türk"
- "Русский"
- "Français"
- "Español"

Restore default settings

"Home">"Settings">Default set

This menu allows you to return to the default settings, which set the control mode to AUTO ADAPT

LCD off time

"Home">"Settings">LCD off time

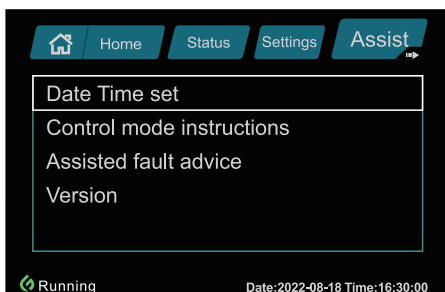
This menu allows you to return to the default factory setting, which sets the LCD off time to 60s.

Night mode

"Home">"Settings">Night mode

This menu can turn on night mode, when the pump is in the 23 to 7 o'clock period of time, the pump automatically into night mode, when the pump power running at 50W

6.4.6 "Assist"



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"Home">"Assist"

This menu provides the following functions

- "Date,time set" - "Assisted fault advice"
- "Control mode instruction" - "Version"

Date,time set

"Home">"Assist">Date,time set

This menu enables date and time setting.

Control mode instruction

"Home">"Assist">Control mode instruction

This menu describes the characteristics of the control mode




Assisted fault advice

"Home">"Help">Assisted fault advice

This menu gives instructions and corrective actions for pump failures.

7.Troubleshooting table

7.1 Operation Status

Status	Instructions	Reason
None displayed	Screen off	Power is off. Water pump is not running.
 Power on	Blue icon +Power on	Power on
 Running	Green icon +Running	Power on (pump running)
 Fault	Red icon +Fault	Alarm (pump stopped working)



Warning

Electric shock

Death or more serious personal injury

The power must be disconnected for at least 3 minutes before any operation is performed on the product.



Attention

Pressurization system

Mild or moderate personal injury

Before disassembling the pump, drain the system or close the isolation valves at both ends of the pump. The pumped liquid can be hot and under high pressure.

7.2 Fault Cause and Finding

Alarm Codes	Fault	Auto reset & restart	Exclusion method
F0	EEPROM failure	-	Contact the after-sales department
F1	Busbar overvoltage fault	YES	The alarm is automatically cleared within 30s, confirm whether the fault still exists.
F2	Busbar undervoltage fault	YES	The alarm is automatically cleared within 30s, confirm whether the fault still exists.
F3	Overcurrent	YES	The alarm is automatically cleared within 30s, confirm whether the fault still exists.
F4	Overheating	YES	Contact the after-sales department
F5	Stalled	-	Clean the pump and remove any foreign objects or impurities that prevent the pump from rotating.
F6	Phase loss	-	Contact the after-sales department
F7	Flux linkage out of control	YES	The alarm is automatically cleared within 30s, confirm whether the fault still exists.
F8	PFC over-current	YES	The alarm is automatically cleared within 30s, confirm whether the fault still exists.
F9	Input frequency fault	-	Check whether the input voltage frequency is 50Hz±3Hz, or 60Hz±3Hz.
F10	Input AC overvoltage	-	Check if the input voltage is too high.
F11	Input AC undervoltage	-	Check if the input voltage is too low.
F12	Communication failure	-	Contact factory for repair.
F13	PFC overvoltage	YES	The alarm is automatically cleared within 30s, confirm whether the fault still exists.
F14	PFC undervoltage	YES	The alarm is automatically cleared within 30s, confirm whether the fault still exists.
F15	Idle	-	To check whether is there water on the pump when running
F16	No sensor detected	-	To check if the sensor is in working order

8. Technical Data

Voltage	1x230V±10%, 50/60Hz, PE	
Motor protection	The pump does not require external motor protection.	
Protection grade	IPX4D	
Insulation class	F	
Relative humidity	Max 95%	
Max. ambient temperature	0~+40°C	
Temperature environment	TF110 (EN60335-2-51)	
Liquid temperature	2~+110°C	
System pressure	1.0MPa	
Pumps can withstand the test pressure of EN 60335-2-51	PN10: 1.2MPa	
Inlet pressure	Liquid temperature	Min inlet pressure
	75°C	0.01Mpa
	95°C	0.05Mpa
	110°C	0.1MPa
Surface temperature	The maximum. surface temperature is not higher than 125°C	



Attention

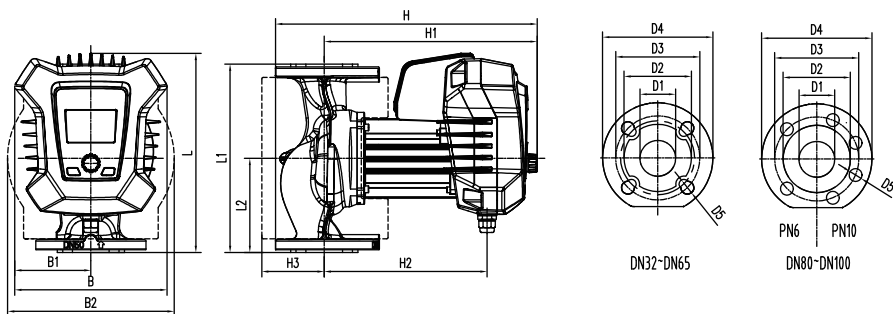
The actual inlet pressure plus the closing pressure of the pump should always be lower than the maximum system pressure allowed by the pump.



Attention

The minimum relative inlet pressure applies to pumps installed at sea level up to 300 m. For altitudes above 300 m, the required relative inlet pressure must be increased by 0.01 bar for every 100 m of altitude.

9.Dimension



Pump type	Dimensions																
	L	L1	L2	B	B1	B2	H	H1	H2	H3	D1	D2	D3		D4	D5	
														PN6	PN10		PN6
GEM32-120F 220	266	220	110	226	113	212	379	312	242	79	32	76	90	100	140	4-φ14	4-φ19
GEM40-80F 220	266	220	110	226	113	212	382	312	242	79	40	84	100	110	150	4-φ14	4-φ19
GEM40-100F 220	266	220	110	226	113	212	382	312	242	79	40	84	100	110	150	4-φ14	4-φ19
GEM40-120F 250	281	250	125	226	113	212	382	312	242	79	40	84	100	110	150	4-φ14	4-φ19
GEM40-150F 250	281	250	125	226	113	212	382	312	242	79	40	84	100	110	150	4-φ14	4-φ19
GEM40-180F 250	281	250	125	226	113	212	382	312	242	79	40	84	100	110	150	4-φ14	4-φ19
GEM50-60F 240	276	240	120	226	113	248	387	312	242	93	50	102	110	125	164	4-φ14	4-φ19
GEM50-80F 240	276	240	120	226	113	248	387	312	242	93	50	102	110	125	164	4-φ14	4-φ19
GEM50-100F 280	296	280	140	226	113	248	389	312	242	93	50	102	110	125	164	4-φ14	4-φ19
GEM50-120F 280	296	280	140	226	113	248	389	312	242	93	50	102	110	125	164	4-φ14	4-φ19
GEM50-150F 280	296	280	140	226	113	248	389	312	242	93	50	102	110	125	164	4-φ14	4-φ19
GEM50-180F 280	296	280	140	226	113	248	389	312	242	93	50	102	110	125	164	4-φ14	4-φ19
GEM65-40F 340	326	340	170	226	113	266	399	320	250	90	65	119	130	145	185	4-φ14	4-φ19
GEM65-60F 340	326	340	170	226	113	266	399	320	250	90	65	119	130	145	185	4-φ14	4-φ19
GEM65-80F 340	326	340	170	226	113	266	399	320	250	90	65	119	130	145	185	4-φ14	4-φ19
GEM65-100F 340	326	340	170	226	113	266	399	320	250	90	65	119	130	145	185	4-φ14	4-φ19
GEM65-120F 340	326	340	170	226	113	266	399	320	250	90	65	119	130	145	185	4-φ14	4-φ19
GEM65-150F 340	326	340	170	226	113	266	399	320	250	90	65	119	130	145	185	4-φ14	4-φ19
GEM80-60F 360	336	360	180	226	113	326	426	326	256	111	80	128	150	160	200	4-φ19	4-φ19
GEM80-80F 360	336	360	180	226	113	326	426	326	256	111	80	128	150	160	200	4-φ19	4-φ19
GEM80-100F 360	336	360	180	226	113	326	426	326	256	111	80	128	150	160	200	4-φ19	4-φ19
GEM80-120F 360	336	360	180	226	113	326	426	326	256	111	80	128	150	160	200	4-φ19	4-φ19
GEM100-40F 450	381	450	225	226	113	356	446	338	268	116	100	160	170	180	220	4-φ19	8-φ19
GEM100-60F 450	381	450	225	226	113	356	446	338	268	116	100	160	170	180	220	4-φ19	8-φ19
GEM100-80F 450	381	450	225	226	113	356	446	338	268	116	100	160	170	180	220	4-φ19	8-φ19
GEM100-100F 450	381	450	225	226	113	356	446	338	268	116	100	160	170	180	220	4-φ19	8-φ19
GEM100-120F 450	381	450	225	226	113	356	446	338	268	116	100	160	170	180	220	4-φ19	8-φ19

10.Maintenance

After 2000 hours of normal use, the electric pump should be repaired and maintained according to the following steps:

- (1) Disassembly: Check whether there are knots or foreign objects inside the motor, and clean it up in time if there is.
- (2) Air tightness test: After disassembling the machine to repair or replace various seals, the water (air) pressure test must be carried out on the pump. The test pressure is 0.2Mpa (megapascal), and there should be no leakage and sweating for 3 minutes.
- (3) When the temperature is below 4°C, anti-freeze work should be done to avoid freezing and cracking the pump body.
- (4) If the electric pump is not used for a long time, the pipeline should be removed, the water accumulated in the pump should be drained, the main parts should be scrubbed clean, and rust-proof treatment should be carried out. Place the pump in a dry and ventilated place and keep it properly.

11.Warranty Terms

The warranty period of the GEM series canned pump is six months from the date of purchase. During the warranty period, the company will provide free maintenance services for failures that occur under normal use conditions as required by the instruction manual. If the fault is caused by the following conditions, the company needs to carry out paid repairs:

- (1) Failure caused by natural disasters or human factors.
- (2) Failure caused by special use environment.
- (3) Fault caused by incorrect wiring or abnormal power supply.
- (4) Identified by our technicians as a failure caused by abnormal operation or improper use.

12. Annex 1

Modbus communication protocol

This protocol is based on the MODBUS-RTU protocol ("remote terminal unit" mode) to realize remote control of hot water circulating pump equipment. The hot water circulating pump is defined as a slave in the communication protocol.

12.1 UART configuration

12.1.1 One start bit, 8 data bits, low bit first;

Start (low)	Bit0 (LSB)	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Parity	Stop (high)
-------------	------------	------	------	------	------	------	------	------	--------	-------------

12.1.2 Baud rate: 115200bps

12.1.3 Check digit: None no check (factory default);

12.1.4 Stop bit: 1bit (default)

The communication configuration of the slave can be changed by the master after the communication is established. Please refer to 5.5.2 corresponding register information and 5.6 command examples.

12.2 communication protocol

12.2.1 Adopt the master-slave mode, all communication must be initiated by the master, and the slave should respond. Support single master-slave mode, the slave address is fixed at 0x01.

12.2.2 Only the master has the right to initiate communication, and the slave only responds after receiving legal and complete instructions from the master.

12.2.3 When the master sends data, it should be continuous, and there should be no interval between each byte or the interval should be <1.5 byte time.

12.2.4 After the slave receives the command from the master, it starts to reply within at least 50ms.

12.2.5 The slave should be continuous when sending data, and there should be no interval between each byte or the interval should be <1.5 byte time.

12.2.6 After the master sends a frame of instructions, if there is no response, it will try again every 200ms. If the communication cannot be carried out normally for a long time, the host should deal with it accordingly.

12.2.7 If the slave machine does not receive a valid command for a long time, the slave machine will also deal with it accordingly.

12.3 Protocol frame

Master to slave:

Address code(8bit)	Command code(8bit)	Data (N*8bit)	CRCL (8bit)	CRCH (8bit)
--------------------	--------------------	---------------	-------------	-------------

Slave to host:

address code(8bit)	Command code(8bit)	Data (N*8bit)	CRCL (8bit)	CRCH (8bit)
--------------------	--------------------	---------------	-------------	-------------

12.3.1 Slave address

Each slave has its 8-bit address. The factory default address of the hot water circulation pump is 0x01. The slave addresses in the same network cannot be duplicated. Except for the broadcast address, the slave only acknowledges and responds to messages with the same ID as itself. The communication protocol defines a broadcast address: 0xFF.

slave address	Command
0x01 to 0xF7	Only when the slave address (1-247) corresponds, execute the command and reply to the master.
0xFF	All slaves receive and execute commands and reply to the master. For one-to-one configuration control.

12.3.2 Supported command codes

code	Command
0x03	read holding register
0x04	read input register
0x06	write a single register

12.3.3 Data

Different instruction data word definitions are also different. For details, see Section 5.4 UART Command Detailed Explanation and Section 5.5 Register Value Range.

12.3.4 CRC check

Redundant cyclic code CRC16 (MODBUS), including 2 bytes, when sending, the low byte comes first, and the high byte follows.

12.4 UART Detailed command

12.4.1 Command code = 0x03 (read holding register)

Master to slave:

Slave address (1 byte)	Command code (0x03)	First holding register address (2 bytes, high byte first)	Number of registers read (2 bytes)	Check CRC (2 bytes)
------------------------	---------------------	---	------------------------------------	---------------------

Slave to master (reply):

Slave address (1 byte)	Command code (0x03)	Total number of data bytes (1 byte)	First register data	... Nth register data	CRC check (2 bytes)
------------------------	---------------------	-------------------------------------	---------------------	-----------------------	---------------------

12.4.2 Command code = 0x04 (read input register)

Master to slave:

Slave address (1 byte)	Command code (0x04)	Input register start address (2 bytes, high byte first)	Number of registers read (2 bytes)	Check CRC (2 bytes)
------------------------	---------------------	---	------------------------------------	---------------------

Slave to master (reply):

Slave address (1 byte)	Command code (0x04)	Total number of data bytes (1 byte)	First register data	... Nth register data	CRC check (2 bytes)
------------------------	---------------------	-------------------------------------	---------------------	-----------------------	---------------------

12.4.3 Command code = 0x06 (write a single holding register)

Master to slave:

Slave address (1 byte)	Command code (0x06)	Holding register address (2 bytes, high byte first)	Holding register address (2 bytes, high byte first)	Check CRC (2 bytes)
------------------------	---------------------	---	---	---------------------

Slave to master (reply):

Slave address (1 byte)	Command code (0x06)	Holding register address (2 bytes, high byte first)	Write the value of the register (2 bytes, high byte first)	Check CRC (2 bytes)
------------------------	---------------------	---	--	---------------------

12.4.4 exception code

In case of error, the slave will only send one data byte (exception code)

0x01: Unsupported command.

0x02: The address of the holding register is out of range.

12.5 register list

12.5.1 Input register list – read-only (24 in total, do not use if not listed)

Address	Register name	Definition	Ranges	Register actual address (hexadecimal)	Remark
10	Control_version	MCE version		0x0600	16 bits, unsigned
11	Now_speed_i	Real-time speed	1200~4200	0x0601	Unit: rpm
12	Igbt_vth	Igbt temperature		0x0602	
13	Input_frequence	Input frequency		0x0603	1 represents 0.1hz
14	Input_voltage	Input voltage		0x0603	1 represents 0.1hz
15	Flt_input_power	Input power		0x0603	1 represents 0.1hz
16	Motor_temp	Imotor temperature		0x0606	Unit: Celsius
17	Run_status	Start up status	0~4	0x0607	"0": stop "1": run "2": constant speed (minimum) "3": constant speed (maximum) "4": failure
18	Device_status	Equipment running status		0x0608	Low bit: whether to enter the power limit mode (1~yes; 0~no) High bit: whether to enter night mode (1~yes; 0~no)
19	Fault_flag	Failure sign		0x060B	F0: EEPROM Failure F1: Bus overvoltage fault F2: Bus undervoltage fault F3: overcurrent F4: IGBT overheating F5: Stall F6: phase loss F7: Motor out of control fault - flux linkage out of control F9: input frequency failure F10: input AC overvoltage F11: input AC undervoltage F12: communication failure F13: PFC bus overvoltage fault F14: PFC bus undervoltage fault F15: idle

Address	Register name	Definition	Ranges	Register actual address (hexadecimal)	Remark
I10	Flow_rt_fit	Show-flow		0x060C	16384 means 50m3
I11	Head_rt_fit	Display - head		0x060D	16384 means 15m
I12	Energy_consumption	Total power low		0x060F	1 means 0.001kwh
I13	Energy_consumption1	Total power high		0x0610	1 means 0.001kwh
I14	Running_hours	Cumulative running time low bit		0x0611	
I15	Running_hours1	Cumulative running time high		0x0612	
I16	limit_power_run	Actual operating power limit point		0x0615	2048 means 260.94W
I17	Default_rpm_limit	The default limit range of speed		0x0616	Default: 10764
I18	Default_flow_limit	Default bounds for traffic		0x0617	Default: 8448
I19	Default_head_limit	Default limits for pressure		0x0618	Default: 3074
I20	Rtc	RTC clock		0x0619	
I21	Rtc1	RTC clock		0x061A	
I22	Rtc2	RTC clock		0x061B	
I23	Rtc3	RTC clock		0x061C	

12.5.2 Holding registers - readable and writable (17 in total, do not use if not listed)

Address	Register name	Definition	Ranges	Register actual address (hexadecimal)	Remark
H0	Set_speed_i	Set speed	1200~4200	0x061E	
H1	Run	Start up command	0~3	0x061F	"0": stop "1": run "2": constant speed (minimum) "3": constant speed (maximum)
H2	Slave_address	Slave address	1~247	0x0620	Default 1
H3	Set_flow	Set flow rate		0x0621	16384 means 50m ³
H4	Set_head	Set head		0x0622	16384 means 15m
H5	Fault_clear	Clear fault flag	0~1	0x0623	"0": Default "1": Clear
H6	Mode_config	Operating mode	0~7	0x0624	"0": adaptive "1": flow adaptive "2": proportional pressure "3": constant pressure "4": constant speed "5": constant temperature "6": temperature difference "7": constant current
H7	limit_power	Power Limiting Point	0~4183	0x0625	4183 means 533W
H8	Device_config	Night mode	1~8	0x0626	"1": night mode "2": remote control "4": internal power control "8": maximum value, used for range limitation
H9	Set_pro_pressure	(for proportional pressure) set pressure value	2~12	0x0627	16384 means 15m
H10	Set_const_temperature	Set temperature value at constant temperature		0x0628	16384 means 200 degrees
H11	Set_diff_temperature	Set temperature value when temperature difference		0x0629	16384 means 200 degrees
H12	Default_set	Restore default settings	0~0xAAAA	0x062A	"0": normal "0xAAAA": restore default settings

Address	Register name	Definition	Ranges	Register actual address (hexadecimal)	Remark
H13	auto_adapt_min_head	Adaptive minimum lift value	1638 ~ 16384	0x062B	
H14	Set_ulBaudRate	Baud rate of modbus communication	0~2	0x062C	"0": 9600 "1": 19200 "2": 115200 Default: 115200
H15	Night_time_start_time	Night mode start time		0x062D	The number of minutes of the day that night mode starts - 60 if it starts at 01:00
H16	Night_time_end_time	Night mode end time		0x062E	The number of minutes in a day that night mode ends - 120 if it ends at 02:00

13. Annex 2

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1.Change records

Version number	Changes
V0.0.1	Proposed 2023/6/26

Gateway Operating Instructions

Requirement: By connecting the communication AB line of the GEM pump to the gateway, use the gateway to collect the data from the pump through the modbus-rtu protocol. The gateway maps the GEM data to the BACnet protocol, thus realizing the function of connecting GEM products to the BACnet network. The following describes the use of the gateway.

2.Gateway program updates

2.1.Update gateway configuration

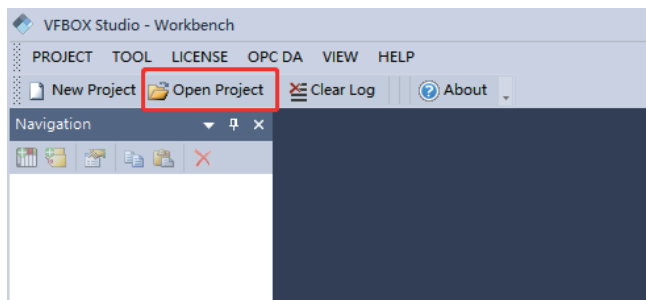
2.1.1.Software installation

First install the following software.

> BACnet > 发给客户的

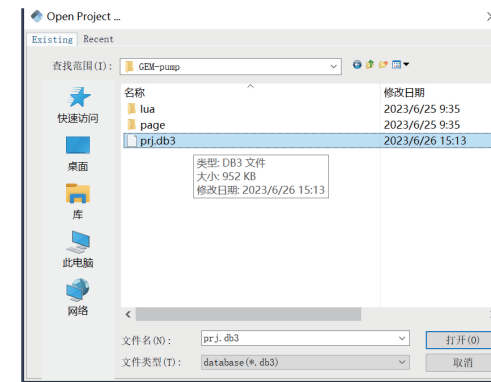
名称	修改日期	类型	大小
GEM-pump	2023-06-26 15:34	文件夹	
0924-301-0029 VFBOX BACnet网关手册	2023-06-26 15:32	WPS PDF 文档	814 KB
BACnetScan	2023-06-25 16:27	WinRAR 压缩文件	2,834 KB
GEM modbus to BACnet instructions(...)	2023-07-21 16:46	DOCX 文档	1,656 KB
Register Description of BACnet	2023-07-19 14:30	XLSX 工作表	11 KB
VFBOXStudio-11.0.0-English	2023-07-19 15:24	应用程序	56,722 KB

After the installation is complete, the following screen will appear. Select Open Project.

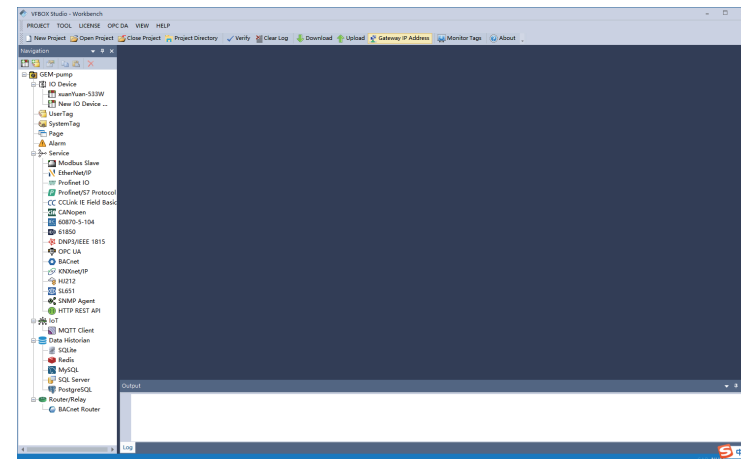


Select the GEM-pump in the folder

名称	修改日期	类型	大小
GEM-pump	2023-06-26 15:34	文件夹	
0924-301-0011 VFBOX 网关采集和转...	2023-06-25 9:24	看图王 PDF 文件	7,978 KB
0924-301-0029 VFBOX BACnet网关手册	2023-06-26 15:32	看图王 PDF 文件	818 KB
0924-301-0061 VFBOX 网关采集MOD...	2023-06-26 15:44	看图王 PDF 文件	388 KB
BACnetScan	2023-06-25 16:27	WinRAR 压缩文件	2,834 KB
BACnet网络讲义	2023-06-25 10:21	看图王 PDF 文件	1,960 KB
GEM modbus to BACnet instructions(...)	2023-07-21 16:48	DOCX 文档	1,660 KB
GEM modbus to BACnet instructions(...)	2023-07-27 16:11	DOCX 文档	2,427 KB
GEM modbus转BACnet操作说明 - v0...	2023-06-26 16:18	DOCX 文档	1,870 KB
VFBOXStudio-10.8.0-Chinese	2023-06-25 9:24	应用程序	56,266 KB
VFBOXStudio-11.0.0-English	2023-07-19 15:38	应用程序	56,722 KB
寄存器说明 BACnet	2023-07-05 15:22	XLSX 工作表	15 KB



When finished, the interface is as follows;



2.1.2. Gateway Connection Hardware

The gateway requires a separate power supply of 9-36Vdc. in position 1 in the diagram below. The gateway requires a separate power supply of 9-36 Vdc. the POW in position 5 will light up after a while after the power is supplied.



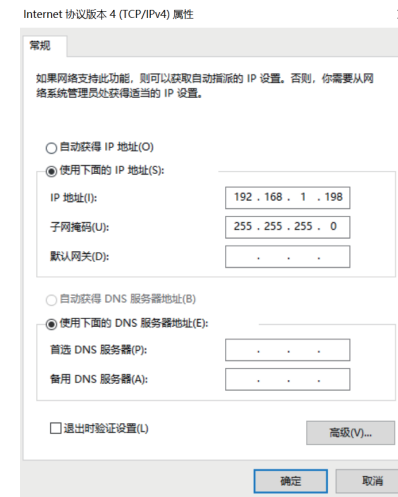
Connect the gateway to your computer via a network cable. The default IP address of the gateway is 192.168.1.199. You need to set the computer and the gateway in a network segment. Connect the network cable at position 2 and the other end to the computer. Set the corresponding online address on this end of the computer as follows.



Click Properties. The following screen appears. Double-click the following tab.

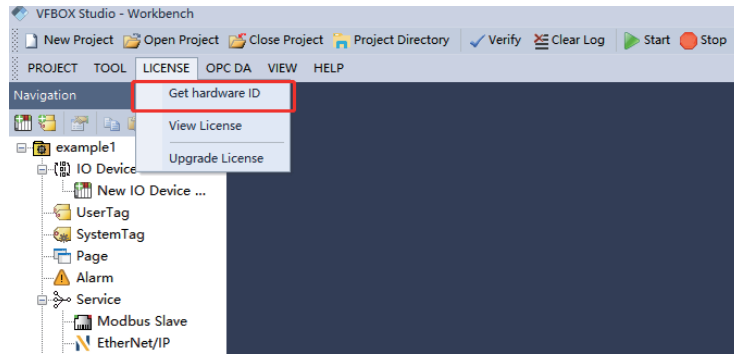


Set to the following screen.

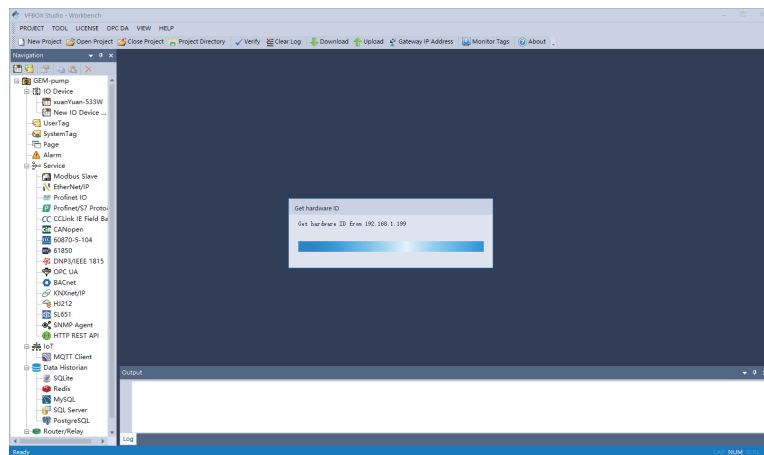


2.1.3. Gateway connection test

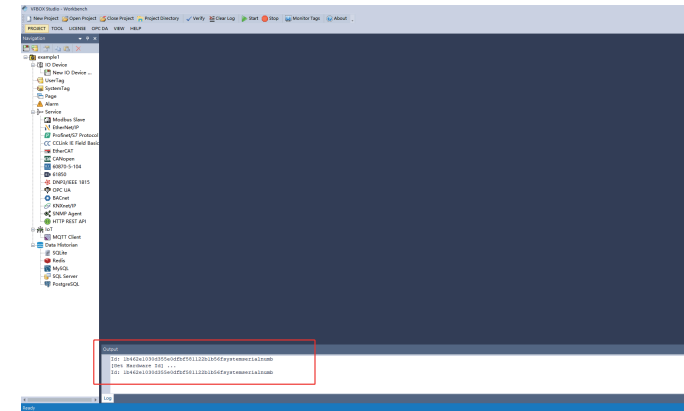
2.1.4. Go back to the software on your computer. Select the tab in the figure below and click on it



The following screen will appear. Wait a moment.

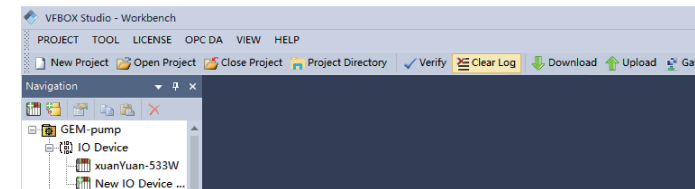


The following message will come out at the bottom, proving that the gateway is well connected to the computer.

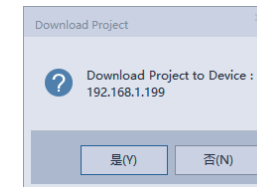


2.1.5. Download the gateway configuration program.

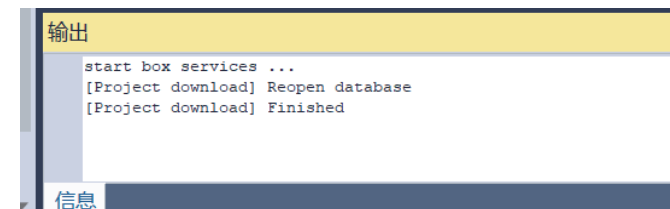
2.1.6. Click on the download in the image below.



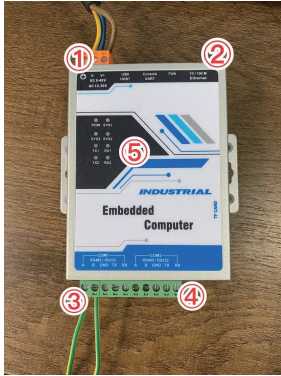
Click again to confirm



The following message will be displayed upon completion



2.2.Gateway Testing and BACnet Network Access.



2.2.1.Mstp Mode Hardware Connections

Position3 accesses the AB and ground wires of the GEM pump. Corresponding access respectively. Position4 access to the BACnet network, corresponding access to the ABline and the ground line. Position 3 accesses the AB and ground wires of the GEM pump. position 2 accesses theBACnet IP network.If you have a BACnet network you can test it directly in the network.Computer-based testing. You can test it by installing the following software on your computer.

2.2.2.Ip Mode Hardware Connection

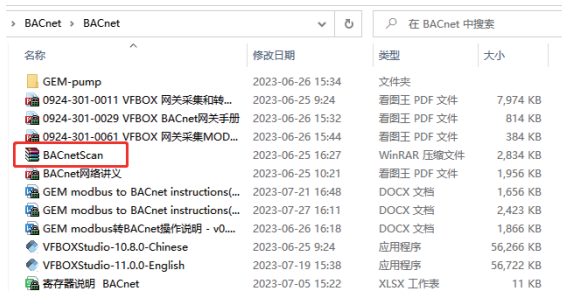
Position 3 accesses the AB and ground wires of the GEM pump. position 2 accesses the BACnet IP network

2.2.3.Gateway testing

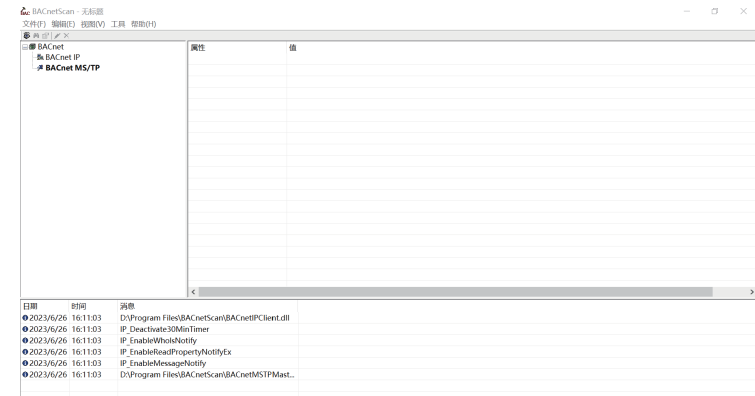
2.2.4.BACnet In-network testing

If you have a BACnet network you can test it directly in the network. Computer-based testing.

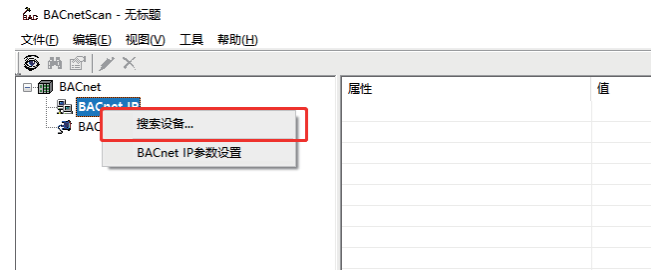
You can test it by installing the following software on your computer.



Open the software interface as follows



Press the following to search for devices, Device_301 will appear to prove that the search has been successful



Click on the search point to read out all AI and AO objects.

