

Shinhoo®

Master SD PWM

Installation and Operation Manual



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Warning

Before starting work on the installation of the equipment, it is necessary to carefully study this document. Installation and operation of the equipment must be carried out in accordance with the requirements of this document and local codes and regulations.



1. Safety instructions

Warning

This equipment must be operated by personnel with the necessary knowledge and experience.

Persons with physical, mental, visual and hearing disabilities shall not be admitted to the operation of this equipment.

Children are not allowed access to this equipment.



General information about document

The Data Sheet, Installation and Operating Instructions contain fundamental information that must be observed during installation, operation and maintenance. It is therefore essential that the relevant operating personnel or the user familiarizes themselves with them before installation and commissioning.

Meaning of symbols and inscriptions on the product

Instructions placed directly on the equipment, e.g:

- arrow indicating the direction of rotation,
- designation of the pressure connection for pumped medium supply,

must be compulsorily observed and preserved so that they can be read at any time.

Qualification and training of service personnel

Personnel who carry out operation, maintenance and inspection work as well as installation of the equipment must have the appropriate qualifications for the job. The scope of matters for which the personnel are responsible and which they must supervise, as well as their area of competence, must be precisely defined by the user.

Dangerous consequences of non-observance of the safety instructions

Failure to observe the safety instructions may result in:

- dangerous consequences for human health and life;
- endangering the environment;
- voiding all warranty claims for damages;
- failure of critical equipment functions;

- ineffectiveness of prescribed maintenance and repair methods;
- a dangerous situation for the health and life of personnel due to electrical or mechanical factors.

Performing work in compliance with safety techniques

The safety instructions in this document, the existing national safety regulations as well as any internal work, operating and safety regulations applicable to the user must be observed during the work.

Safety instructions for the user or the personnel operating

- It is forbidden to dismantle the existing protective guards for moving parts and components when the equipment is located in operation.
- The possibility of electrical hazards must be excluded (for more details see, for example, the regulations of the PUE and the local power supply companies).

Safety instructions for maintenance, inspection and installation work

The user must ensure that all maintenance, inspection and installation work is carried out by qualified personnel who are authorized to carry out such work and have been sufficiently familiarized with it through a detailed study of the installation and operating instructions.

All work must always be carried out with the equipment switched off. The shutdown procedure described in the installation and operating instructions must be strictly adhered to.

Immediately after completion of work, all safety and protection devices that have been removed must be reinstalled or switched on again.

Self-conversion and manufacture of spare parts and components

Conversion or modification of the devices may only be carried out in agreement with the manufacturer.

Original spare parts and components as well as components authorized by the manufacturer are designed to ensure reliable operation.

The use of assemblies and parts from other manufacturers may cause the manufacturer to deny liability for any resulting consequences.

Unacceptable operating modes

The operational reliability of the supplied equipment is guaranteed only if it is used according to with functional purpose according to section 6.

Scope of

application. The maximum permissible values specified in the technical data must be compulsorily observed in all cases.

2. Transportation and storage

The equipment should be transported in covered wagons, closed cars, by air, river or sea transport.

During transportation, the packed equipment must be securely fastened to the means of transportation to prevent unintentional movement.

The maximum prescribed storage period is 2 years.

No preservation is required during the entire storage period.

Storage and transportation temperature (in empty state) min. -30 °C; max. +70 °C.

3. Meaning of symbols and description in the document



Warning

Non-observance of these instructions can have dangerous consequences for human health.

Attention

Safety instructions which, if not followed, may cause equipment failure, as well as damage to it.

Guideline

Recommendations or instructions to facilitate work and ensure safe operation.



Warning

Failure to follow these instructions can result in electric shock and have life- and health-threatening consequences.



Warning

Contact with hot fluids or equipment surfaces can cause burns and serious injury.

4. General information about product

This document applies to Master SD PWM circulation pumps.

Master SD PWM pumps are designed to work in all types of heating systems, cooling systems and air-conditioning systems with variable or constant fluid flow rates. Master SD PWM is equipped with 3 control modes: PWM1, PWM2, MAX

Master SD PWM pumps are equipped with a built-in frequency converter. Do not use an external voltage converter that converts or modifies the frequency or voltage of the pump supply to control pump performance. The stabilizers or UPS used must have a sinusoidal voltage output.

Attention

The scope of delivery includes:

Master SD PWM, plug, rubber seals, threaded pipe connections, technical documentation. The equipment is not supplied with accessories and tools for adjustments, maintenance and intended use. Use standard tools in accordance with the safety requirements of the manufacturer.

Design

The pump is equipped with a permanent magnet motor and an integrated motor speed control system to ensure that the pump performance is matched to the actual demand of the heating system in which the pump is used.

The rotor of Master SD pumps is isolated from the stator by a hermetically sealed sleeve. This means that pump and motor form a single unit without shaft seals. The pump bearings are lubricated by the pumped liquid.

Standard type designation

Example

MASTER SD 25 -4 180 PWM

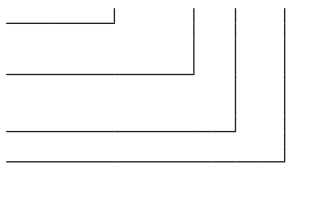
Typical range

Nominal suction diameter and pressure connections (DN), [mm]

Maximum head [m]

Mounting length [mm]

PWM function



Branded plate

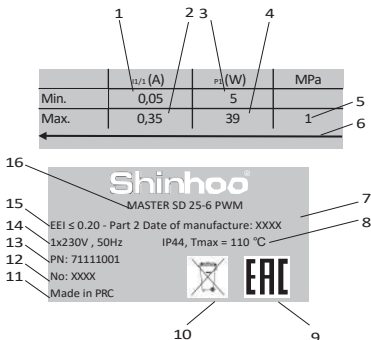


Fig. 1 Master SD pump nameplate

Pos.	Name
1	Minimum amperage
2	Maximum amperage
3	Minimum power consumption
4	Maximum power consumption
5	Maximum system pressure
6	Direction of rotation
7	Date of manufacture [YYWW, where YY is the year of manufacture, WW is the week of manufacture]
8	Degree of protection and maximum fluid temperature
9	Market signs
10	Manipulation sign
11	Country of manufacture
12	Serial number
13	Item
14	Number of phases, mains voltage and rated current frequency
15	Energy Efficiency Index EEI
16	Pump type designation

5. Packing and moving

Packaging

Upon receipt of the equipment, inspect the packaging and the equipment itself for any damage that may have occurred during transportation. Before disposing of the packaging, carefully check for any documents or small parts that may have been left behind. If the equipment received does not match your order, contact to the equipment supplier.

If the equipment is damaged in transit, contact the shipping company immediately and notify the equipment supplier.

The supplier reserves the right to thoroughly inspect possible damage.

Moving



Attention

Warning

Local code restrictions for manual lifting and loading and unloading operations must be observed.

Do not lift the pump by the supply cable.

6. Area of application

Master SD PWM pumps (hereinafter referred to as pumps) are designed for circulation of liquids in cooling and heating systems.

The motor speed can be controlled either by the built-in control modes or by a low-voltage PWM signal from an external controller (see section *PWM Control*).

Pumped fluids

In heating systems, water must meet the requirements of the heating unit mains water quality standards, e.g. VDE.

The pump is suitable for pumping the following liquids:

- Low-viscosity, clean, non-aggressive and non-explosive liquids without solid and long-fiber inclusions.

- The pH value of the pumped liquid must be between 6.5 and 8.5 .
The minimum value depends on the hardness of the water and must not be lower than 7.4 at 4° dH (0.712 mmol/l).
- Electrical conductivity at 25 °C should be $\geq 10 \mu\text{S/cm}$

The kinematic viscosity of water is $\nu = 1 \text{ mm}^2/\text{s}$ (1 cSt) at 20 °C. If the pump is used to pump liquids with a higher viscosity, the pump performance will be reduced.

Example: The viscosity of a pumped liquid containing 50 % glycol at 20 °C is approximately 10 mm²/sec (10 cSt), which reduces the pump capacity by about 15%.

Do not use impurities that may adversely affect the operation of the pump.

The viscosity of the pumped liquid must be taken into account when selecting the pump.



Warning

Do not use the pump for pumping flammable liquids such as diesel fuel, gasoline and other similar liquids.



Warning

Do not use the pump for pumping aggressive liquids such as acids and seawater.

Glycol

Master SD PWM pumps can be used for pumping glycol solutions with a concentration of up to 50 %. The maximum viscosity of a 50% glycol solution at -10 °C is approximately 32 cSt.

Pumping glycol solution changes the hydraulic characteristics of the pump. Increasing the concentration of glycol in the solution above 40% leads to a decrease in the heat capacity of the liquid and a decrease in the efficiency of the system.

Guideline

To prevent the glycol solution parameters from changing, it is necessary to control the temperature of the liquid exceeding the maximum permissible value.

The operating time at high temperatures must be reduced. The system must be cleaned and flushed before adding glycol solution to the system.

The glycol solution should be checked regularly to prevent corrosion and sludge formation. If additional glycol dilution is required, follow the instructions in the glycol supplier's manual.

Attention *DEX-COOL® grade glycol can cause damage to the pump.*

7. Principle of action

The Master SD PWM pumps work by increasing the pressure of the liquid moving from the inlet connection.

The liquid flows through the pump inlet into the rotating impeller.

The centrifugal forces increase the speed of the liquid.

The increasing kinetic energy of the fluid is converted into increased pressure at the outlet.

The rotation of the impeller is provided by an electric motor.

8. Installation of the mechanical part

Location installation

The pumps are intended for indoor installation without danger of external or atmospheric influences. The operating conditions must comply with the requirements of 15. Technical data.

The pumps must be installed in dry conditions, without danger of getting wet, e.g. from surrounding equipment.



Warning

Installation must be carried out by a specialist in accordance with local codes and regulations.

Pump housing

1. The arrows on the pump casing show the direction of liquid flow (see 2).
2. Before the pump is installed in the piping, install the two gaskets supplied with the pump (see Fig. 3).

Install the pump so that the position of the motor shaft and pump head meet the requirements in the section Pump Location Requirements.

3. Tighten the fittings (see 4).

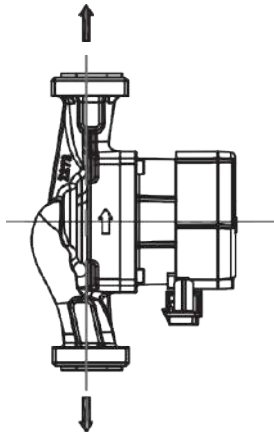


Fig. 2 Direction of flow

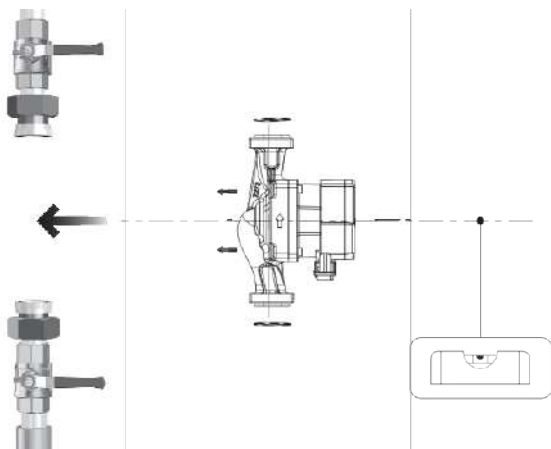


Fig. 3 Mounting the pump

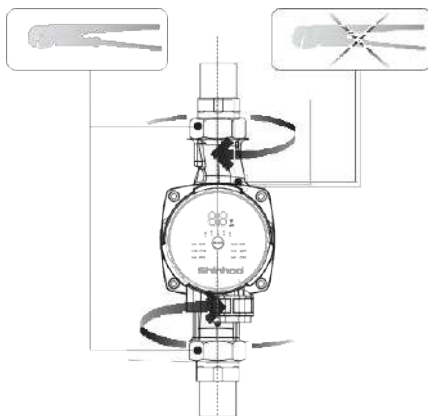


Fig. 4 Tightening the fittings

Location requirements pump

1. The pump must always be mounted so that the motor shaft is horizontal to the ground (see Fig 5).
 2. The pump head can be positioned in any of the four possible positions (see 6). For information on *changing the head position*, see *Changing the Pump Head Position*.
- Examples of correct pump installation are shown in Fig 5.

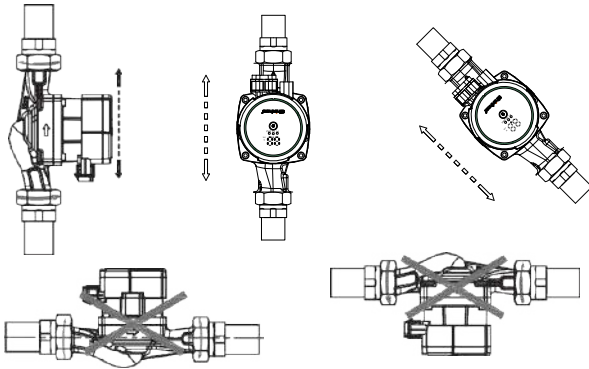


Fig. 5 Pump location

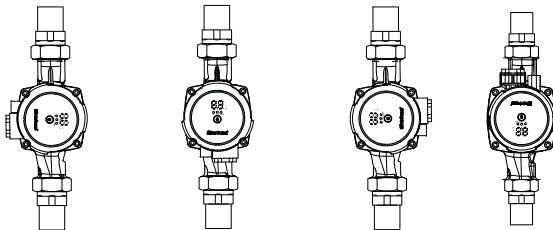


Fig. 6 Pump Head Location

Changing the position of the pump head



Warning

Turn off the power to the pump before performing any work on the pump. Once the power has been turned off, make sure that it cannot be accidentally turned back on.



Warning

The pump casing may be hot due to the high temperature of the liquid it is pumping.

Close the shut-off valves on both sides of the pump before any work is carried out and wait for the pump casing to cool down.






Warning

The pumped liquid in the system may be very hot and pressurized. Before disassembling the pump, drain the system or close the shutoff valves on both sides.

The pump head can be positioned in any of the four possible positions (see 6).

Step	Action	Illustration
1	Make sure that the cocks on the inlet and discharge side are closed. There is no pressure inside the pump.	
2	Remove the pump head mounting screws. Hold the head piece with your hand to prevent it from falling out.	

Step	Action	Illustration
3	Turn the pump head in the shaft axis to the desired position without removing it from the cochlea.	
4	Re-install the mounting screws and tighten crosswise.	
5	Open the taps on the inlet and pressure side, make sure there are no leaks.	

Thermal losses of the pump can be reduced by installing a special thermal insulating cover on the pump casing (see 7). The thermal insulation cover is not included in the delivery of the pump.

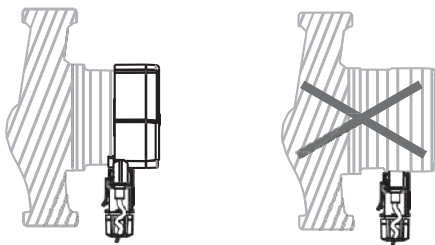


Fig. 7 Installing the insulating jacket

Attention Do not cover the control panel with insulation.

9. Connecting electrical equipment



Warning

Electrical equipment must be wired in accordance with local codes and regulations.



Warning

Turn off the power to the pump before performing any work on the pump. Once the power has been turned off, make sure that it cannot be accidentally turned back on.



Warning

The pump must be grounded. The pump must be connected to an external switch. The gap between the switch contacts on all poles must be at least 3 mm.



Warning

If the electrical insulation is damaged, the current may become a pulsating direct current. Comply with local legislation on the requirements and selection of a residual current device (RCD) when installing the pump.

Warning



Before connecting the pump, make sure that the mains power supply corresponds to the required values on the nameplate, see Nameplate section.

The motor of Master SD PWM pumps is equipped with built-in thermal protection and does not require additional external protection.

The pump must be connected to the power supply using the special plug supplied with the pump.

Connecting plug

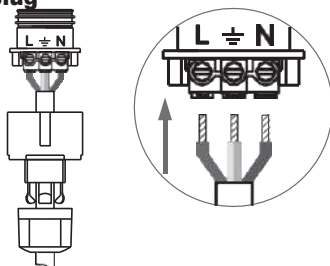


Fig. 8 Pump connection diagram

PWM signal connection

Master SD PWM pumps can be controlled by a PWM signal generated by a third party controller.

A signal cable with a Mini Superseal connector is required to connect the PWM signal (see 9)

Signal cable is not included in the scope of delivery



Fig. 9 Mini Superseal connector

Procedure for connecting the cable:

Step	Action
1	Ensure that the pump is turned off by a PWM signal generated by a third party controller.
2	Connect the cable with Mini Superseal connector to the pump.
3	Turn on the power.
4	The pump will automatically detect the presence of a suitable PWM signal connection and will go to the appropriate operating mode.

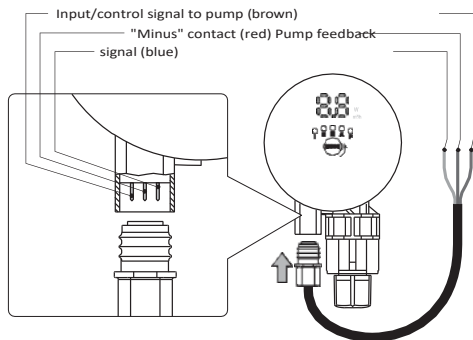


Fig. 10 Connecting the signal cable

For details on the PWM signal control mode from an external controller, refer to *PWM signal control*.

10. Commissioning

All products are subjected to acceptance testing at the factory. No additional testing is required at the installation site.

The system must be filled with operating fluid before operation.






Warning

Do not allow the pump to run without pumped liquid ("dry run")

To put the Master SD PWM pumps into operation, the mains switch must be turned to position "On." The indicator light on the control panel will indicate that the power is on. If necessary, the pump and system must be vented before operation.

Launch

Step	Action	Illustration
1.	Open all shut-off valves	
2.	Turn on the voltage	
3.	The lights on the control panel indicate that voltage is applied and the pump is running	

Removing air from system

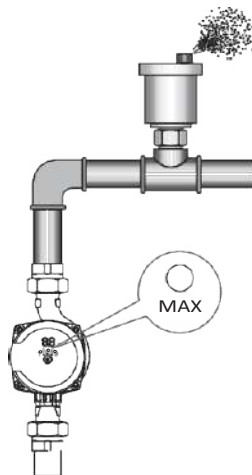


Fig. 11 Venting the system

Air is removed from the heating system by means of an automatic air release valve, installed at the top point of the system. After filling the heating system with working fluid, the following steps must be carried out:

1. Open the air release valve.
2. Use the button on the control panel to set speed III.
3. Turn on the pump for a short period of time, the exact duration of which depends on the size and design of the system.
4. After the system has been vented, i.e. after the noises have disappeared, adjust the pump as recommended, see section *Operation* for more details.

Repeat this procedure if necessary. Once the pump and the heating system have been vented, the pump can be started in operation.

11. Operation




Attention *Do not use the pump to bleed the entire system. Do not operate a pump that is not filled with operating fluid.*

The pump must not be operated for long periods of time without water in the system or without the minimum permissible inlet pressure (see section 15. *Technical data*). Failure to observe these requirements may cause damage to the motor and the pump.

Panel display diagram explanation

The default working mode when powered on is MAX. The working gear of the water pump is shown in the following table.



Light area	illustrate	Icon
MAX	Constant speed high speed	
P1	PWM1 control	
P2	PWM2 control	

Gear Mode Switching Instructions:

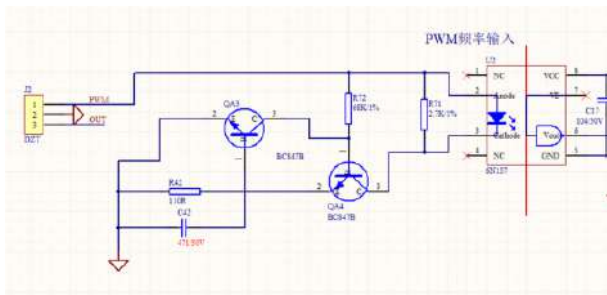
1. The MAX gear is displayed by default.
2. PWM signal switching:
 - 2.1. MAX mode→PWM1: After the PWM signal is turned on, it will automatically switch into PWM1 mode, disconnect the PWM signal and switch to MAX mode.
 - 2.2. MAX mode → PWM2: Automatically cut into PWM1 mode after turning on the PWM signal, at this time the P1 file light is on, and then switch to the PWM2 gear by pressing the button once, the P2 file light is on, press the button once to switch to PWM1 gear, at this time, the P1 file light is on, disconnect the PWM signal and cut into the MAX mode.
3. Switch between power display and flow display: long press for 3 ~ 5 seconds to switch power and flow (flow unit: m^3/h , power unit: W).

Signal connection

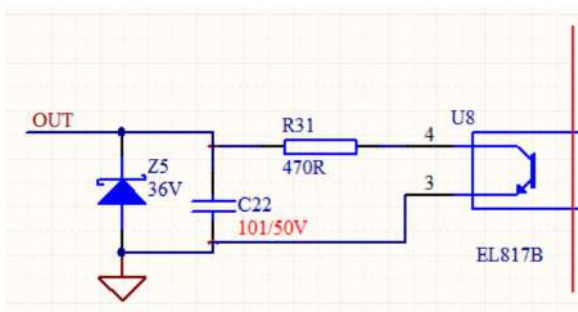
PWM input signal voltage: 4-24V , PWM input signal frequency: 100-4000Hz;

PWM output signal:pump feedback signal, PWM frequency is $75Hz \pm 5\%$.

Interface circuit of PWM input signal



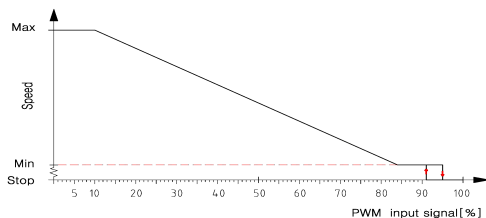
PWM output interface circuit



Electric control instructions

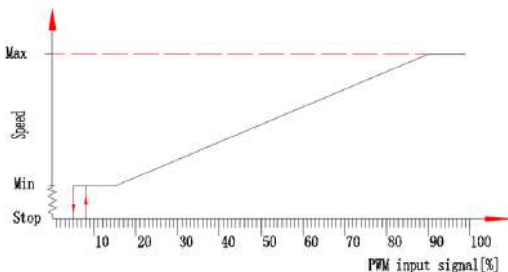
PWM 1 signal input

Under fixed frequency, different duty cycles correspond to different motor given speed signals. Inverse proportional control mode is adopted. The specific control logic is as follows:



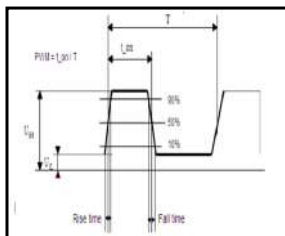
PWM1 Input Signal (%)	Pump Status
0	the pump switches to non-PWM mode (normal mode), and the default system will have no PWM signal input.
≤ 10	the pump runs at the highest velocity
$> 10/\leq 84$	the pump curve will drop from the highest to the lowest
$> 84/\leq 91$	the pump runs at the lowest velocity
$> 91/95$	if the velocity variance point of input signal fluctuates, then it will block the start and stop of the pump according to the principle of magnetic hysteresis
$> 95/\leq 100$	stand-by, the pump stops
Recognition accuracy	± 1 (Example: When the PWM input signal is 20%, the actual duty cycle is in the range of 19%-21%)

PWM 2 signal input



PWM1 Input Signal (%)	Pump Status
≤ 5	Gear display: P2 file light is on, indicating that it is in PWM2 mode Pump status: standby, the pump stops running (the signal line is not connected to the PWM signal, and the pump also stops running)
$> 5/\leq 8$	If the input signal fluctuates near the speed change point, the pump is prevented from starting and stopping according to the hysteresis principle
$> 8/\leq 15$	The water pump operates at the lowest speed
$> 15/\leq 90$	The pump rises linearly from the lowest to the highest
$> 90/\leq 100$	Gear display: P2 file light is on, indicating that in PWM2 mode, pump status: the pump is running at the highest speed
Recognition accuracy	± 1 (Example: When the PWM input signal is 20%, the actual duty cycle is in the range of 19%-21%)

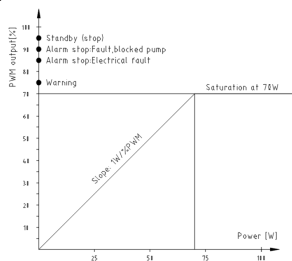
PWM input signal	parameter
Current isolation in pump	YES
Frequency input	100 – 4000 Hz
Input voltage high level	4.0 – 24 V
Input voltage low level	≤ 0.7V
Input current high level	Max 10 mA@100Ohms
Input PWM duty cycle	0 – 100 %
Signal polarity	Fixed changeless
Rise time	≤ T/1000



PWM feedback

Frequency range: 75±5%Hz.

Corresponding relationship between output signal and circulating pump and operating status.



PWM output signal(%)	State	Potential causes
95	Standby (stop)	The pump stops
90	Alarm shutdown, fault (pump stuck) (locked rotor protection)	The water pump does not operate. After the fault disappears, the water pump will operate again.
85	Alarm shutdown, electrical fault (light load protection, phase loss protection, overcurrent protection, over temperature protection, etc.)	The water pump does not run, and the water pump will run again after the fault disappears; Remarks: After the number of protection times is reached, it will not be restarted, and it needs to be powered on again for operation.

	Warning (overvoltage protection and undervoltage protection)	The water pump does not operate. In this case, the fault has been detected, but the fault is not critical. It can still work normally after the protection value is restored.
	0-70W (slope 1 W/% PWM) $\pm 1\%$	
Recognition accuracy: ± 1 (Example: When the PWM input signal is 20%, the actual duty cycle is in the range of 19% ~ 21%)		

12. Technical maintenance

If the pump is not running for a long period of time (disconnected from electricity), there is a high risk of the pump jamming. In order to avoid pump jamming during idle periods, the pump room should be cleaned

Guideline

to remove deposits and residual pumped liquid.

Maintenance of the pump consists of keeping the product clean and regularly checking the integrity of the electrical cables, electrical blocks and connection of the inlet and outlet connections of the pump. Depending on the pumped medium (high water hardness, suspended solids, iron salts), cleaning of the pump part may be necessary.



Warning

Before starting any work on the pump, make sure that the power supply is switched off so that it cannot be switched on accidentally.



Warning

Provision must be made to protect personnel from injury and to prevent equipment damage from fluid escaping from the pump during maintenance work.

13. Withdrawal from operation

In order to take the Master SD pumps out of operation, the mains switch must be turned to position

"Disabled."



Warning

All electrical lines upstream of the mains switch are permanently energized. Therefore, the mains switch must be locked out to prevent accidental or unauthorized activation of the equipment.

14. Protection against low temperatures

If the pump will not be operated during a period of sub-zero ambient temperature, the pump must be drained of the pumped liquid to avoid damage.

If there is a risk of damage to the pump during cold storage, the pump must be protected from low temperatures.

Attention

15. Technical data

Performance data		
Sound pressure level	Does not exceed 45 dB(A). Measurement uncertainty characteristic (parameter K) is 3 dB.	
Relative humidity	95% max, non-condensing environment environment	
System pressure	PN 10: Maximum 1 MPa (10 bar)	
Pump inlet pressure	Maximum 1 MPa (10 bar)	
Required minimum pressure at the pump inlet connection	Liquid temperature	Pressure
	≤75 °C	0,5 m (0.05 bar)
	90 °C	2,8 m (0.28 bar)
	110 °C	10 m (1 bar)
Ambient temperature	-30 ... 70 °C	
Pumped liquid temperature	-30 ... +110 °C	
Liquid	Maximum water/propylene glycol ratio = 50% Note: Glycol content reduces pump performance due to increased viscosity pumped liquid	
Viscosity	Maximum 10 mm ² /s (10 cSt)	
Maximum installation height in relation to sea level	1000 m above sea level	

Electrical data		
Rated supply voltage	1x230 V \pm 10 %, 50 Hz, PE	
Heat resistance class of insulation materials	H	
Pump power consumption when the pump is switched off	\leq 3 W	
Inrush current	< 10A	
Pump on/off frequency	No special requirements	
General data		
Engine protection	No additional protection required	
Protection class	IP 44	
Temperature class	TF 110	
Energy Efficiency Index EEI	Master SD XX-4 Master SD XX-6 Master SD XX-7 Master SD XX-8	\leq 0.20

Prolonged operation of the pump at mains voltages other than the rated voltage may shorten its service life.

Attention

16. Detecting and eliminating faults

If the pump has detected one or more alarms, the LEDs on the control panel flash continuously and an error code is displayed. The type of alarm can be determined from Table 1. If more than one alarm occurs at the same time, the LEDs will indicate the error with the highest priority.

Table 1: Troubleshooting

1. Over-voltage protection: In the power test, the detection input voltage is higher than $278\pm 10\text{V}$, enters the overvoltage protection after 2S, the gear indicator flashes once at the same time, the display board shows E1, the pump stops running, when the voltage returns to $260\pm 10\text{V}$, the pump returns to normal work.

2. Under-voltage protection: In the power-on test, detect the input voltage is lower than $160\pm 10\text{V}$, enter the under-voltage protection after 2s, the gear indicator flashes twice at the same time, the display board displays E2, the pump stops running, when the voltage returns to $170\pm 10\text{V}$, the pump works normally.

3. Over-current protection: When the pump is running, if the hardware current is too large, turn on the overcurrent protection. When overcurrent occurs, the pump stops working immediately, the gear indicator flashes 3 times at the same time, the display board displays E3, the pump restarts after 8s, if the fault is not eliminated, it has been circulating.

4. Phase loss protection: When the motor is out of phase, the gear indicator flashes 4 times at the same time, and the display board displays E4. The pump stops working immediately, and the pump restarts after 8s. After the consecutive number of protection reaches 5 times, the pump is completely protected and no longer restarted. It needs to be powered on again. (Missing one phase reports missing phase, missing two phases reports blocked rotation)

5. Stalled rotor protection: After 3s of blocked rotation, the gear indicator flashes 5 times at the same time, the display board displays E5, the pump stops working, and the pump restarts after 8s. If the fault is not eliminated. After the consecutive number of protection reaches 5 times, the pump is completely protected and no longer restarted, and it needs to be powered on again.

6. Light load protection: In MAX, the pump continues to run for 10s in no-load state, turn on light load protection, then the gear indicator blinks for 6 times at the same time, the display board shows E6, and the pump restarts after 8s, after the consecutive number of protection reaches 5 times, the pump is completely protected, no longer restarted, need to be powered on again.

7. Over-temperature protection: At rated voltage, frequency, high temperature environment and high temperature water operation, when the IPM module surface temperature is higher than $125\pm 10\%^\circ\text{C}$, the pump will stop, the gear indicator will blink 7 times at the same time, and the display board will display E7. When the IPM surface temperature is lower than $100\pm 10\%^\circ\text{C}$, the pump will resume normal operation.

8. Overheat protection: The pump is in the state of reduced power operation. In the rated voltage, frequency, high temperature environment high temperature water operation, when the IPM module surface temperature is higher than $115\pm 10\%^\circ\text{C}$, the pump is reduced to 0.5 times the rated power operation, the temperature is lower than $100\pm 10\%^\circ\text{C}$, the pump returns to normal work.



Warning

Before starting work, make sure that the power to the pump is switched off and take measures to prevent it from being switched on accidentally.

Actions in case of contamination of the flow part of pump

In case of contamination of the flowing part of the pump, it must be cleaned:

1. Before starting work, close the gate valves on each side of the pump, disconnect the power supply.
2. Remove the four set screws (4 or 5 mm) while holding the motor stator.
3. Carefully separate the stator housing from the pump casing.
4. Clean (rinse) the impeller.
5. Carefully insert the stator housing into the pump casing.
6. Insert the set screws and tighten them diagonally and with a constant torque (5 Nm).
7. Check that the impeller turns freely. If the impeller does not turn freely, repeat the disassembly/assembly process.

Critical failures can result:

- incorrect electrical connection;
- improper storage of equipment;
- damage or malfunction of the electrical/hydraulic/mechanical system;
- damage or malfunction of critical parts of the equipment;
- violation of rules and conditions of operation, maintenance, installation, control inspections.

To prevent erroneous actions, personnel must be thoroughly familiarized with this installation and operating manual.

In the event of an accident, failure or incident, the equipment must be stopped immediately and contact the service center.

17. Disposal of product




The main criterion for the limit state of a product is:

1. failure of one or more component parts that cannot be repaired or replaced;
2. increased repair and maintenance costs resulting in uneconomic operation.

This product, as well as assemblies and parts, must be assembled and disposed of in accordance with local environmental regulations.

18. Information on recycling packaging

General information on labeling any type of packaging		
 <p>The packaging is not intended to come into contact with foodstuffs</p>		
Packing material	Name of packaging / packaging aids	Letter designation of the material from which the packaging/ packaging aids are made
Paper and cardboard (corrugated cardboard, paper, other cardboard)	Boxes/boxes, liners, gaskets, liners, liners, grates, retainers, packing material	 PAP
Wood and wood-based materials (wood, cork)	Boxes (board, plywood, fiberboard), pallets, laths, removable sides, strips, laths, clamps	 FOR
Plastic (low-density polyethylene)	Pouches, bags, foils, pouches, bubble wrap, retainers	 LDPE

Packing material		Name of packaging / packaging aids	Letter designation of the material from which the packaging/ packaging aids are made
Plastic	(high-density polyethylene)	Sealing gaskets (made of film materials), including air gaskets. bubble wrap, clamps, stuffing material	 HDPE
	(polystyrene)	Sealing gaskets made of foamed plastics	 PS
Combination packaging (paper and cardboard/plastic)		Skin type packaging	 C/PAP
<p>Please pay attention to the marking of the packaging itself and/or the packaging aids (if applied by the packaging manufacturer). If necessary, in order to save resources and environmental performance, the manufacturer may reuse the packaging and/or packaging aids. The packaging, packaging aids and the materials from which they are made are subject to change at the manufacturer's discretion. Please contact the manufacturer of the finished product listed in section 18 for the latest information. Manufacturer. Service life of this Data Sheet, Installation Manual and operation. Please specify the article number when inquiring equipment.</p>			

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