# Technical Specification

SPM-A High efficiency circulator serials

# 1. Product overview

## 1.1. Model Illustration

| SPM25-6-130A | |
|---|---|
| SPM-A | Intelligent variable frequency circulating pump |
| 25 | Inlet & outlet diameter 25mm 25mm |
| 6 | Max head：6m（flow 0 m³/h） |
| 130 | Distance between inlet & outlet 130mm 130mm |

## 1.2. Product application

This series of products is specially designed for heating systems and can be applied to heating systems such as domestic hot water circulation systems, heating ventilation and air conditioning (HVAC) systems, such as:

➢ Ground heating mixed water system

➢ Air energy hot water circulation system

➢ HVAC

➢ Boiler system

➢ Heat pump

➢ Micro combined heat and power (CHP)

## 1.3. Main features

➢ EEI≤0.20 - Part 3

➢ Permanent magnet motor, intelligent frequency control

➢ Compact size, easy for installation

➢ Faster connector cable, easy for installation and maintenance.

➢ Proportional pressure mode

➢ Constant pressure mode

➢ Constant speed mode

➢ AUTO mode

➤ PWM external control available

➤ Low noise, low temperature

## 1.4. Working condition

➤ Liquid temperature: 0℃ ~ +110℃

➤ Ambient temperature: -25℃ ~ +53℃

➤ Max system pressure: 1.0MPa (10bar)

➤ Protection level: IP44

➤ Rated voltage/frequency: 230V、50/60Hz

➤ Insulation class: F

➤ Pumped liquid characteristics: clean liquid, free from solids and mineral oils, non-toxic, chemically neutral, close to the characteristics of water

## 1.5. Pumped liquid

➤ Heating water

➤ Glycol solution with density ≤50%

➤ Liquid p 6.5 ~ 8.5

➤ The medium does not contain solid impurities with a volume ratio of more than 0.01% and a particle size of not more than 0.1mm

➤ The number of filter meshes shall not be less than 55 meshes

## 1.6. Technical data

| Parameter | Data |
|---|---|
| Pump type | Centrifugal circulating pump (non-self-priming) |
| Single-phase power supply（AC/DC） | AC |
| Voltage | 230V |
| Frequency | 50/60Hz |
| Input power | 4～65W |
| Current | 0.04～0.65A |
| Rotation speed | 1000～4000r/m |
| IP class | IP44 |
| Insulation class | Class F |
| EEI | 4/6m EEI≤0.20-Part3, |
| | 8m EEI≤0.21-Part3 |
| Max head | 4m/6m/8 m |
| Max flow | 4m：2.4m（1.5m³/h）  6m：3.8m（1.8m³/h） 8m：5.5m（1.9m³/h） |
| Pipe size | DN20/ DN25/ DN32 |
| Inlet&outlet union size | G1/ G1.5/ G2 |
| Rotation direction | Clockwise seeing form the control box |
| Overload protection | Electronic overload protection |
| Inrush current pump internal solution | NTC+varistor+Relay |

# 2. Product function

| No. | Item | Description |
|---|---|---|
| 1 | Running、control mode | PP, CP, CS, AUTO mode+PWM external speed control(optional) |
| 2 | Start | Under maximum torque |
| 3 | PWM external speed control((optional)) | PWM signal automatically recognizes entering and exiting speed control mode |
| 4 | Display | LED digital tube, speed control mode display, fault code display |
| 5 | Protection | Overcurrent protection, over/under voltage protection, phase loss protection, locked rotor protection |
| 6 | PWM feedback | 0—specified flow, feedback pump flow, fault feedback |

## 2.1. Performance curve

（1）SPM-4m
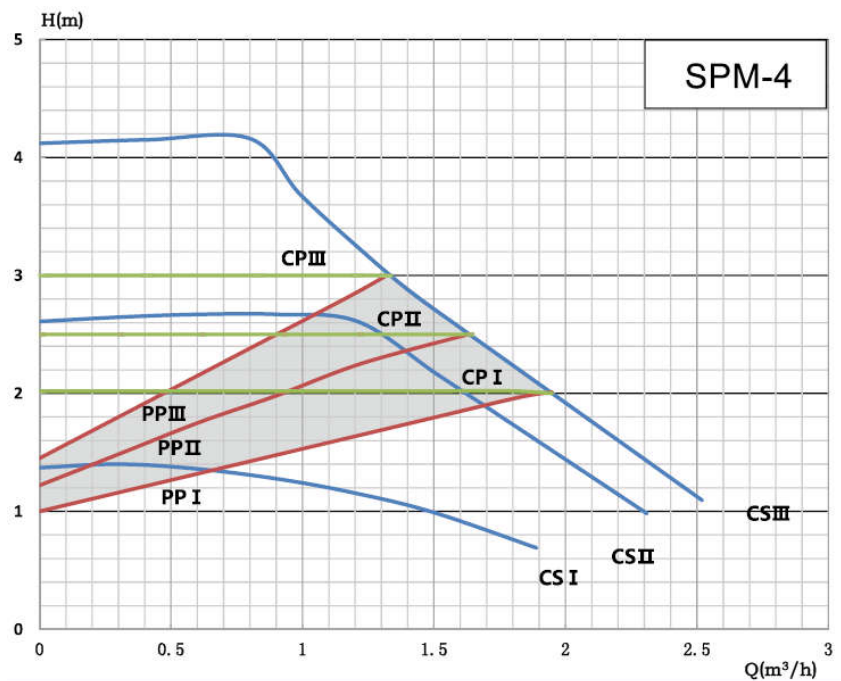


（2）SPM-6m
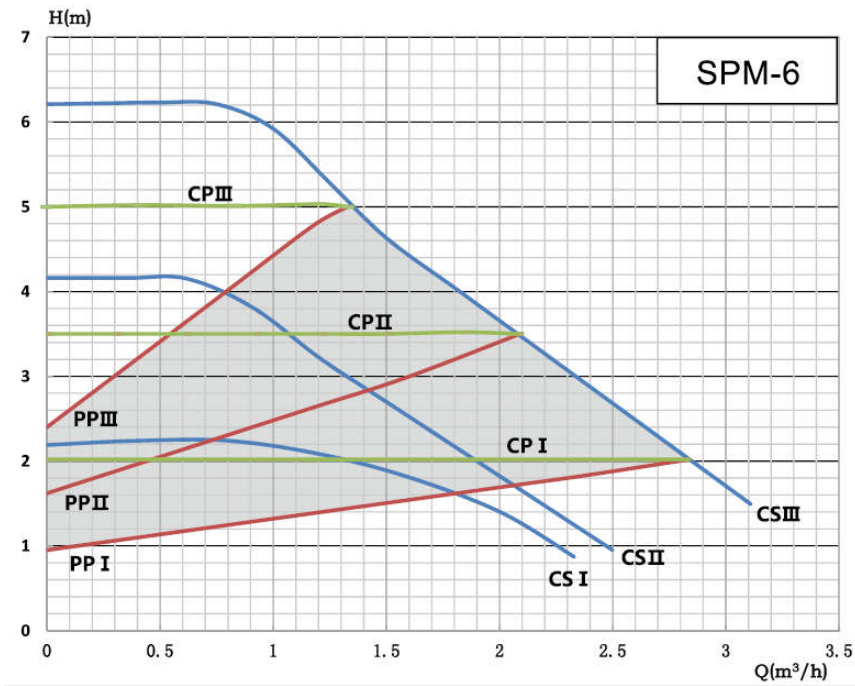
(3) SPM-8m
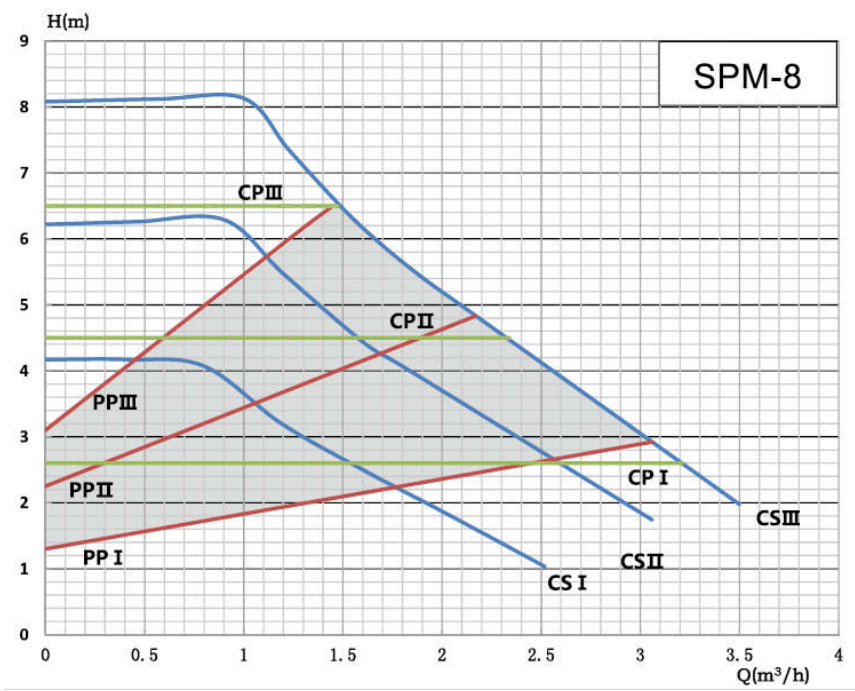
| Item | Model | Pipe size | Max input power | Max head | Max flow | Rated flow | Rated head | Eff. | EEI |
|------|-------|-----------|------|----------|----------|------------|------------|------|-----|
| | | (mm) | W | m | m^3/h | m^3/h | m | % | ≤0.20 |
| 1 | SPM20-4-130A | DN20 | 25 | 4 | 2.2 | 1.5 | 2.4 | 40 | ≤0.20 |
| 2 | SPM20-6-130A | DN20 | 45 | 6 | 2.5 | 1.8 | 3.8 | 40 | ≤0.20 |
| 3 | SPM20-8-130A | DN20 | 63 | 8 | 2.5 | 1.9 | 5 | 40 | ≤0.21 |
| 4 | SPM25-4-130A | DN25 | 25 | 4 | 2.5 | 1.5 | 2.4 | 40 | ≤0.20 |
| 5 | SPM25-6-130A | DN25 | 45 | 6 | 3.5 | 1.8 | 3.8 | 40 | ≤0.20 |
| 6 | SPM25-8-130A | DN25 | 63 | 8 | 3.5 | 1.9 | 5 | 40 | ≤0.21 |
| 7 | SPM25-4-180A | DN25 | 25 | 4 | 2.5 | 1.5 | 2.4 | 40 | ≤0.20 |
| 8 | SPM25-6-180A | DN25 | 45 | 6 | 3.5 | 1.8 | 3.8 | 40 | ≤0.20 |
| 9 | SPM25-8-180A | DN25 | 63 | 8 | 3.8 | 1.9 | 5 | 40 | ≤0.21 |
| 10 | SPM32-4-180A | DN32 | 25 | 4 | 3 | 1.5 | 2.4 | 40 | ≤0.20 |
| 11 | SPM32-6-180A | DN32 | 45 | 6 | 3.5 | 1.8 | 3.8 | 40 | ≤0.20 |
| 12 | SPM32-8-180A | DN32 | 63 | 8 | 4 | 1.9 | 5 | 40 | ≤0.21 |

## 2.2.  PWM

### 2.2.1.  Basic Control Logic

When the PWM signal is connected, the operation of the water pump is controlled by the PWM signal. When there is no PWM signal, the operation of the water pump is controlled according to the internal control logic.
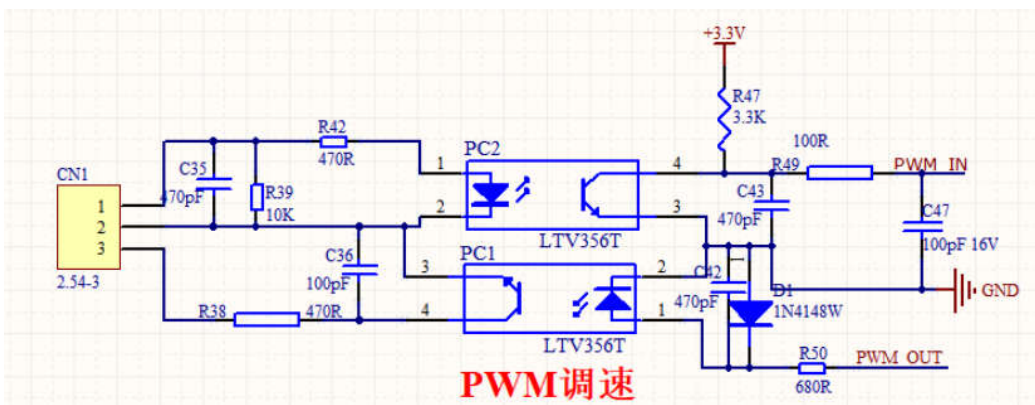


### 2.2.2.  PWM input signal (PWM1 for heating)

When the PWM signal percentage (duty cycle) is high, the hysteresis can prevent the circulating pump from starting and stopping if the input signal fluctuates around the transition point. When the PWM signal percentage is low, the speed of the circulation pump is high for safety reasons. If the cables in the gas boiler system are damaged, the pump will continue to run at maximum speed to transfer heat from the primary heat exchanger. This is also suitable for heating the circulating pump to ensure that the pump can transfer heat in the event of a cable damage.
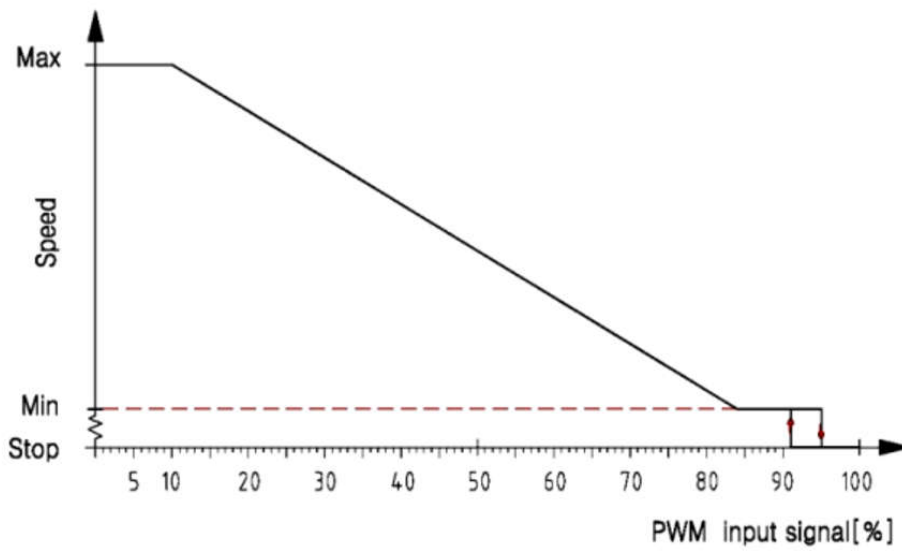
PWM input signal（%）

| PWM input signal (%) | Pump status |
|---|---|
| 0 | the pump enter into non-PWM mode (internal control) operation, the system has no PWM signal input by default |
| 0＜PWM≤10 | Maximum speed: Max. |
| 10＜PWM≤84 | Variable speed: max. to min. |
| 84＜PWM≤91 | Minimum speed: Min |
| 91＜PWM≤95 | Hysteresis area: on/off |
| 95＜PWM≤100 | Standby mode: off |

### 2.2.3. PWM Signal Characteristic Definition

2.2.3.1. PWM input

| Signal Characteristic Definition | |
|---|---|
| Optocoupler isolation | YES |
| PWM input frequency | 150—5000Hz |
| High-level input voltage$U_{iH}$ | 2.8—5.5V |
| Low-level input voltage$U_{iL}$ | ＜1V |
| High-level input current$I_H$ | ＜10mA |
| PWM output duty cycle | 0—100% |
| Signal polarity | Fixed |
| Length of signal line | ＜3m |
| Rising and falling time | ＜T/1000 |
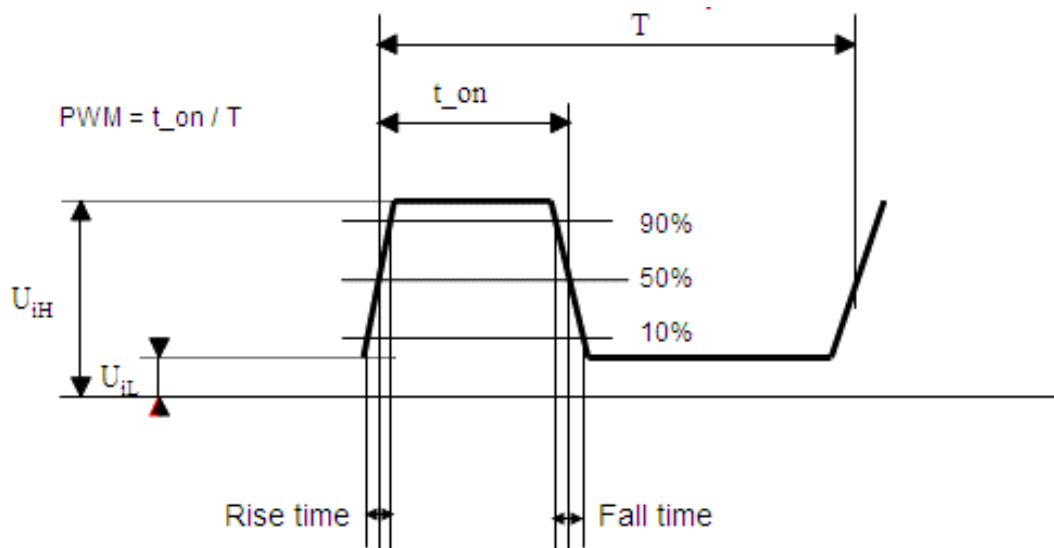


## 2.2.3.2. PWM output

| Signal Characteristic Definition | |
|---|---|
| Optocoupler isolation | YES |
| PWM output frequency | 75Hz±5% |
| PWM output signal accuracy | ±3% |
| PWM output duty cycle | 0—100% |
| Output pole current drive capability | ＜10mA |
| Output pole maximum pull-up voltage | ＜50V |
| Signal polarity | fixed |
| Length of signal line | ＜3m |

Remark：recommended value：

➢ The peak voltage of PWM input is 2.8-5V, that is: conventional 3.3V or 5V。

➢ PWM output: The pull-up voltage of the output pole is 5V. It is recommended to use a pull-up resistor with a resistance value of 4.7K.

   The pull-up voltage of the output pole is 3.3V. It is recommended to use a pull-up resistor with a resistance value of 3K or 3.3K.

   The pull-up voltage of the output pole is 15V. It is recommended to use a pull-up resistor with a resistance value of 10K.

## 2.2.4. PWM output
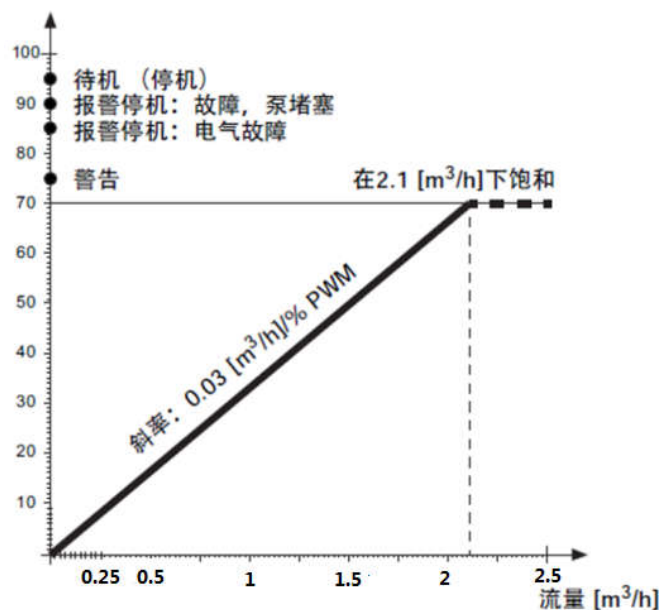


PWM output strategy

| PWM output signal（%） | Pump status | Causes |
|---|---|---|
| 0 | PWM output signal missing | PWM signal feedback line connection problem, or the water pump is powered off and shut down |
| 2 | Stand-by | / |
| 5-70 | Pump is running，return 0—Qmax,（specified flow）flow information | / |
| 75 | Warning (low voltage 170-194V/high voltage 250-270V) | The power input voltage is at low or high voltage |
| 85 | Alarm/stop/electric error(phase loss, overcurrent fault) | Motor UVW phase loss and UVW short circuit cause hardware overcurrent |
| 90 | Alarm/stop/block error (stall/dry-running fault) | Rotor stuck, pump locked |
| 95 | Standby/stop | |
| 100 | No PWM signal input | PWM signal line connection problem |
| Remark | output signal frequency75Hz（±3%） | |

Under/Over Voltage Protection Description：

➢ Under/overvoltage protection voltage value accuracy range ±5V

➢ Under-voltage reset: When the voltage is lower than 170V, the low-voltage protection of the electric pump stops running, and the voltage needs to be reset to 185V to start the electric pump normally (when the voltage changes dynamically)

➢ Overvoltage reset: When the voltage is higher than 270V, the high-voltage protection of the electric pump stops running, and the voltage needs to be reset to 265V to start the electric pump normally (when the voltage changes dynamically)

## 2.3 Start-up peak current

| Pump model | Input voltage | Imax | Tmax |
|---|---|---|---|
| All models | 180V | < 1.3A | < 6ms |
| | 230V | < 1.6A | < 6ms |
| | 265V | < 2.1A | < 6ms |

| | |
|---|---|
| Remark | In order to avoid the effect of self-heating, the interval between two measurements should not be less than 2Min |
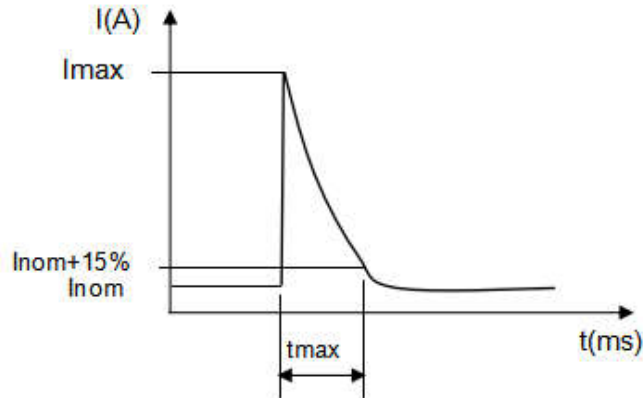


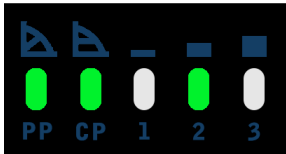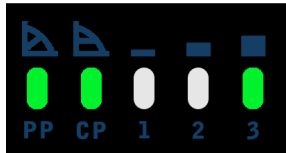**Peak current graph**

## 2.4 Panel display

When there is no PWM signal input, the pump runs according to the maximum constant power curve. When there is a PWM signal input, it runs according to the PWM speed regulation logic. The right picture is an overview of the panel.



After the power is turned on, all green LED lights flash 3 times, and the speed control mode is displayed as follows:

| Pump status | Display | Pump status | Display |
|---|---|---|---|
| No PWM signal |  | PWM signal enter in |  |

## 2.5 Fault display

| Fault description | | |
|---|---|---|
| **Protection** | **Description** | **Display** |
| Locked rotor protection | When the rotor shaft of the electric pump is stuck, the electric pump tries to restart, and restarts every 5S. When trying to restart, the electric pump reports a blocking error and the panel displays a fault code. The pump restarts in this cycle for 5 times and then stops. | |
| Over/Under Voltage Protection | In abnormal conditions, when the input voltage is less than 165V or higher than 275V, the electric pump will enter the protection state and stop, and report an electrical fault and the panel will display a fault code, so as not to exceed the range and cause damage. When the voltage return to 160V-270V, the electric pump will resume running. | |
| Phase loss protection | When the phase failure of the electric pump occurs, the electric pump tries to restart, and restarts every 1S. When trying to restart, the electric pump reports an electrical error and the panel displays a fault code. The pump restarts in this cycle for 5 times and then stops. | |
| Overcurrent (Short Circuit) Protection | When the electric pump is short-circuited, overheated and other faults, the electric pump tries to restart, and restarts every 1S. When trying to restart, the electric pump reports an electrical error and the panel displays a fault code. The pump restarts in this cycle for 5 times and then stops. | |

## 3. Applied standards

Q/SG 602, GB 4706.1-2005, GB 4706.71-2008, EMC Directive (2004/108/EC), ErP Directive (2009/125/EC), RoHS II Directive (2011/65/EU)
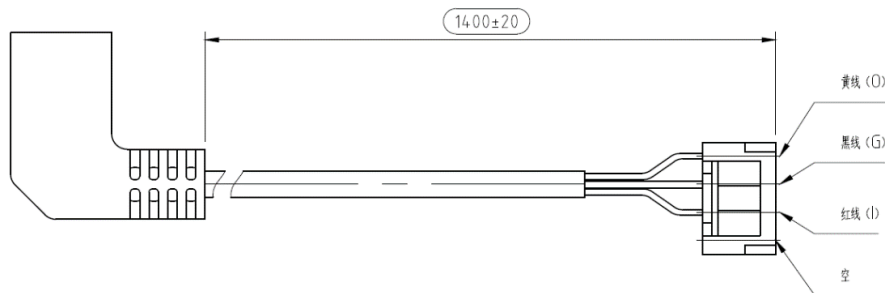
## 4. Pump structure
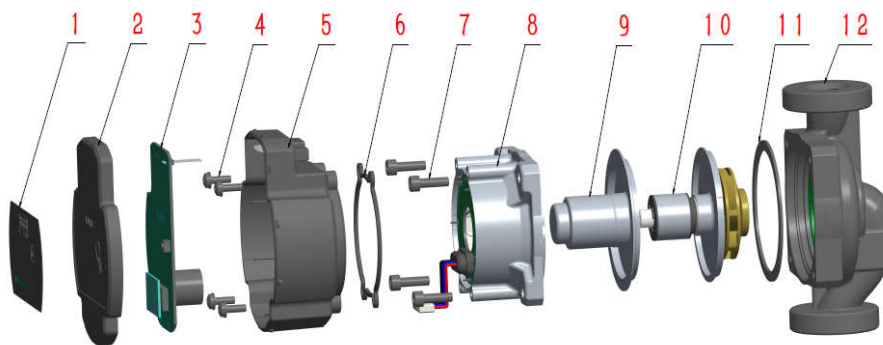


| Item | Part name |
|:---:|:---|
| 1 | Display panel |
| 2 | Control box cover |
| 3 | Control electronics |
| 4 | Nuts |
| 5 | Control box |
| 6 | Control box sealing |
| 7 | Nuts |
| 8 | Motor |
| 9 | Rotor can assembly |
| 10 | Rotor assembly |
| 11 | Flat gasket |
| 12 | Pump body |

# 5. Wiring diagram

## 5.1 Signal cable



The black wire of the PWM signal line is connected to the GND mark (ground) of the control board, the red wire is connected to the Input mark (input), and the yellow wire is connected to the Output mark (output).

## 5.2 Power cable
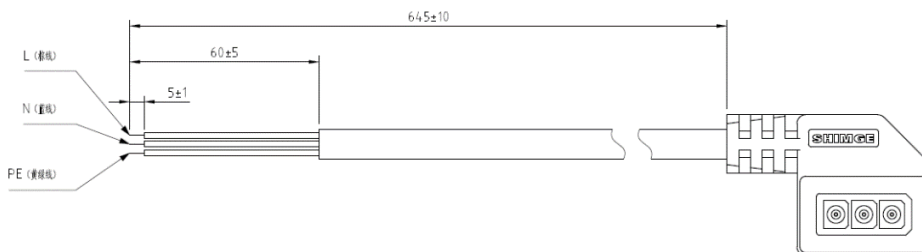


The brown wire of the power cord is connected to the L mark (live wire) of the control board, the blue wire is connected to the N mark (neutral wire), and the yellow-green wire is connected to the PE mark (ground).

# 6. Pump dimension
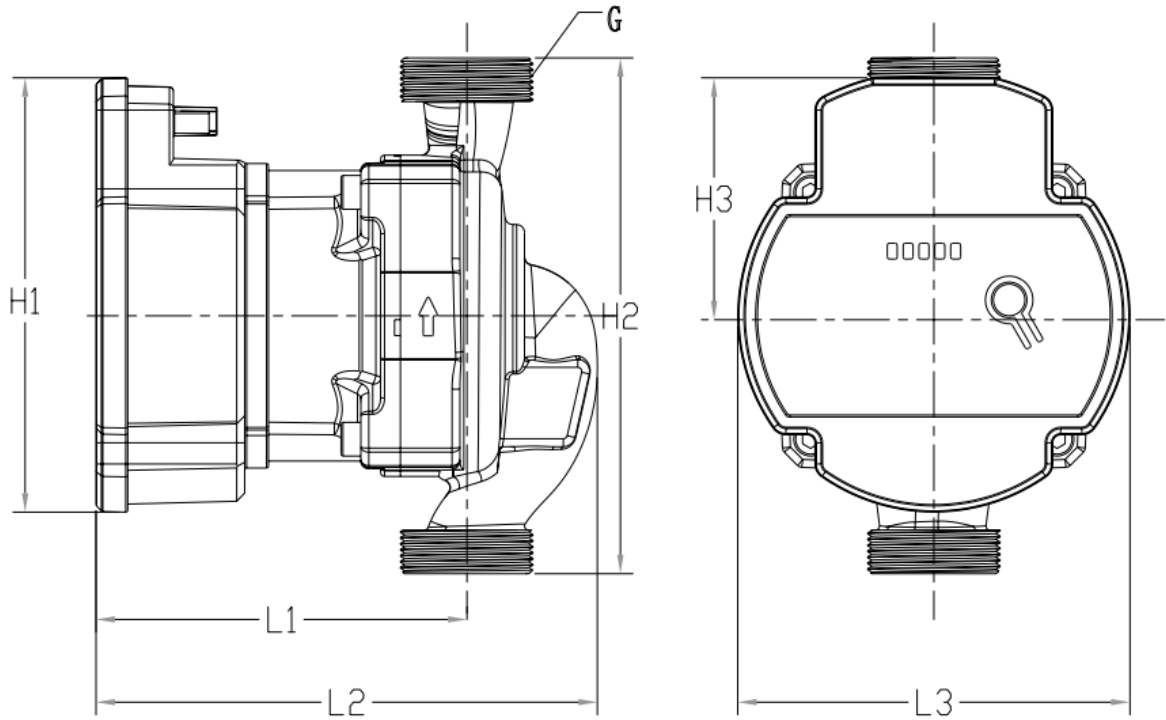
| Model | Size（mm） | | | | | | | | Inner box（kg） | | Outer box | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L1 | L2 | L3 | H1 | H2 | H3 | G | Union | NW | GW | Qty | Size（mm） | GW（kg） |
| SPM20-4-130A | | | | | | | G1 | G1 to G3/4 | 1.6 | 2.0 | | 320×290×260 | 16 |
| SPM20-6-130A | | | | | | | | | | | | | |
| SPM20-8-130A | | | | | 130 | | | | | | | | |
| SPM25-4-130A | | | | | | | G1 1/2 | G1 1/2 to G1 | 1.7 | 2.2 | | | 18 |
| SPM25-6-130A | 94 | 127 | 99 | 110 | | 60 | | | | | 8 | | |
| SPM25-8-130A | | | | | | | | | | | | | |
| SPM25-4-180A | | | | | | | | | 1.9 | 2.4 | | 410×290×240 | 20 |
| SPM25-6-180A | | | | | | | | | | | | | |
| SPM25-8-180A | | | | | 180 | | | | | | | | |
| SPM32-4-180A | | | | | | | G2 | G2 to G1 1/4 | 2.0 | 2.75 | | | 22.5 |
| SPM32-6-180A | | | | | | | | | | | | | |
| SPM32-8-180A | | | | | | | | | | | | | |