Single-Phase Fully Isolated Intelligent Voltage Regulation Module

Introduction:

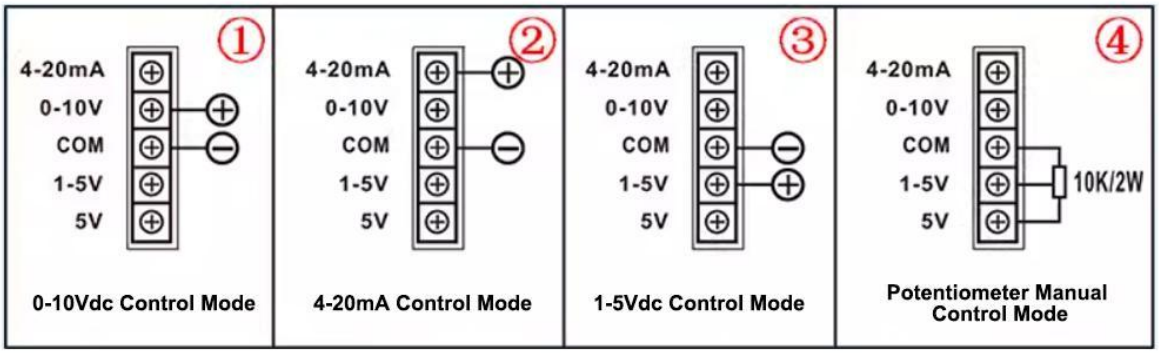
1. The single-phase fully isolated voltage regulation module is a high-precision product independently developed by our company. It adopts imported integrated circuit design, and internally integrates phase-shift trigger circuits, unidirectional or bidirectional thyristors, power circuits, etc.
2. It automatically adjusts the voltage on the load by changing the firing angle, thereby regulating the output power. It is widely used in electric furnaces, injection molding equipment, textile equipment, injection molding machines, industrial lighting, stage lighting, infrared heating, power distribution systems, drying systems and other industries.

3. The module is available in single-phase 220V and single-phase 380V versions, with current ratings: 10A, 25A, 40A, 60A, 80A, 100A, 120A, 160A, 200A; for higher currents, please use our intelligent single-phase AC phase-shift trigger module.
4. It supports full-compatibility input control modes including 0-5Vdc, 0-10Vdc, 4-20mA, and can also be manually controlled. The output voltage is linearly adjustable from 0V to the maximum value.
5. The module features an integrated structure with a built-in power transformer, featuring simple wiring, convenient use and extremely high cost performance.
6. The module adopts SMT process and DCB ceramic substrate, ensuring stable performance and high reliability, and can adapt to resistive loads.
7. The module is equipped with an LED power indicator and LED output indicator.
8. Full isolation design is adopted between all input control terminals and the main power circuit, with a dielectric withstand voltage exceeding 2000 Vac.
9. It has a linear compensation function, making the output characteristic linear.

Instructions for Use of Each Functional Mode of Input Terminals

Unique full-compatibility input control mode: compatible with automatic modes such as 0-10Vdc, 4-20mA, 1-5Vdc, and can also be manually controlled via a potentiometer. It features a wide input adjustment range, high output adjustment accuracy and strong anti-interference ability.

Single-Phase Fully Isolated Intelligent Voltage Regulation Module Control Method



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1. 0-10Vdc Control Mode:

As shown in the diagram, it can accept 0-10Vdc analog signals from PLC, temperature controllers, etc. The input impedance of the internal 0-10Vdc terminal relative to the COM terminal is greater than 100KΩ.

2. 4-20mA Control Mode:

As shown in the diagram, it can accept 4-20mA analog signals from PLC, temperature controllers, etc. The input impedance of the internal 4-20mA terminal relative to the com terminal is 250Ω. When 4-20mA control is input, as the control current increases, the phase-shift angle α linearly decreases from 180° to 0°, and the voltage on the AC load increases from 0 to the maximum value; 19-20mA is the full-open area with maximum output.

3. 1-5Vdc Control Mode:

As shown in the diagram, it can accept 1-5Vdc analog signals from PLC, temperature controllers, etc. The positive pole of the control input is connected to 1-5V, and the negative pole is connected to com. The input impedance of the internal 1-5V terminal relative to the com terminal is 500Ω. When the control terminal cont changes from 1-5Vdc, the voltage on the AC load is linearly adjustable from 0V to the maximum value: as the control voltage increases, the phase-shift angle α linearly decreases from 180° to 0°, the conduction angle increases, and the voltage on the AC load increases from 0V to the maximum value.

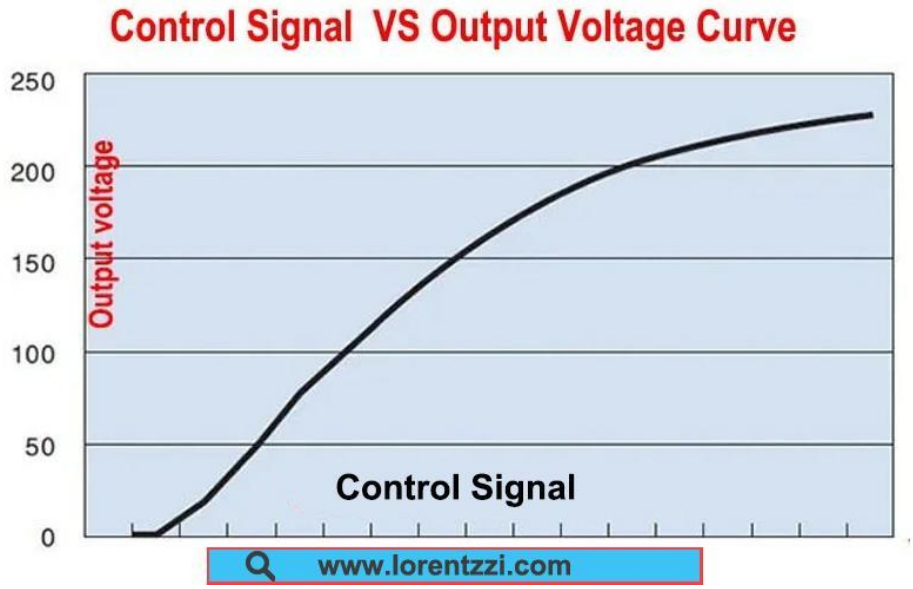
4. Potentiometer Manual Control Mode:

As shown in the diagram, the middle terminal of the potentiometer is connected to the module's 1-5V (COM) terminal, and the two ends of the potentiometer are connected to the module's com terminal and +5V terminal respectively. The +5V voltage is generated internally by the module, no external supply is required. It only works with a hand-controlled potentiometer and has no other functions. The selected potentiometer resistance is 2W 10K. When the control terminal COM changes from 1-5V, the voltage on the AC load is linearly adjustable from 0V to the maximum value: the higher the COM terminal voltage, the greater the module output.

Note:

1. All functional terminals must be positive relative to the COM terminal, and the COM terminal is negative. If the polarity is reversed, the output of the module's main circuit may be out of control.
2. The control characteristics of all functional terminals of the module are positive: the higher the control voltage, the higher the output voltage of the module's main power circuit.

3. It is advisable to use only one input control mode at a time. If two or more modes are input simultaneously, the one with a stronger input signal will generally play a major role. The module can be used for both manual and automatic operation. For example, connect automatic to the 4-20mA terminal and manual to the 0-10V terminal, and switch functions via a double-pole switch.
4. The module has a linear compensation function, with the input-output characteristic curve as shown below:

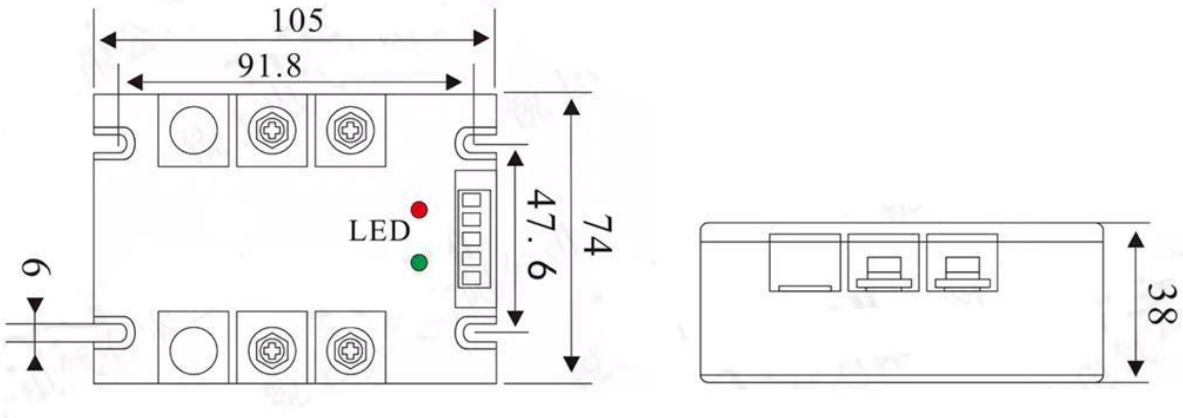


Product Parameters

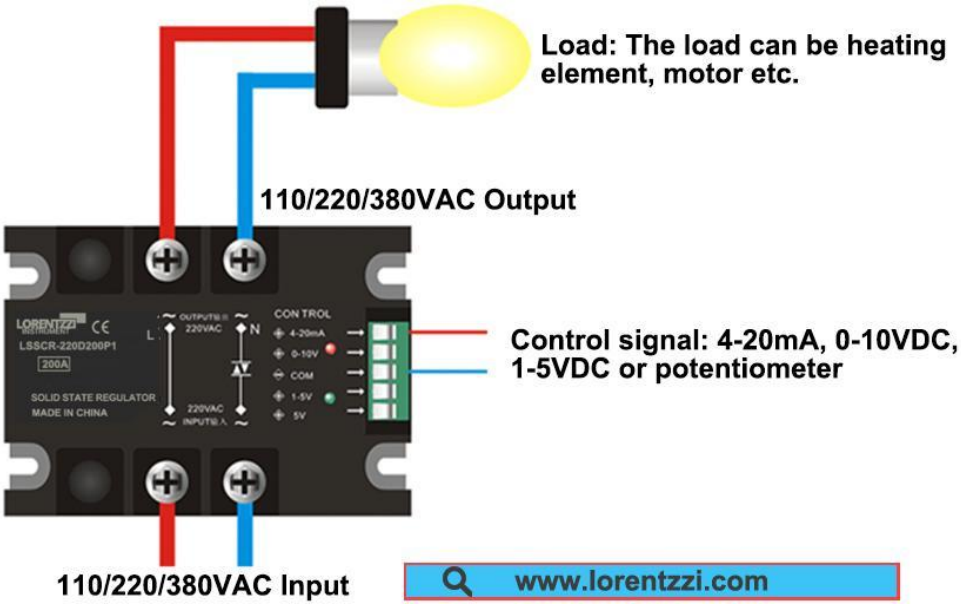
Item	Specification
Brand	Lorentzzi Electric
Product Name	Single-Phase Intelligent Fully Isolated Voltage Regulation Module
Load Current	10A, 25A, 40A, 60A, 80A, 100A, 120A, 150A, 180A, 200A
Load Voltage	0-220VAC(default) or 0-380VAC
Control Voltage	4-20mA / 0-10V / COM / 1-5V / 2W 10K

Control Current	≤20mA
On-State Voltage Drop	≤1.5V
On-State Leakage Current	≤5mA
Dielectric Withstand Voltage	4000VAC, 50Hz/60Hz, 1min
Insulation Resistance	1000MΩ (500VDC)
Ambient Temperature	-30 ~ +75°C
Installation Method	Bolt Mounting
Operation Indication	LED

Outline and Installation Dimensions (mm)



Product Wiring



Precautions

This module generates a lot of heat. When the load current exceeds 10A in use, a heat sink must be used; for currents above 60A, forced air cooling with a fan is required (apply thermal grease between the solid-state relay and the heat sink).

Specification Selection and Heat Dissipation

1. Specification Selection

The selection of the module's current rating should consider factors such as grid voltage fluctuations and current surges during load startup. It is recommended to reserve an appropriate margin. To ensure reliable long-term operation, the following selection is recommended:

- **Resistive Load**: The module's nominal current should be 2-3 times the load's rated current.
- **Inductive Load**: The module's nominal current should be 5-7 times the load's rated current.

2. Heat Generation and Conduction Angle

When the module outputs a large current for a long time at a small conduction angle (i.e., high input voltage, low output voltage), it will cause severe heating or even burnout. This is because the current measured by a common meter in a non-sine wave state is not the RMS value. Although the displayed current does not exceed 1/3 or 1/5 of the module's nominal value, the RMS value may exceed several times the nominal value.

Therefore, it is recommended to operate the module at a large conduction angle (i.e., adjust the output voltage to more than 1/2 of the input voltage). The maximum allowable output current at different output voltages is shown in the table below: The actual output voltages of the module are 220VAC, 180VAC, 130VAC, 90VAC, corresponding to the actual load rated current values (100%, 85%, 60%, 40%, 25%).

3. Heat Calculation and Heat Dissipation Requirements

The heat generation of the module is related to the actual operating current of the load, and has no direct connection with the product's rated current.

Heat Generation = Actual Load Current (A) × 1.5 W/A

The heat dissipation effect of the heat sink depends not only on its size but also on ambient temperature (season, ventilation conditions, air volume), installation density, and other factors. The reference standard for heat dissipation is: The temperature of the module's base plate (contact surface with the heat sink) must not exceed 80°C.

In practical applications, a 75°C temperature switch can be installed on the heat sink. The module's control signal is connected in series with this normally closed (NC) contact. When the temperature exceeds 75°C, the NC contact opens, cutting off the control signal. A temperature switch protection is generally used where the actual current exceeds 50A, with high installation density, or in high ambient temperature environments.

In addition, when installing the heat sink, be sure to apply a layer of creamy thermal grease to the module to ensure effective heat dissipation.

Common Problems and Fault Causes

1. Unadjustable Voltage at No-Load Test

The product must not be operated under no-load conditions. After installation and wiring are completed, connect a low-power load (such as an incandescent lamp) for testing first. After the test is normal, connect the actual load.

2. Control Indicator (Green/Red) Not Lit

No input signal at the control terminal. Please check if the control wiring is correct.

3. Normal Initial Operation, Abnormal After a Period, Normal After Power Cycle

Insufficient heat sink size, poor ventilation, or insufficient current margin.

4. No Full-Voltage Output

Check if the potentiometer is adjusted to the maximum value.

5. Inability to Precisely Speed Control Asynchronous Motor

This voltage regulation module is only suitable for applications with low speed requirements, such as torque motors, fans, or water pumps. It cannot be used for precise speed control of asynchronous motors.

6. Can It Replace Transformers for Low-Voltage High-Current Output?

The voltage regulation module cannot directly output low-voltage high-current, otherwise it will cause overcurrent burnout. A combination of a voltage regulation module and a transformer should be used: first regulate the primary voltage of the transformer with the module, then step down the voltage with the transformer to stably output low-voltage high-current.

7. Three Single-Phase Modules for Three-Phase Voltage Regulation

Not recommended. It is recommended to use the company's three-phase fully isolated voltage regulation module or a three-phase phase-shift trigger matched with thyristor modules.

8. Burned-Out Input/Output Terminals of Main Circuit

Insufficient product specification selection, leading to burnout of internal thyristors. Or direct load short circuit occurs, such as poor high-temperature insulation of electric heating tubes, sparking during power contact of silicon carbide rods, etc.

9. Poor Contact or Electrochemical Corrosion of Main Circuit Terminals

Replace standard terminals in a timely manner and tighten bolts firmly.

10. Overcurent Protection Measures

In your design and manufacturing process, fully consider the possibility of avoiding load short-circuit faults (such as using high-quality electric heating materials, increasing insulation performance, etc.). In addition, a high-quality fast fuse can be installed at the input end of the module for overcurrent protection. However, since the overcurrent burnout speed of the thyristor during a load short circuit is on the same order of magnitude as the fusing speed of the fast fuse, the fast fuse cannot always play the role of overcurrent protection.

11. Overvoltage Protection Measures

A varistor can be connected between the input and output terminals of each phase. Selecting a varistor with a voltage rating of 800V-900V can effectively perform overvoltage protection.