UNDER CONTROL INSTRUMENTS LTD

# *BSC-AL*
# *IR Temperature Blackbody Calibrator*

*User Manual*

**Unit 5 Junction 6 Industrial Park**
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*Rev. 2024*

# Table of Contents

# Before You Start

## 1.1 Symbols Used

Table 1 lists the International Electrical Symbols. Some or all of these symbols may be used on the instrument or in this manual.

***Table 1*** *International Electrical Symbols*

| Symbol | Description |
|---|---|
|  | AC (Alternating Current) |
|  | AC-DC |
|  | Battery |
|  | CE Complies with European Union Directives |
|  | DC |
|  | Double Insulated |
|  | Electric Shock |
|  | Fuse |
|  | PE Ground |
|  | Hot Surface (Burn Hazard) |
|  | Read the User's Manual (Important Information) |
|  | Off |
|  | On |

## 1.2 Safety Information

Use this instrument only as specified in this manual. Otherwise, the protection provided by the instrument may be impaired.

The following definitions apply to the terms “Warning” and “Caution”.

- “WARNING” identifies conditions and actions that may pose hazards to the user.
- “CAUTION” identifies conditions and actions that may damage the instrument being used.

### 1.2.1 ⚠ WARNINGS

To avoid personal injury, follow these guidelines.

- Use only a grounded AC mains supply of the appropriate voltage to power the instrument. The calibrator requires a maximum of 1 amp, 50/60 Hz, 110/220 VAC.
- **DO NOT** connect this unit to a non-grounded, non-polarized outlet.
- **DO** use a ground fault interrupt device.
- **HIGH VOLTAGE** is used in the operation of this equipment. **SEVERE INJURY or DEATH** may result if personnel fail to observe safety precautions. Before working inside the equipment, turn power off and disconnect power cord.
- **DO NOT** use this unit in environments other than those listed in the user’s manual.
- **DO NOT** use this unit for any application other than calibration work.
- Follow all safety guidelines listed in the user’s manual.
- Calibration Equipment should only be used by Trained Personnel.

### 1.2.2 ⚠ CAUTIONS

To avoid possible damage to the instrument, follow these guidelines.

- Operate the instrument in room temperatures between 15°C ~60℃. Allow sufficient air circulation by leaving at least 6 inches of space be- tween the instrument and nearby objects. Overhead clearance needs to allow for safe and easy insertion and removal of probes for calibration.
- The calibrator is a precision instrument. Although it has been designed for optimum durability and trouble free operation, it must be handled with care. The instrument should not be operated in excessively wet, oily, dusty, or dirty environments. It is important to keep the wells of the in- strument clean and clear of any foreign matter. Do not operate near flam- mable materials.
- **DO NOT** use fluids to clean out the well.
- If a mains supply power fluctuation occurs, immediately turn off the in- strument. Power bumps from brown-outs and black-outs could damage the instrument. Wait until the power has stabilized before re-energizing the instrument.

## 1.3 Authorized Service Centers

Please contact one of the following authorized Service Centers to coordinate service on your product:

Unit 5 Junction 6 Industrial Park
Electric Avenue
Birmingham
B6 7JJ
Email: info@undercontrol.co.uk
Tel: +44 121 238 2795

# 2 Introduction

This series blackbody furnace is perfect for the calibration of thermal sensors in industries such as glass making, electrical power, automotive and material processing..

This blackbody furnace utilizes a specially profiled heater that gives a central zone of constant temperature, and at just 3kg, it is compact and portable enough for easy use onsite. With convenient touch screen and one point set function, which provides optimal control and accuracy throughout the full range of the unit.

This blackbody furnace cools quickly, and can stabilize in 15 minutes. The surface area as: 58mm(diameter) , and custom diameter can be machined per customer specifications. It also can be used in English, French, Italian, or Spanish etc.


***Figure 1*** *blackbody calibrator*


***Figure 2*** *Machine diagram*

Note：

●Power switch ： Power switch "O" means off and "-" means on. When the power is turned on, the switch light will light up.

●Power interface ： Power input: AC110 or AC220V ±10%. Please confirm according to the ordering information. Do not connect AC110V equipment to a power supply system higher than AC110V. This may cause the fuse to burn out or even damage the equipment!

●Communication ： The communication interface includes a USB interface and an RS232 interface. The USB interface is used for software upgrades and debugging equipment. It does not serve the purpose of a standard USB interface. Please do not connect any USB devices and lines other than the U disk used for debugging and upgrades. , please be responsible for any damage to equipment and lines caused by incorrect connection. For the definition of the RS232 interface and communication-related information, please refer to the communication protocol chapter in the manual. (Note: Some models of equipment do not have communication functions and are not equipped with an RS232 interface. Please refer to the ordering information)

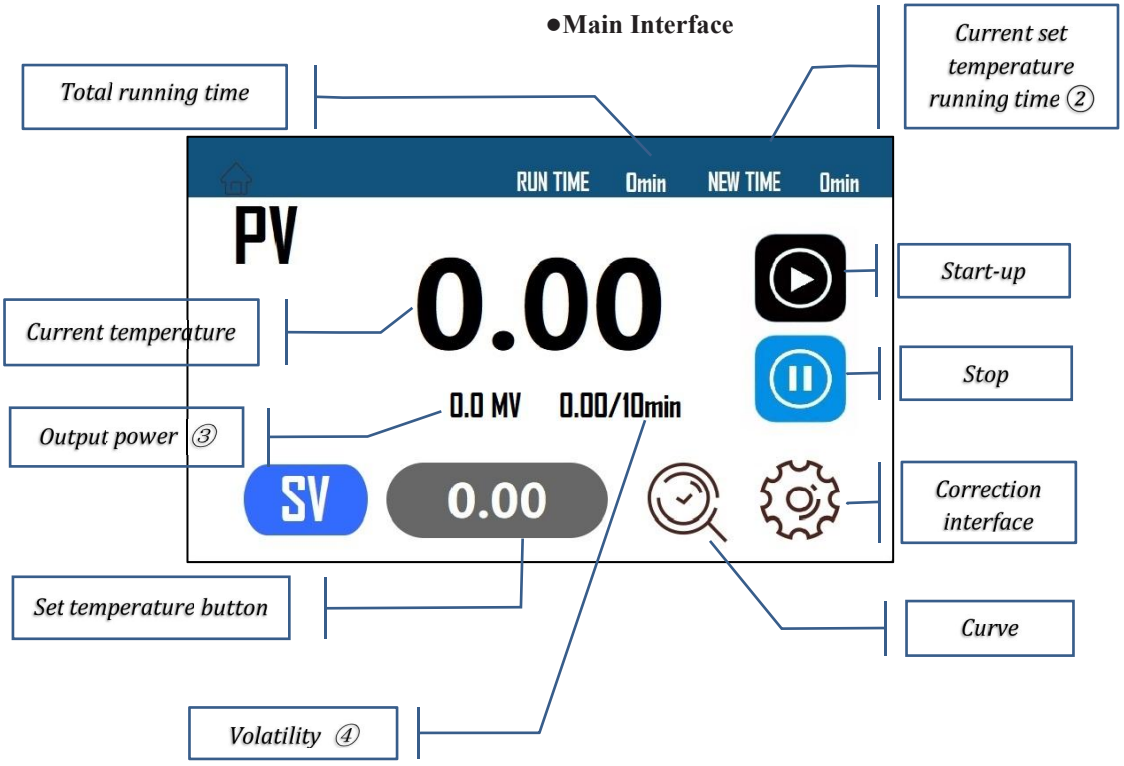
●Touchscreen ： The device has no physical operation buttons. All operations are completed by the LCD touch screen. Do not press hard when using it. Do not use sharp and hard objects to operate. Do not use corrosive solvents to wipe the screen. Do not try to disassemble the device. Please do not use it when transporting the device. Do not place the screen on the bottom, do not place heavy objects on the screen during transportation, and be sure to stay away from high temperature, extreme cold, and other environments that may cause damage to the screen. If the screen is damaged due to the above matters, it will Cannot enjoy free warranty!

●Handle ： The device handle can only bear the weight of the device itself. Do not lift the device with other heavy objects attached!

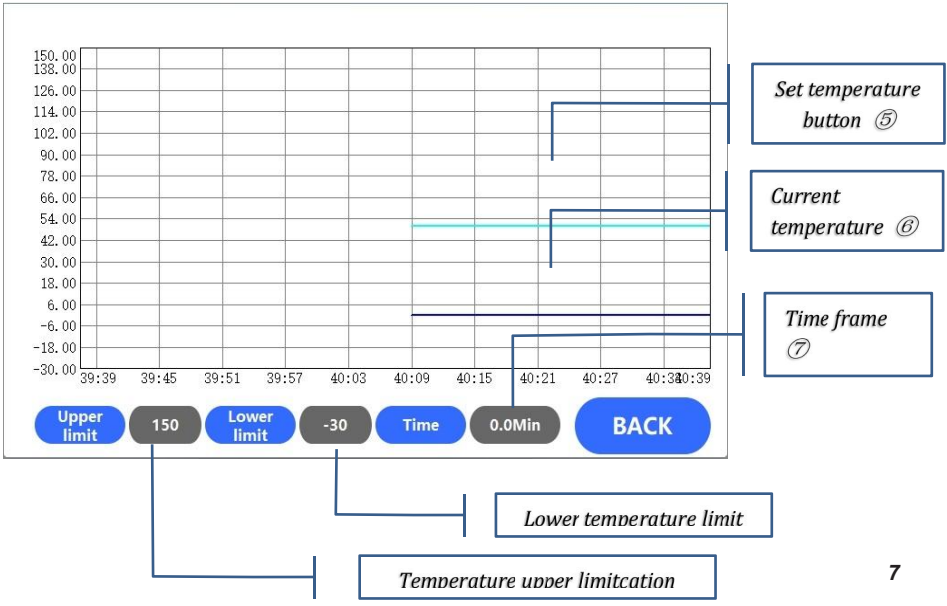
●Dissipation hole ： When the equipment is running, please be careful not to place any light objects or dust particles around the air inlet. Otherwise, foreign matter may be inhaled during operation and cause damage. Do not place anything that blocks the air outlet at the air outlet. This may cause poor heat dissipation and damage the equipment. damage!

## 2.1 User Interface

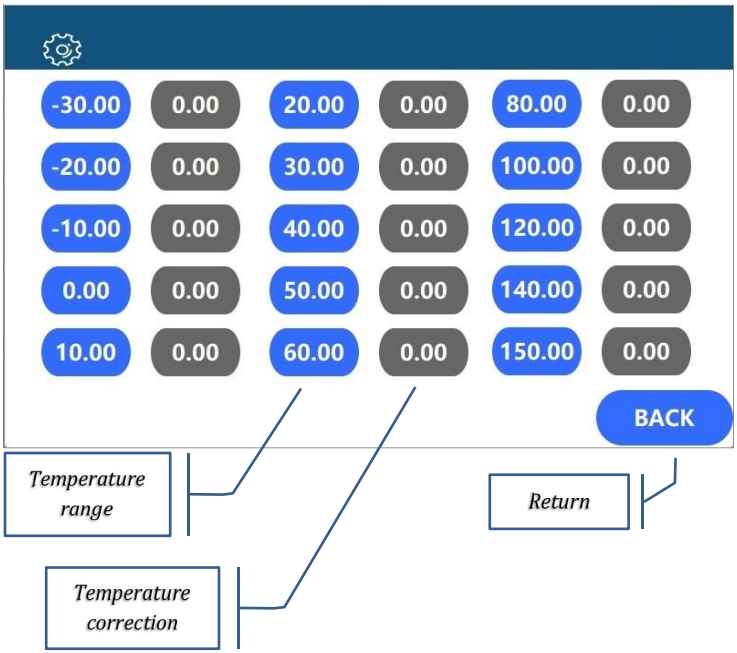
●Main Interface



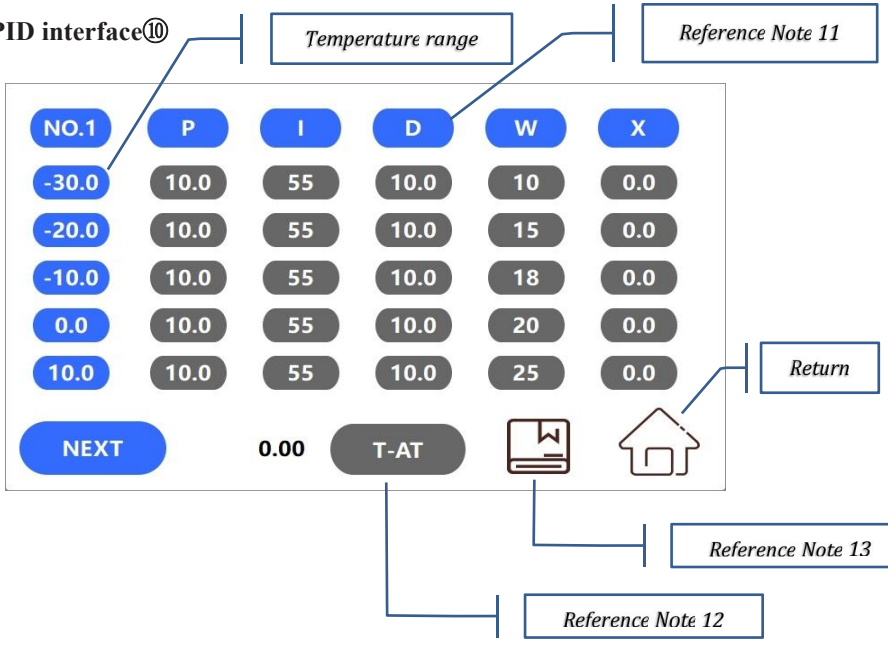

●Temperature Curve interface（Optional）



●Temperature Curve interface




●PID interface⑩



●**Numeric keypad interface**


Note:

1.Total running time: The total running time after setting the temperature and starting. After stopping, the timer ends and is cleared.

2.Current set temperature running time: When the temperature is reset, the running time of the current set temperature will be restarted from zero.
3.Output power: The output power of the current device. The power will be automatically adjusted and cannot be changed manually.

4. Volatility: The degree of fluctuation of the current temperature within 10 minutes. It takes a certain time for the temperature to stabilize. Different equipment will eventually stabilize with different stabilization times.

5.Set temperature button: The cyan line indicates the current set temperature.

6.Current temperature: The blue line indicates the current actual temperature.

7.Time frame: The time range of the temperature curve.

8.Temperature upper limitcation port: The temperature upper limit setting value of the curve.

9.Lower temperature limit: The lower temperature limit setting value of the curve.

10. Internal parameter setting interface: Internal parameters have been set at the factory. Please do not modify any parameters without the consent of the supplier.

11. Internal parameter setting interface: NO.1-This is currently the first page of the internal parameter setting interface. The three parameters P, I, and D are automatically generated by the self-tuning function. Only in special circumstances, professionals can fine-tune the parameters. W-Set different power upper limits corresponding to different temperature ranges. The power size is set according to the balance between the speed of temperature rise and fall and the stabilization time. Too large or too small power will cause stability problems. Please do not adjust by yourself. Otherwise, the equipment will be permanently damaged! X-corresponds to the correction value in different temperature ranges. This correction value is the factory calibration value. Please do not modify it without authorization, otherwise it will cause a certain temperature deviation. Users should adjust the calibration value in the external temperature correction interface.

12. Self-tuning function: When the temperature is unstable, the self-tuning function can automatically adjust the stability. Please do not use it casually!

13. Save: When auto-tuning or manually modifying parameters, you must click the save button to modify the parameters.

14. Numeric keyboard: The lowest temperature that can be set by the current device.

15. Numeric keyboard: The maximum temperature that can be set by the current device.

# 3 Specifications and Environmental Conditions

## 3.1 Specifications

| | |
|---|---|
| Temperature Range | 35℃~ 500℃ |
| Display Accuracy | ±0.3℃%+1%(customizable) |
| Display Stability | ±0.2℃～0.2%t |
| Working Condition | 0℃~ 35℃, 20 %～75 %RH（No condensation） |
| | < 2000 m |
| Working Environment | 22℃±3℃ |
| Surface area | 58mm |
| Cavity Diameter | 5~50mm |
| Uniformity | ±0.2℃～0.5%t |
| Stable Time | 15 min |
| Resolution | 0.1° |
| Display | LCD display，℃ or ˚F |
| Dimensions | 260mm*290 mm*135 mm |
| Weight | 3 kg |
| Power | 100 V～115 V（±10 %）50/60 Hz, 575 W |
| | 200 V～230 V（±10 %）50/60 Hz, 575 W |

## 3.2 Environmental Conditions

Although the instrument has been designed for optimum durability and trouble-free operation, it must be handled with care. The instrument should not be operated in an excessively dusty or dirty environment. Maintenance and cleaning recommendations can be found in the Maintenance Section of this manual.

The instrument operates safely under the following conditions:

- Temperature range: 15~25°C
- Humidity range:≤75%RH
- Pressure: 75kPa–106kPa
- Mains voltage within ±10% of nominal
- Vibrations in the calibration environment should be minimized
- Altitude :1000m at most

## 3.3 Warranty

We warrants
this product to be free from defects in material and workmanship under normal use and service for a period as stated in our current product catalog from the date of shipment. This warranty extends only to the original purchaser and shall not apply to any product which, in our's sole opinion, has been subject to misuse, alteration, abuse or abnormal conditions of operation or handling.

Software is warranted to operate in accordance with its programmed instructions on appropriate products. It is not warranted to be error free.

Ourobligation under this warranty is limited to repair or replacement of a product which is returned to us within the warranty period and is determined, upon examination by us, to be defective. If we determines that the defect or malfunction has been caused by misuse, alteration, abuse or abnormal conditions or operation or handling, we will repair the product and bill the purchaser for the reasonable cost of repair.

To exercise this warranty, the purchaser must forward the product after calling or writing an Authorized Service Center (see Section 1.3) for authorization. The Service Centers assume NO risk for in-transit damage.

THE FOREGOING WARRANTY IS PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR MECHANTABILITY, OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE.WE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSS WHETHER IN CONTRACT, TORT, OR OTHERWISE.

# 4 Quick Start

## 4.1 Unpacking

Unpack the instrument carefully and inspect it for any damage that may have oc- curred during shipment. If there is shipping damage, notify the carrier immediately.

And here's notice before use:

1. It is strictly prohibited to tilt, invert or lay flat during transportation. If there is any tilt, be sure to leave it for 24 hours before normal use.

2. After removing the outer packaging of the equipment, it must be left undisturbed for 24 hours before it can be used normally and powered on.

3. Be sure to unpack and inspect the goods within 3 days of receiving them. If there are any damaged parts or incomplete parts, please contact our company in time.

Verify that the following components are present:

- Blackbodycalibrator*1
- Power cable*1
- Insert *1
- Insert lift*1
- Carrying suitcase*1
- Product catalog*1
- User's Manual*1
- U disk*1

## 4.2 Set up

Place the instrument upright on a flat stable surface. The area around the instrument must be clear to allow adequate air circulation. For best results operate the instrument in room of constant temperature between 15 to 25°C free from drafts. Stable ambient temperatures allow stable well gradients and less drift.

Turn on the power to the calibrator by toggling the power switch on. The touch screen will light up and show the ambient temperature, the unit is not at the correct temperature until the touch screen is lighting up.

## 4.3 Power

Connect the power cord provided into the instrument and plug the other end into a power socket of specified voltage. Normally this will be 110/220 VAC, 50/60 Hz.

# 5 General Operation

## 5.1 Set up

Place the calibrator upright on a flat stable surface. The

area around the instrument must be clear to allow adequate air circulation. For

best results operate the calibrator

in room of constant temperature between 18 to25° C (64 to 77° F)

free from drafts. Stable ambient temperatures allow
stable well gradients and less drift.

## 5.2 Measurement

When you use the temperature higher than 300℃，please let the machine cooling down to 100℃ first, and then you can turn off the calibrator, if you use the temperature lower than 100℃, you can turn off the calibrator directly. Please kindly notice that if you turn off the calibrator at temperature higher than 100℃,the furnace temperature may be transmitted to the temperature control part and cause irreversible damage to the machine.

## 5.3 After use

1. Waiting the calibrator to cooling down to around the room temperature
2. Turn off the power of the machine
3.Put the calibrator stand on the flat and avoid the heat/cold object until next use

# 6 Heating and cooling time reference table

| Temperature | Heating time | Stable time |
|---|---|---|
| Room temperature to 200℃ | 15min | 15min |
| 200 to 400℃ | 15min | 15min |
| 400℃~500℃ | 15min | 15min |

The instrument operates safely under the following conditions:

- Temperature range: 15~25°C
- Humidity range:≤75%RH
- Pressure: 75kPa–106kPa
- Mains voltage within ±10% of nominal
- Vibrations in the calibration environment should be minimized
- Altitude :1000m at most

# 7 Maintenance

The calibration instrument has been designed with the utmost care. Ease of operation and simplicity of maintenance have been a central theme in the product development. Therefore, with proper care the instrument should require very little maintenance. Avoid operating the instrument in an oily, wet, dirty, or dusty environment.

●If the outside of the instrument becomes soiled, it may be wiped clean with a damp cloth and mild detergent. DO NOT use harsh chemicals on the surface which may damage the paint.

●It is important to keep the well of the calibrator clean and clear of any foreign matter. DO NOT use fluid to clean out the well.

●The calibrator should be handled with care. Avoid knocking or dropping the calibrator.

●DO NOT slam the probe stems into the well. This type of action can cause a shock to the sensor.

●If a hazardous material is spilt on or inside the equipment, the user is responsible for taking the appropriate decontamination steps as outlined by the national safety council with respect to the material.

●If the mains supply cord becomes damaged, replace it with a cord with the appropriate gauge wire for the current of the instrument. If there are any questions, call us for more information.

●If the instrument is used in a manner not in accordance with the equipment design, the operation of the calibrator may be impaired or safety haz- ards may arise.

# 8 After-sales

The following quality guarantees are specially made to the majority of users:

This verification device fully meets the technical and parameter index requirements put forward by the bidding party. The equipment equipped with it has passed the factory inspection and has a certificate of conformity. The device meets the requirements of the latest national verification regulations and is responsible for transporting the equipment to the installation site.

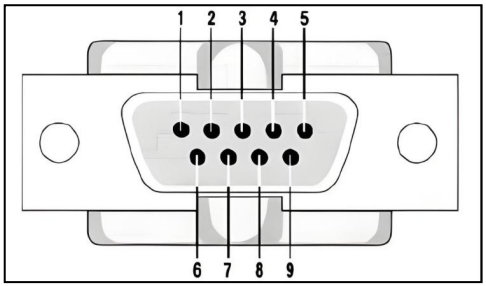
Our company will carry out the necessary on-site installation, commissioning and other technical services for the equipment. Provide a detailed supply list for the sold products, including the performance parameters of the main components, the place of origin, and the manufacturer. At the same time, a full set of technical documents, installation manuals, spare parts manuals, maintenance instructions and other materials are provided.

Our company will also provide detailed quality assurance measures, related technical documents and user manuals. Ensure that the equipment sold is in good condition and qualified. If quality problems are found, the buyer can return the goods immediately, and the supplier is responsible for replacement.Three guarantees (including repair, replacement, and return) will be implemented within one year after the product is sold. The warranty period is 1 year. After the warranty period, timely maintenance services are still provided, and only the cost of spare parts is charged. Commit to users to ensure on-site tracking services. Responsible for delivery, installation, commissioning, and conscientiously do well in reception and registration for users' letters, calls, and visits, and make clear and timely handling.

If the product breaks down, reply within 12 hours after receiving the user's call or written notice. Provide users with various forms of free technical training and technical guidance,assist users to establish various operating procedures and management systems for the use and management of the system (equipment), meet the technical requirements of users, and ensure the safe, reliable and efficient operation of the equipment.
After the equipment is delivered to use, our company will provide users with vulnerable parts for a long time, and only charge the cost. Free upgrade and maintenance of system software.

# 9 Communication Protocol

●**Port**




② RS232 RXD ③ RS232 TXD ⑤ GND

●**Serial port parameter settings**

Station number: 1 Baud rate: 38400 Data bits: 8 Stop bits: 1 Parity bit: NONE

●**Command list**

*1.* 01 reading coil

| from address | function code | initial address | Number of coils | CRC check |
|---|---|---|---|---|

Answer:

| from address | function code | Number of bytes | Number of coils | CRC check |
|---|---|---|---|---|

For example:

Read: 01 01 00 13 00 13 8C 02
Answer: 01 01 03 CD 6B 05 42 82

*2.* 05 Write a single coil

| from address | function code | Output address | output value | CRC check |
|---|---|---|---|---|

Answer:

| from address | function code | Output address | output value | CRC check |
|---|---|---|---|---|

For example:

Read: 01 05 00 00 FF 00 8C 3A
Answer: 01 05 00 00 FF 00 8C 3A

*3.* 03 Read register

| from address | function code | Read the first address of data | Read data quantity | CRC check |
|---|---|---|---|---|

Answer：

| from address | function code | Number of bytes | Read data | CRC check |
|---|---|---|---|---|

For example：

Read： 01 03 03 00 00 02 C4 4F
Answer： 01 03 04 00 C8 00 00 7B CD

***4.*** 06 Write a single register

| from address | function code | write data address | write data | CRC check |
|---|---|---|---|---|

Answer：Original data return

For example：

Read： 01 06 03 00 00 C8 88 18
Answer： 01 06 03 00 00 C8 88 18

***5.*** 10 Write multiple registers

| from address | function code | Register starting address | Number of registers | Number of bytes | Register value | CRC check |
|---|---|---|---|---|---|---|

Answer：

| from address | function code | Register starting address | Number of registers | CRC check |
|---|---|---|---|---|

For example：

Read： 01 10 00 0A 00 02 04 00 00 43 48 42 D6
Answer： 01 10 00 0A 00 02 61 CA

**●Communication address**

| Function | Data address（hexadecimal） |
|---|---|
| On/off | 0001 |
| Set temperature | 000A |
| Current temperature | 000C |

On：01 06 00 01 00 01 19 CA

Off：01 06 00 01 00 00 D8 0A

Set temperature(0℃)：01 06 00 0A 00 00 A9 C8

Current temperature：01 03 00 0C 00 01 44 09

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