ONMEAS®

Rev.A1

AT4901

Data Logger



User's Guide

Scan QR code for operation video

Statement

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⚠ Warning ⚠ Dangerous: To avoid possible electric shock and personal safety, please follow these guidelines.

Disclaimer	Please read the following safety information carefully before starting to use the instrument. Onmeas Instruments will not be responsible for any personal safety and property damage caused by the user's failure to comply with the following terms.
Ground The Instrument	To prevent the danger of electric shock, please connect the power ground wire.
Do not use the instrument in an explosive atmosphere	Do not use the instrument in a flammable and explosive gas, vapor or dusty environment.Using any electronic device in such an environment is a risk to personal safety.
Do not open the instrument case	Non-professional maintenance personnel should not open the instrument case in an attempt to repair the instrument.The instrument may still have undischarged charges for a period of time after it is turned off, which may cause an electric shock hazard to persons.
Do not use instruments that work abnormally	If the instrument is not working properly and its danger is unpredictable, disconnect the power cord, do not use it, and do not attempt to repair it yourself.
Do not use the instrument in a manner other than that specified in this manual	Beyond the range, the protection provided by the instrument will be invalid.
	**Warning**： Do not apply over 350V DC or 230V AC to the test terminals. This will damage the instrument.

Safety Sign：



Equipment protected by double insulation or reinforced insulation.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC



Do not throw in trash can

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Onmeas provides a one-year free warranty from the date of shipment, which also includes VFD or LCD. During the warranty period, the instrument is damaged due to improper operation by the user, and the maintenance cost shall be borne by the user.After two years until the life of the instrument, Onmeas will provide maintenance for a fee.For VFD or LCD replacement, the fee is charged at the current cost price.

If the product is found to be damaged, please contact Applent for information on agreeing to return or exchange.After that, please send this product to the seller for return.Be sure to state the reason for the damage to the product, and prepay postage and insurance to the destination.For the repair or replacement of the product within the warranty period, Onmeas will be responsible for the return shipping cost.For the repair of non-guaranteed products, Onmeas will estimate the repair cost, and only carry out the repair under the premise of obtaining your consent. All costs incurred by the repair will be borne by the user, including the return shipping cost.

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People's Republic of China
Jiangsu Province
Changzhou Onmeas Instruments Ltd.
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Contents

Statement 3
Safety Information 3
Limited Warranty And Limitation of Liability 4
Contents 5
1. The Install and Setup Wizard 7
1.1 Packing List 7
1.2 Power Requirement 7
1.3 Operation Environment 7
1.4 Cleaning 7
2. Overview 8
2.1 Introduction 8
2.2 Main Specifications 8
2.3 Main Function 8
2.3.1 Functions 8
2.3.2 Sorting Setting 8
2.3.3 Correction Function 8
2.3.4 FAT Save Function 9
2.3.5 System Setting 9
2.3.6 Remote Control 9
3. Startup 10
3.1 Front Panel 10
3.2 Connection of the Thermocouple 12
4. [Meas] Page 13
4.1 <MEASURE DISPLAY>Page 13
4.2 <HISTOGRAM>Page 14
4.3 <CHAN SETUP>Page 14
4.3.1 【SENSOR】Setting 15
4.3.2 【LOW】Setting 15
4.3.3 【HIGH】Setting 15
4.3.4 【DELTA】Setting 15
5. [Setup] Page 17
5.1 <SETUP>Page 17
5.1.1 【COMP】Setting 17
5.1.2 【RATE】Setting 18
5.1.3 【BEEP】Setting 18
5.1.4 【UNIT】Setting 18
5.1.5 【DISK】Setting 18
5.1.6 【PREFIX】Setting 19
5.1.7 【SPLIT】Setting 19
5.1.8 【DELAY】Setting 19
6. SYSTEM CONFIG 21
6.1 <SYSTEM CONFIG>Page 21
6.1.1 【LANGUAGE】 21
6.1.2 【DATA】 22
6.1.3 【TIME】 22
6.1.4 【I/F Setup】 22
6.1.5 【PROTOCOL】 23
6.1.6 【ADDRESS】 23

6.1.7 【BAUDRATE】 23
6.1.8 【IP】 23
6.1.9 【NET MASK】 24
6.1.10 【GATEWAY】 24
6.1.11 【PORT】 24
6.2 <SYSTEM SERVICE>Page 24
7. FILE Page 25
7.1 <FILE>Page 25
8. SCPI Command Reference 26
8.1 Command String Parsing 26
8.1.1 Command Parsing Rules 26
8.1.2 Symbol Conventions and Definitions 26
8.1.3 Command Tree Structure 26
8.1.4 Commands 27
8.1.5 Parameters 27
8.1.6 Separator 28
8.2 Command Reference 28
8.2.1 MEAS Subsystem 28
8.2.2 SYST Subsystem 31
8.2.3 FETCH Subsystem 31
8.2.4 ERROR Subsystem 32
8.2.5 IDN Subsystem 32
9. Modbus(RTU) Command Reference 33
9.1 Data Format 33
9.1.1 Command Parsing Rules 33
9.1.2 CRC-16 Calculation Method 34
9.1.3 Response Frame 34
9.1.4 No Response 35
9.1.5 Error Code 35
9.2 Function Code 35
9.3 Register 36
9.4 Read Out Multiple Registers 36
9.5 Write to Multiple Registers 37
9.6 Echo Test 38
10. Modbus(RTU) Instruction Set 39
10.1 Register Overview 39
10.1.1 Channel 1 Test Result Register【2000】 39
10.1.2 Channel 2 Test Result Register【2002】 40
10.1.3 Sampling Switch Register【3000】 40
10.1.4 Display Page Register【3001】 40
10.1.5 Sensor Register【3002】 41
11. Modbus(TCP) Command Reference 42
11.1 Data Format 42
11.1.1 Command Parsing Rules 42
12. Modbus(TCP) Instruction Set 43
12.1 Register Overview 43
12.1.1 Channel 1 Test Result Register【2000】 43
12.1.2 Sampling Switch Register【3000】 44
13. Specification 45
13.1 Qualification 45
13.2 Specification 45
13.3 Measurement Accuracy 46
11.4 Outline Dimension 47

1.The Install and Setup Wizard

Thank you for buying our company's product! Please read this chapter carefully before use.
You will learn the following information in this chapter

- Packing List
- Power Requirement
- Operation Environment
- Cleaning
- Instrument Handheld

1.1 Packing List

Before formally using the instrument, please first:

1. Check whether the appearance of the product is damaged to damage, scratches and other bad phenomena;

2. Check whether the instrument accessories are lost against the instrument packing list.

If there is any damage or insufficient accessories, please contact the Applent equipment sales department or the seller immediately.

1.2 Power Requirement

ATQ4901data logger can only be used in the following power supply conditions:

Voltage：100V-240VAC

Frequency：47.5-52.5Hz

Power Supply：Max 10VA

Warning: To avoid electric shock, please properly connect the protective earth ground.If the power cord is replaced by the user, ensure that the ground wire of the new power cord is securely connected.

1.3 Operation Environment

ATQ4901must be used in the following environment conditions:

Temperature：0℃～55℃，

Humidity：23℃，＜70%RH

Altitude：0~2000 m

1.4 Cleaning

Do not clean the inside of the instrument.

Note：Instruments should not be cleaned with solvents (alcohol or gasoline, etc.).

Before cleaning, the power cord must be unplugged, clean the shell and panel with a clean cloth.

2.Overview

You will learn about the following in this chapter:

- Introduction
- Main Specification
- Main Function

2.1 Introduction

Thanks for your buying the ATQ4901 multi channel temperature tester.
ATQ4901 multi-channel temperature tester is controlled by a high-performance ARM microprocessor. It can simultaneously collect multi-channel temperature data, record the data to a USB storage device, support upper/lower limit alarms and communication transmission, and can be expanded to 200 channels of temperature data. It is compatible with a variety of temperature sensors, features fast response speed and stable data, and is equipped with a broken thermocouple detection function.
The instrument is equipped with TYPE-C, LAN, RS-232, and USB-232 communication interfaces. Data acquisition, analysis, and printing can be realized via the standard computer software.
It supports USB disk storage for real-time sampling data storage. Users can perform independent calibration on each channel of data.

2.2 Main Specifications

The technical specifications of the ATQ4901 series include the basic technical specifications of the instrument and the allowable range for instrument testing.these specifications represent the achievable performance of the instrument at the time of its manufacture.

- Input Type：Thermocouple J,K,T,E,S,N,B,R
- Test Range：-200.0℃~1800.0℃（varies with different thermocouple types）
- Resolution：0.1℃
- Channel Number：20 channels（Expandable up to 200 channels）
- Speed：Slow，Fast
- Display : 7.0-inch true-color LCD touchscreen

2.3 Main Function

2.3.1 Functions

1. Comparator Setting
2. Beep Setting
3. Baud Rate Setting
4. Temperature Unit Setting

2.3.2 Sorting Setting

Build-in sorting data, each temperature data can be set both high limit and low limit

2.3.3 Correction Function

Each channel data can been corrected by the user

2.3.4 FAT Save Function

Users are allowed to create file suffix【.csv】,every channel data can be saved in USB memory(do not support removable hard disk)

2.3.5 System Setting

1. Switch both in English and Chinese
2. Data and Time Setting

2.3.6 Remote Control

Support max 115200bps baud rate,compatible with SCPI protocol,MODBUS protocol,ASCII transfer.

3.Startup

You will learn about the following in this chapter:

- Front and Rear Panel
- Connection of the Thermocouple

3.1 Front Panel

Figure 3- 1 Front Panel

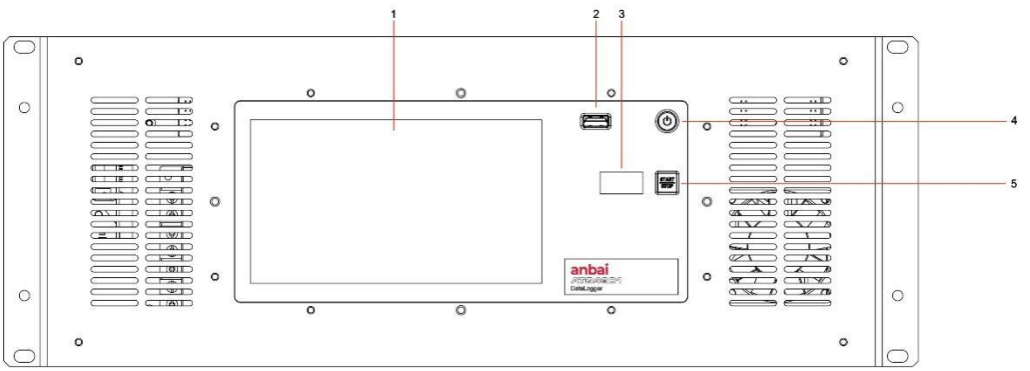


Table 3- 1 Front Panel Description

No.	Function
1	LCD display with touch screen
2	USB Disk interface
3	Status display
4	Power switch(tactile key) ⚠ Warning: to ensure stable operation, the instrument must wait 10 seconds after power-off before restarting.
5	Start/Stop key

Figure 3-2 Rear Panel

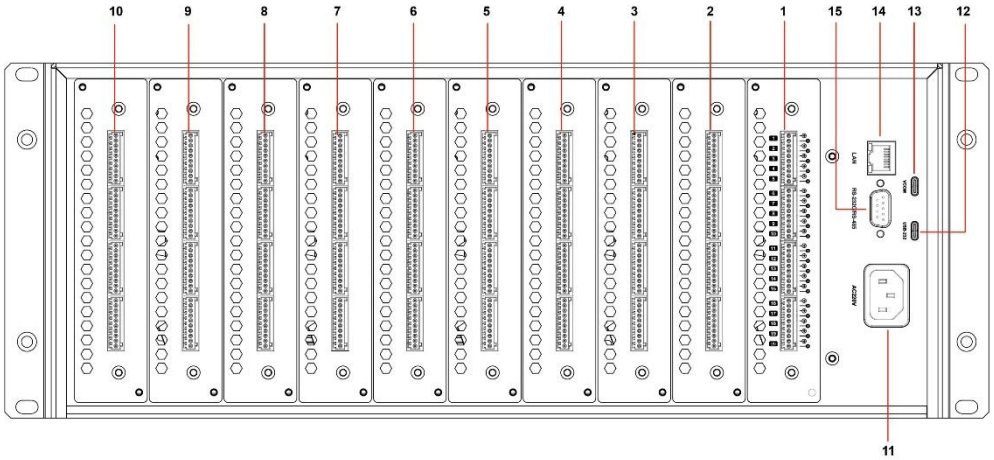
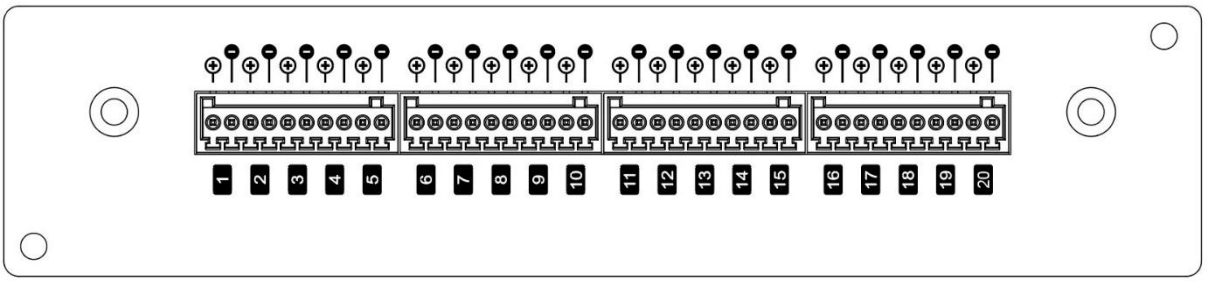


Table 3-2 Rear Panel Function Description

No.	Function
1	Slot 1: 20-channel thermocouple acquisition module installed.
2	Slot 2: 20-channel thermocouple acquisition module installed.
3	Slot 3: 20-channel thermocouple acquisition module installed.
4	Slot 4: 20-channel thermocouple acquisition module installed.
5	Slot 5: 20-channel thermocouple acquisition module installed.
6	Slot 6: 20-channel thermocouple acquisition module installed.
7	Slot 7: 20-channel thermocouple acquisition module installed.
8	Slot 8: 20-channel thermocouple acquisition module installed.
9	Slot 9: 20-channel thermocouple acquisition module installed.
10	Slot 10: 20-channel thermocouple acquisition module installed.
11	Power Socket （100V-240VAC, 50Hz/60Hz）
12	USB-232
13	TYPE-C
14	LAN
15	RS-232

3.2 Connection of the Thermocouple



3-3 Terminal Description

+	Thermocouple Positive Terminal
-	Thermocouple Negative Terminal

*Other channels are connected in the same way

Channel-to-channel isolation voltage: 350 VDC, 230 VAC

4. [Meas] Page

You will learn the following information in this chapter:

- <MEASURE DISPLAY>Page
- <HISTOGRAM>Page
- <CHAN SETUP>Page

4.1 <MEASURE DISPLAY>Page

From any page, simply press【Meas】to enter the <MEASURE DISPLAY>Page.

<MEASURE DISPLAY> page mainly highlights the measurement results, and current sorting results will be displayed in different font and color.

Tip: Measuring data and sorting result are only valid in <Measure Display> page. U-disk storage device data logging function is only valid in <Measure Display> , <GRAPH> and <HISTOGRAM> page.

Press the function key to switch the display page.

Figure 4-1 Display the 10 Channel Page:

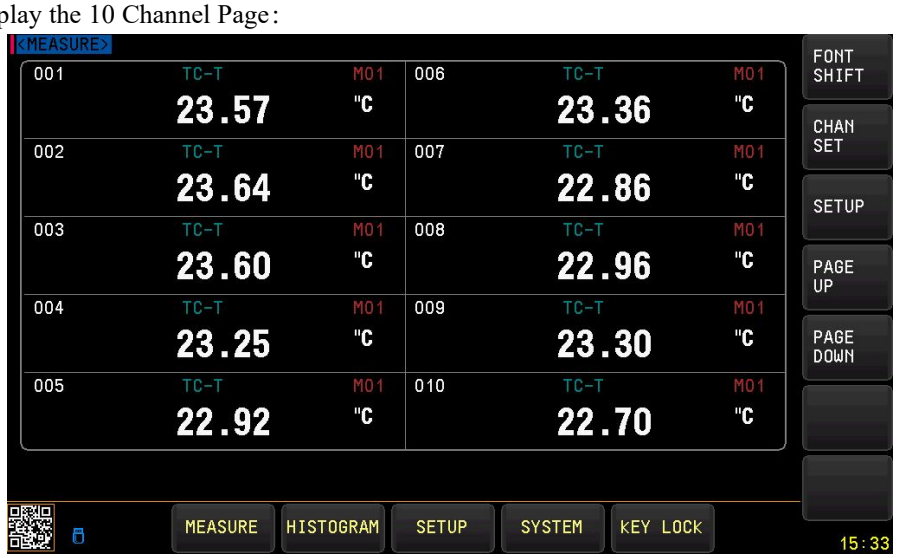
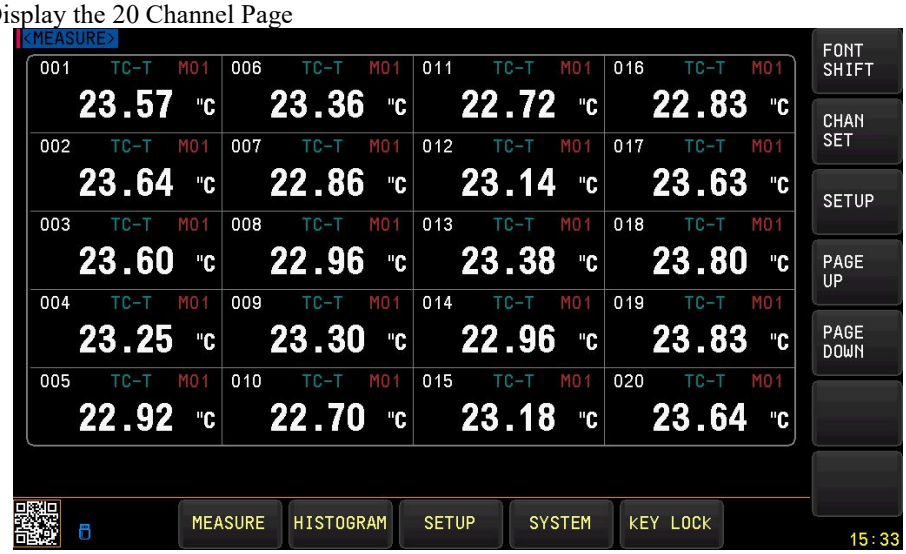


Figure 4-2 Display the 20 Channel Page



Steps to Switch Pages:

Step 1	Press【Meas】to enter the <Measure Display> page.
Step 2	Press the function keys【Previous】or【Next】to switch pages

4.2 <HISTOGRAM>Page

Press the【Meas】key,and then press the function key【HISTOGRAM】to enter the <HISTOGRAM>page.

Figure 4-6 HISTOGRAM Page



4.3 <CHAN SETUP>Page

Press the【Meas】key，and then press the function key【CHAN SETUP】to enter<CHAN SETUP>page.

Figure 4-7 CHAN SETUP Page



4.3.1 【SENSOR】Setting

Channel 001 Sensor Setting:

■ Setup Steps

Step 1	Press [Meas] key to enter<MEASURE DISPLAY> page
Step 2	Press [CHAN SETUP] soft key to enter<CHAN SETUP> page
Step 3	Use the cursor key to select【TC-K】field;
Step 4	Use the function key to select

Soft keys	Function
TC-K	Type K Thermocouple
TC-T	Type T Thermocouple
TC-J	Type J Thermocouple
TC-N	Type N Thermocouple
TC-E	Type E Thermocouple
TC-S	Type S Thermocouple
TC-R	Type R Thermocouple
TC-B	Type B Thermocouple
ONEKEY SET	Set the sensor model of other channels to the sensor model of the current channel.

4.3.2 【LOW】Setting

Channel 001 Low Setting:

■Setup Steps

Step 1	Press [Meas] key to enter<MEASURE DISPLAY> page
Step 2	Press [CHAN SETUP] soft key to enter<CHAN SETUP> page
Step 3	Use the cursor key to select【-200.0】field;
Step 4	Use numeric key to input low value, then press [Enter] to end

Soft keys	Function
Reset	Under the current channel limit restore factory Settings
ONEKEY SET	Set other channels of low limit for the low limit of the current channels

4.3.3 【HIGH】Setting

Channel 001 high setting:

■ Setup Steps

Step 1	Press the【Meas】key to enter <MEASURE DISPLAY>page
Step 2	Press the【CHAN SETUP】to enter the <CHAN SETUP>page
Step 3	Use the cursor key to select the【1800.0】field;
Step 4	Use numeric key to input high value, then press [Enter] to end

Soft keys	Function
Reset	Under the current channel limit restore factory Settings
ONEKEY SET	Set other channels of high limit for the high limit of the current channels

4.3.4 【DELTA】Setting

Channel 001data setting:

■ Steps to correct channel 001:

Step 1	Press the【Meas】to enter the <MEASURE DISPLAY>page

Step 2	Press the【CHAN SETUP】to enter <CHAN SETUP>page	
Step 3	Use soft key to select【0.0】field.	
Step 4	Use the function key to select.	
	Soft keys	Function
	INPUT	Input correction temperature value in selected channel, using numeric key to input data, press [Enter] to end
	DELETE	Delete the select channel correction temperature values
	ONEKEY SET	Enter the correction value of the user's current page, then press [Enter] to end the setting
	ONEKEY RESET	Delete the correction value of the user's current page

*Steps to correct other channels are the same as above.

■ Steps to switch channel pages:

Step 1	Press the【Meas】key to enter the <MEASURE DISPLAY>page
Step 2	Press the function key【User Correction】to enter the <User Correction> page
Step 3	Press the function keys【Previous】or【Next】to switch between pages.

5.[Setup] Page

You will learn about the following information in this chapter ：

- <SETUP>Page
- <CHAN SETUP>Page（Refer to【Meas】）
- <User Correction>page

5.1 <SETUP>Page

At any time,press the【Setup】key to enter the <SETUP>page.

<SETUP>page can complete all setting concerned with the measurement,measurement and sorting result will not displayed and the instrument is in waiting state.Following parameters are included:

- COMP – The Comparator function settings
- RATE – Sampling Rate Setting
- BEEP – Beep Setting
- UNIT – Temperature Unit Setting
- AUX – AUX Setting
- LOW – Curve Lower Limit Setting
- HIGH – Curve Upper Limit Setting
- SCALE – Curve Time Axis Setting
- DISK – Storage Disk Selection Setting
- PREFIX – Stored File Prefix Setting
- SPLIT – Auto-split of Stored Files
- DELAY – USB Flash Drive Data Logging Interval

Display 5-1 <SETUP>Page



5.1.1 【COMP】Setting

Comparator setting includes：ON and OFF

■ Steps to set the comparator

Step 1	Press the【Setup】key to enter the <SETUP>page	
Step 2	Use the cursor key to select【COMP】field;	
Step 3	Use the function key to select	
	Soft keys	Function

	OFF	Turn off the comparator function
	ON	Turn on the comparator function

5.1.2 【RATE】Setting

Rate setting includes：Slow

■ Steps to set the rate

Step 1	Press the【Setup】key to enter the <SETUP>page	
Step 2	Use the cursor key to select【RATE】field;	
Step 3	Use the function key to select	
	Soft keys	Function
	1s	Sampling rate 1s
	500ms	Sampling rate 0.5s

5.1.3 【BEEP】Setting

Beep includes：ON/OFF

■ Steps to set the beep

Step 1	Press the【Setup】key to enter the <SETUP>page	
Step 2	Use the cursor key to select【BEEP】field;	
Step 3	Use the function key to select	
	Soft keys	Function
	OFF	Turn off the beep
	ON	Turn on the beep

5.1.4 【UNIT】Setting

Unit includes：℃,K,℉

■ Steps to set the unit

Step 1	Press the【Setup】key to enter the <SETUP>page	
Step 2	Use the cursor key to select【UNIT】field;	
Step 3	Use the function key to select	
	Soft keys	Function
	℃	Degree Celsius
	K	Degree Kelvin
	℉	Degree Fahrenheit

5.1.5 【DISK】Setting

Disk Setup：

■ Setup Steps：

Step 1	Press the【Setup】key to enter the <SETUP>page	
Step 2	Use the cursor key to select【USBDisk】field;	
Step 3	Use the function key to select	
	Soft keys	Function
	Internal Memory	Internal Storage
	USB Disk	Select USB Flash Drive Storage

5.1.6 【PREFIX】Setting

Prefix setting includes：

■ Setup Steps：

Step 1	Press the【Setup】key to enter the【SETUP】page.	
Step 2	Use the cursor key to select the【AUTO】field.	
Step 3	Use the function key to select	
	Soft keys	Function
	Input Prefix	Create a new file prefix.Example: the input file name “AUTO”,the actual file called “AUTO0001.csv”

5.1.7 【SPLIT】Setting

Disk file split setting：

■ Setup Steps：

Step 1	Press the【Setup】key to enter the【SETUP】page.	
Step 2	Use the cursor key to select the【SPLIT】field.	
Step 3	Use the function key to select	
	Soft keys	Function
	CLOSE	Shut down automatically split function
	10m	Save the new file in about 10 minutes
	20m	Save the new file in about 20 minutes
	30m	Save the new file in about 30 minutes
	1h	Save the new file in about 1 hours

5.1.8 【DELAY】Setting

Disk recording interval setting：

■ Steps to set the delay：

Step 1	Press the【Setup】key to enter the【SETUP】page
Step 2	Use the cursor key to select【SPLIT】field,close the SPLIT function
Step 3	Use the cursor key to select the【DELAY】field
Step 4	Use the numeric key to input delay time,maximum 3600 seconds,then press the【Enter】to end.

NOTE：

USB data recording is only available in 【MEAS】,【HISTOGRAM】or【GRAPH】page. Data is written to the USB drive in real time.

USB Operation Steps：

Step 1：Insert the USB drive into the USB port,the instrument will show “USB-DISK Ready”

Step 2：Press【Start】to begin data acquisition.

Step 3：Press【Stop】to end data acquisition

Step 4：Remove the USB drive

Data logging time is based on the instrument’s internal clock.If the internal clock stops working,data logging will also stop. Replace the internal battery when the clock malfunctions.

Data includes two parts,logging time and corresponding channel temperature

For example：

File Path：ATQ4901/20210616/AUTO0001.csv
Data format is floating point number,use ","as division of channel

6.SYSTEM CONFIG

You will learn about the following information in this chapter:

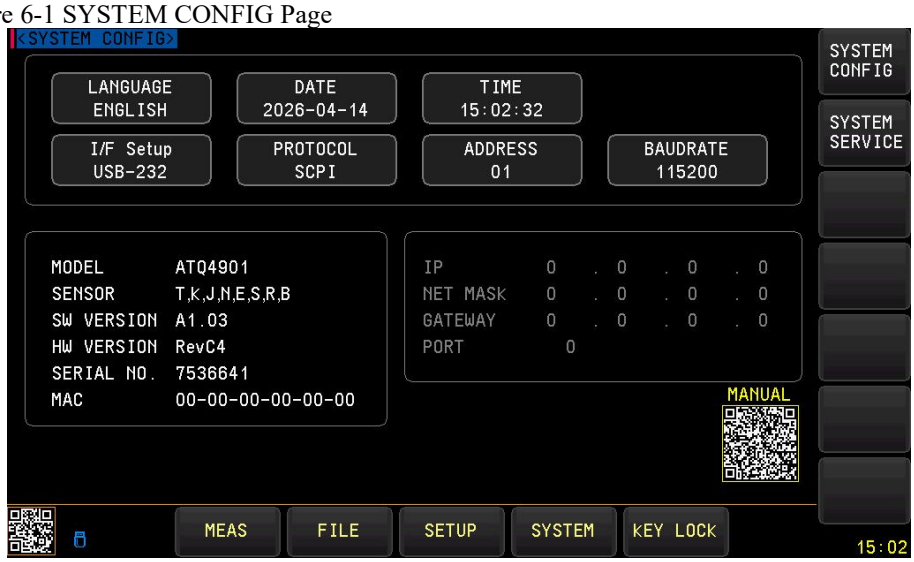
- <SYSTEM CONFIG> Page
- <SYSTEM SERVICE> Page

6.1 <SYSTEM CONFIG>Page

At any time, Press the【Setup】key, select the【System】key to enter the **<SYSTEM CONFIG>**page.
<**SYSTEM CONFIG**>page includes the following settings:

- LANGUAGE
- DATA
- TIME
- I/F Setup
- PROTOCOL
- ADDRESS
- BAUDRATE

Figure 6-1 SYSTEM CONFIG Page



6.1.1【LANGUAGE】

The instrument supports both English and Chinese.

■ Steps to set the language:

Step 1	Select the【System】key to enter the <System Configuration>page.	
Step 2	Use the cursor key to select 【Language】field.	
Step 3	Use the function key to select language	
	Soft keys	Function
	中文（CHS）	Chinese
	ENGLISH	English

6.1.2 【DATA】

■ Steps to set the data:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Use the cursor key to select the【DATA】	
Step 3	Use the function key to select the data	
	Soft keys	Function
	YEAR INCR+	+1 year
	YEAR DECR-	-1 year
	MONTH INCR+	+1 month
	MONTH DECR-	-1 month
	DAY INCR+	+1 day
	DAY DECR-	-1 day

6.1.3 【TIME】

The instrument uses 24-hour time format.

■ Steps to set the time:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Use the cursor key to select the【TIME】	
Step 3	Use the function key to select the time	
	Soft keys	Function
	HOUR INCR+	+1 hour
	HOUR DECR-	-1 hour
	MINUTE INCR+	+1 minute
	MINUTE DECR-	-1 minute
	SECOND INCR+	+1 second
	SECOND DECR-	-1 second

Note: If the internal battery is low, the clock will stop operating. In this case, the battery needs to be replaced.

6.1.4 【I/F Setup】

The instrument supports VCOM、USB-232、RS-232 and LAN interface

Steps to set the interface:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Use the cursor key to select the【I/F Setup】	
Step 3	Use the function key to set interface.	
	Soft keys	Function
	MAP DISK	The computer can access the instrument's internal memory via the TYPE-C interface. You can copy and delete data files on the internal memory on the computer.
	VCOM	The host computer obtains real-time acquisition data via the TYPE-C interface.
	USB-232	The host computer obtains real-time acquisition data via the USB-232 interface.
	RS-232	The host computer obtains real-time acquisition data via the RS-232 interface.
	LAN	The instrument has a built-in LAN interface. You can connect the instrument to the company's internal local area network to enable other computers on the network to control the instrument and

		perform data acquisition. Before using the LAN interface, you must assign an IP to the instrument and specify the gateway of the local area network.

6.1.5 【PROTOCOL】

The instrument supports SCPI and MODBUS communication protocols.

Steps to set the communication protocol:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Use the cursor key to select the【PROTOCOL】	
Step 3	Use the function key to set the communication protocol.	
	Soft keys	Function
	SCPI	Select SCPI as the host computer communication protocol. For protocol details, refer to Chapter 8.
	MODBUS	Select MODBUS as the host computer communication protocol. For protocol details, refer to Chapter 9.

6.1.6 【ADDRESS】

The instrument address only support values from 1 to 20

Steps to set the communication address:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Use the cursor key to select the【ADDRESS】	
Step 3	Use the function key to set the communication address.	
	Soft keys	Function
	1	Set the instrument communication address to 1.
	2	Set the instrument communication address to 2.
	…	…
	20	Set the instrument communication address to 20.

6.1.7 【BAUDRATE】

BAUD RATE

Steps to set the baud rate:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Use the cursor key to select the【BAUDRATE】	
Step 3	Use the function key to set the baud rate.	
	Soft keys	Function
	9600	Set the instrument communication baud rate to 9600.
	19200	Set the instrument communication baud rate to 19200
	38400	Set the instrument communication baud rate to 38400
	57600	Set the instrument communication baud rate to 57600
	115200	Set the instrument communication baud rate to 115200

6.1.8 【IP】

Steps to set the IP address:

Step 1	Select the【System】key to enter the <System Configuration>page
Step 2	Select the【IP】field.
Step 3	Use the function key to set the IP address.

	Soft keys	Function
	192.168.1.1	Set the IP address of this instrument

6.1.9 【NET MASK】

Steps to set the net mask:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Select the【NET MASK】field.	
Step 3	Use the function key to set the net mask.	
	Soft keys	Function
	255.255.255.0	Set the net mask of this instrument.

6.1.10 【GATEWAY】

Steps to set the gateway:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Select the【GATEWAY】field.	
Step 3	Use the function key to set the gateway.	
	Soft keys	Function
	192.168.1.1	Set the gateway of this instrument.

6.1.11 【PORT】

Steps to set the network port:

Step 1	Select the【System】key to enter the <System Configuration>page	
Step 2	Select the【PORT】field.	
Step 3	Use the function key to set the port.	
	Soft keys	Function
	2000	Set the network port of this instrument.



NOTE!
Due to hardware limitations of the instrument, the IP address and gateway cannot be obtained automatically. You must obtain them from your network administrator.

6.2 <SYSTEM SERVICE>Page



WARNING
This page is not accessible to users. It is used for factory calibration.Do not attempt to enter without professional guidance.Otherwise, calibration data may be lost, resulting in significant measurement errors.

7.FILE Page

You will learn the following information in this chapter:

- <FILE> Page

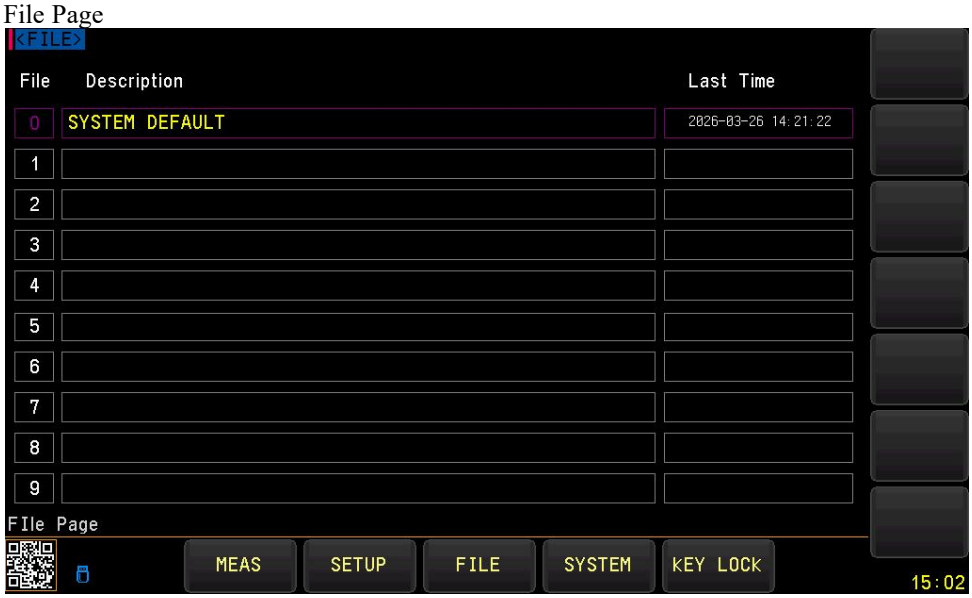
7.1 <FILE>Page

At any times,press the【Meas】or【Setup】key,select the【FILE】key to enter the<File Management> page.

<File Management>page includes the following setting:

- FILE

Figure 7-1 File Page



■ Steps to set the file:

Step 1	Press the [Setup] shortcut key to enter the main page.	
Step 2	Press the function key【FILE】to enter the <File> page.	
Step 3	Use the cursor keys to select the [SYSTEM DEFAULT] field.	
Step 4	Use the function keys on the sidebar to configure file operations.	
	Soft keys	Function
	SAVE	Save the current instrument settings.
	RECALL	Load the saved instrument settings
	ERASE	Delete the saved instrument settings

8.SCPI Command Reference

This chapter contains reference information for the SCPI Command for ATQ4901

- Command parser——Learn some rules of the command parser
- Command and parameter——Writing rules for command lines
- Command reference

This chapter provides all the SCPI commands used by the instrument, and by these SCPI commands give complete control of all functions of the instrument.

8.1 Command String Parsing

The host can send a string of commands to the instrument, and the instrument command parser starts resolving after capturing the end character (\ n) or the input buffer overflows.

For example: Valid Command String:

AAA:BBB CCC;DDD EEE;:FFF

The instrument command parser is responsible for all commands resolution and execution, and you must first learn about its resolution rules before writing a program.

8.1.1 Command Parsing Rules

1. The command parser parses and responds to ASCII code data.
2. **SCPI command string must use NL (' \n ' ASCII 0x0A) as the terminator**. The command parser will start executing the command string only after receiving the terminator or when the buffer overflows.
3. If the command handshake opens, the command parser immediately returns the character to the host after each character received, and the host can only continue to send the next character sent after receiving the character.
4. Upon detecting an error during parsing, the command parser immediately terminates the parsing process and invalidates the current command.
5. Upon detecting a query command during parsing, the command parser terminates the parsing of the current command string, and the subsequent character strings are ignored.
6. The command parser performs case-insensitive parsing of command strings.
7. The command parser supports abbreviated forms of commands; refer to subsequent chapters for the abbreviation specifications.

8.1.2 Symbol Conventions and Definitions

This chapter uses symbols that are not part of the command tree, just to get a better understanding of the command string.

< > Text in the pointed brackets indicates the parameters of the command

[ ] Text in square brackets indicates optional commands

{} When the braces contain several parameter items, it means that only one item can be selected from them.

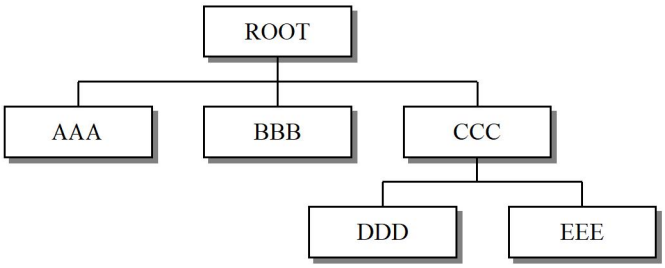
( ) The abbreviated form of the parameters is placed in parentheses.

The abbreviated form of the capital letter command.

8.1.3 Command Tree Structure

For the SCPI command using the tree structure, it can go down three levels (note: the command parser of this instrument can go down down any layer), here the highest level is called the subsystem command. The subordinate command is valid only if the subsystem command is selected, and the SCPI uses a colon (:) to separate high-level and low-level commands.

Figure 8- 1 Command Tree Structure



For example ROOT:CCC:DDD PPP
ROOT Subsystem Command
CCC Level 2
DDD Level 3
PPP Parameter

Commands and Parameters
A command tree consists of commands and [parameters], separated by a space (ASCII: 20H).

For example AAA:BBB 1.234
Command [Parameter]

8.1.4 Commands

Command words can be a long command format or short form, which allows engineers to better understand the meaning of the command string; the short form is suitable for writing.

8.1.5 Parameters

- Single-command Word Command,no parameters
  For example：AAA:BBB
- Parameters can be in string format,and their abbreviation rules still follow the “command Abbreviation Rules” in the Previous section.
  For example：AAA:BBB CCC
- Parameters can be in numeric Format
  - *<integer>* Integer 123, +123, -123
  - *<float>* Floating-point number
    1. <fixfloat>：Fixed point floating point number：1.23，-1.23
    2. <Sciloat>：Scientific notation floatingp-point number：1.23E+4，+1.23e-4
    3. <mpfloat>: Multiplier-based floating point：1.23k，1.23M，1.23G，1.23u

Table 8- 1 Multiplier Abbreviations

Values	Multipliers
1E18 (EXA)	EX
1E15 (PETA)	PE
1E12 (TERA)	T
1E9 (GIGA)	G
1E6 (MEGA)	MA
1E3 (KILO)	K
1E-3 (MILLI)	M
1E-6 (MICRO)	U
1E-9 (NANO)	N
1E-12 (PICO)	P
1E-15 (PEMTO)	F
1E-18 (ATTO)	A

Note: Multipliers are case-insensitive and their notation differs from standard names.

8.1.6 Separator

The instrument command parser accepts only the allowed separators, otherwise the delimited command parser produces the Invalid separator error. These separators include:

; Semicolon:used to separate two commands.
For example: AAA:BBB 100.0;CCC:DDD

: Colcolon,which separates the command tree,or command tree restart.
For example: AAA:BBB:CCC 123.4;:DDD:EEE 567.8

? Question mark,used for the query.
For example: AAA?

□ Spare space:used to separate the parameter.
For example: AAA:BBB□1.234

The host can send a command string to the instrument,The instrument's command parser will start parsing after detecting the terminator (\n) or when the input buffer overflows.

FOR EXAMPEL: Valid Command String:

AAA:BBB CCC;DDD EEE;:FFF

The instrument's command parser is responsible for parsing and executing all commands. You must first understand its parsing rules before writing programs.

8.2 Command Reference

All commands are interpreted in the order of subsystem commands, and all subsystems are listed below.

- MEAS Measurement Setup Subsystem
- SYST System Setup Subsystem
- FETCH Data Fetch Subsystem
- ERROR Error Subsystem
- IDN? Query Subsystem

8.2.1 MEAS Subsystem

MEAS Subsystem command group sets the meas page.

Table 8-2 MEAS Command Tree

Meas	:MODEL	{tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b}
	:RATE	{fast,med,slow}
	:KEYLOCK	{on,off}
	:START	{on,off}
	:CMODEL	<para>,<level>
	:CHANON	<para>,<on,off>
	:LOW	<level>
	:CLOW	<para>,<level>
	:HIGH	<level>
	:CHIGH	<para>,<level>
	:SENSOR	{tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b}
	:FONT	{fong24,font18,font16,font6x9}

8.2.1.1 MEAS:MODEL

MEAS:MODEL is used to set the sensor model

Command Syntax	MEAS:MODEL <tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b>
Example	SEND> MEAS:MODEL TC-T<NL> //Set the sensor model to T-type thermocouple.
Query Syntax	MEAS:MODEL?

Query Response	< tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b ><NL>
Example	SEND> MEAS:MODEL?<NL> RET> tc-t<NL>

8.2.1.2 MEAS:RATE

MEAS:RATE is used to set the sampling rate

Command Syntax	MEAS:RATE <fast,med,slow>
Example	SEND> MEAS:RATE fast<NL> //Set the sampling rate to fast
Query Syntax	MEAS:RATE?
Query Response	<fast,med,slow><NL>
Example	SEND> MEAS:RATE?<NL> RET> fast<NL>

8.2.1.3 MEAS:KEYLOCK

MEAS :KEYLOCK is used to set the key lock

Command Syntax	MEAS:KEYLOCK <on,off>
Example	SEND> MEAS:KEYLOCK off<NL> //Set the key to off
Query Syntax	MEAS:KEYLOCK?
Query Response	<on,off><NL>
Example	SEND> MEAS:KEYLOCK?<NL> RET> on<NL>

8.2.1.4 MEAS:START

MEAS :START is used to start sampling

Command Syntax	MEAS:START <on,off>
Example	SEND> MEAS:START off<NL> //Set the sampling to end
Query Syntax	MEAS:START?
Query Response	<on,off><NL>
Example	SEND> MEAS:START?<NL> RET> on<NL>

8.2.1.5 MEAS:CMODEL

MEAS :CMODEL is used to set the sensor model for each channel

Command Syntax	MEAS:MODEL <para>,<tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b>
Example	SEND> MEAS:CMODEL 0 TC-T<NL> //Set the sensor of channel 001 to type T
Query Syntax	MEAS:CMODEL? //Get the sensor model numbers of all channels MEAS:CMODEL? <int> //Get the single-channel sensor model number,minimum channel number is 1
Query Response	<tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b><NL>
Example	SEND> MEAS:CMODEL?<NL> RET> <tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b><NL> SEND> MEAS:CMODEL? 1<NL> //Get sensor model for channel 001 RET> <tc-t><NL>

8.2.1.6 MEAS:CHANON

MAEAS:CHANON is used to set the status of each channel.

Command Syntax	MEAS:CHANON <para>,<integer>

Example	SEND> MEAS:CHANON 1, ON<NL> //Set channel 001 to ON
Query Syntax	MEAS:CHANON?
Query Response	<on,off><NL>
Example	SEND> MEAS:CHANON?<NL> RET> <on,off,on,on,on,on,on,on,on><NL>

8.2.1.7 MEAS:LOW

MAEAS:LOW is used to set the low values for all channels.

Command Syntax	MEAS:LOW <float>
Example	SEND> MEAS:LOW -200.0<NL> //Set the low limit of channel to -200.0
Query Syntax	MEAS:LOW?
Query Response	<float,float><NL>
Example	SEND> MEAS:CLOW?<NL> RET> <-2.00000e+02, -2.00000e+02 ><NL>

8.2.1.8 MEAS:CLOW

MAEAS:CLOW is used to set the low for each channel

Command Syntax	MEAS:CLOW <para>,<float>
Example	SEND> MEAS:CLOW 1, -200.0<NL> //Set the low limit of channel to -200.0

8.2.1.9 MEAS:HIGH

MAEAS:HIGH is used to set the high for all channels

Command Syntax	MEAS:CHIGH <para>,<float>
Example	SEND> MEAS:CHIGH 1, 1800.0<NL> //Set the high for all channels to 1800.0
Query Syntax	MEAS:HIGH?
Query Response	<float,float><NL>
Example	SEND> MEAS:HIGH?<NL> RET> <1.80000e+03, 1.80000e+03 ><NL>

8.2.1.10 MEAS:CHIGH

MAEAS:CHIGH is used to set the high value for each channel.

Command Syntax	MEAS:CLOW <para>,<float>
Example	SEND> MEAS:CHIGH 1, 1800.0<NL> //Set the low of channel to 1800.01

8.2.1.11 MEAS:SENSOR

MAEAS:SENSOR is used to obtain the thermocouple type of each channel.

Query Syntax	MEAS: SENSOR
Query Response	< tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b ><NL>
Example	SEND> MEAS:SENSOR<NL> RET> < tc-t,tc-k,tc-j,tc-n,tc-e,tc-s,tc-r,tc-b ><NL>

8.2.1.12 MEAS:FONT

MAEAS:FONT is used to set the display page.

Command Syntax	`MEAS:FONT < font24,font18,font16,font6x9>`
Example	`SEND> MEAS:FONT font24<NL>` **//Set the display to font size 24**

8.2.2 SYST Subsystem

SYST Subsystem is used to set the SETUP page.

Table 8-3 SYST Command Tree

`Meas`	`:COMP`	`{on,off}`
	`:BEEP`	`{on,off}`
	`:UNIT`	`{cel,kel,fah}`

8.2.2.1 SYST:COMP

SYST :COMP is used to set the comparator state

Command Syntax	`MEAS:COMP <on,off>`
Example	`SEND> SYST:comp on<NL>` `//Set the comparator to ON.`
Query Syntax	`MEAS:comp?`
Query Response	`<on,off><NL>`
Example	`SEND> SYST:comp?<NL>` `RET> on<NL>`

8.2.2.2 SYST:BEEP

SYST:BEEP is used to set the state of beep.

Command Syntax	`MEAS:BEEP <on,off>`
Example	`SEND> SYST:beep on <NL>` `//Set the beep to ON.`
Query Syntax	`MEAS:beep?`
Query Response	`<on,off><NL>`
Example	`SEND> SYST:beep?<NL>` `RET> on<NL>`

8.2.2.3 SYST:UNIT

SYST:UNIT is used to set the temperature unit.

Command Syntax	`MEAS:UNIt <cel,kel,fah>`

Parameter	<cel,kel,fah>
	`cel: Celsius`
	`kel: Kelvin`
	`fah: Fahrenheit`

Example	`SEND> SYST:unit cel<NL>` **//Set temperature unit to Celsius**
Query Syntax	`MEAS:unit?`
Query Response	`<℃,K,F><NL>`
Example	`SEND> SYST:unit?<NL>` `RET> ℃<NL>`

8.2.3 FETCH Subsystem

FETCh Subsystem is used to acquire temperature data.

Table 8-4 FETCH Command Tree

`fetch?`	

8.2.3.1 FETCH?

FETCh? is used to acquire temperature data

Query Syntax	**Fetch?**
Query Response	<float, float, float><NL>
Example	SEND> fetch?<NL> RET> +1.00000e-05, +1.00000e-05, +1.00000e-05<NL>

8.2.4 ERROR Subsystem

ERRor Subsystem returns error information

Query Syntax	**ERROR?**
Query Response	**Error string**
Example	SEND> ERR?<NL> RET> no error<NL>

8.2.5 IDN Subsystem

IDN? is used to query the instrument ID.

Query Syntax	**IDN? Or *IDN?**
Query Response	**<MODEL>,<Revision>,<SN>,< Manufacturer>**

9. Modbus(RTU) Command Reference

You will learn the following information in this chapter:

- Data Format——Understand the Modbus Communication format
- Function——Writing rules on the command line
- Variable domains
- Function code

This chapter provides all MODBUS commands for instrument operation.With these MODBUS command, all Functions of the instrument can be fully controlled.

9.1 Data Format

We comply with the Modbus（RTU）communication protocol.The instrument will respond to commands from the host computer and return standard response frames.

Reference： You can contact the sales department of our company to obtain the Applent instrument communication test tool, which has the Modbus communication debugging method. Including the CRC-16 calculator and the floating point number into the Modbus floating point number format.

9.1.1 Command Parsing Rules

Figure 9-9 Modbus Command Frame



Table 9- 1 Command Frame Instruction

	A squelch interval of at least 3.5 characters is required.
Slave address	1byte Modbus can support 00~0x63 slave Specified as 00 for the unified broadcast Without the RS485 option, the default slave address is 0x01
Function code	1byte 0x03：Read out the multiple registers 0x04：=03H，Not to be used 0x06：Write to a single register and can be replaced with 10H 0x08： Echo test (used for commissioning only) 0x10：Write to multiple registers
Data	Specifies the register address, quantity, and content
CRC-16	2 bytes, low in front CyclicRedundancy Check Calculate all data from the slave address to the end of the data to obtain the CRC16 check code.
	A squelch interval of at least 3.5 characters is required.

9.1.2 CRC-16 Calculation Method

1 Set the initial value of the CRC-16 register to 0xFFFF.
2 XOR on the 1st byte of the CRC-16 register and information and returns the calculation to the CRC register.
3 Fill in the MSB with 0 and shift the CRC register by 1 bit to the right .
4 If the bit moved from the LSB is 0, repeat step (3) (processing the next 1 shift).If the bit moved from the LSB is "1", perform XOR to the CRC register and 0xA001 and return the result to the CRC register.
5 Repeat steps (3) and (4) until 8 bits are moved.
6 If the information processing is not finished, perform the XOR operation on the CRC register and the next 1 byte of the information and return the CRC register, repeating from step (3).
7 Attach the calculated result (the value of the CRC register) from the low-level byte to the message.

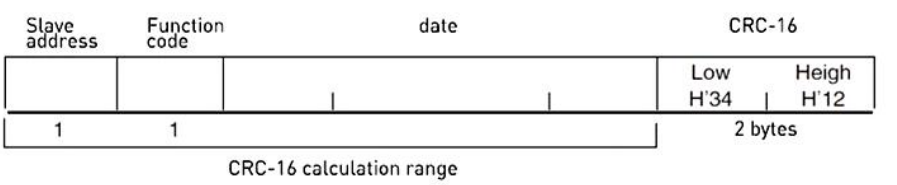
The following is a CRC calculation function for a VB language:

```
Function CRC16(data() As Byte) As Byte()
    Dim CRC16Lo As Byte, CRC16Hi As Byte   'CRC Register
    Dim CL As Byte, CH As Byte       'Poly Code&HA001
    Dim SaveHi As Byte, SaveLo As Byte
    Dim i As Integer
    Dim flag As Integer
    CRC16Lo = &HFF
    CRC16Hi = &HFF
    CL = &H1
    CH = &HA0
    For i = 0 To UBound(data)
       CRC16Lo = CRC16Lo Xor data(i) 'Each data is XXOR to the CRC register                For flag
= 0 To 7
           SaveHi = CRC16Hi
           SaveLo = CRC16Lo
          CRC16Hi = CRC16Hi \ 2     'Move a high right
        CRC16Lo = CRC16Lo \ 2     'Move one position from low to right
            If ((SaveHi And &H1) = &H1) Then 'if the last digit of the high byte is 1
           CRC16Lo = CRC16Lo Or &H80   'Then the low byte moves right after the front fill 1
            End If            'Otherwise, automatically fill 0
            If ((SaveLo And &H1) = &H1) Then 'If LSB is 1,then XOR with the polynomial code
           CRC16Hi = CRC16Hi Xor CH
           CRC16Lo = CRC16Lo Xor CL
       End If
         Next flag
     Next i
     Dim ReturnData(1) As Byte
     ReturnData(0) = CRC16Hi      'CRC high byte
     ReturnData(1) = CRC16Lo      'CRC low byte
     CRC16 = ReturnData
     End Function
```

Reference: Our company's "Applent instrument communication test tool", which has Modbus communication debugging method. The CRC-16 calculator is included.

Calculating that the CRC-16 data need to be attached to the end of the instruction frame, e. g: 1234H

Figure 9- 1 Modbus Additional CRC-16 Value



9.1.3 Response Frame

Except for the 00H slave address command, the other slave address instrument returns the response frame.

Figure 9-2 Normal Response Frame

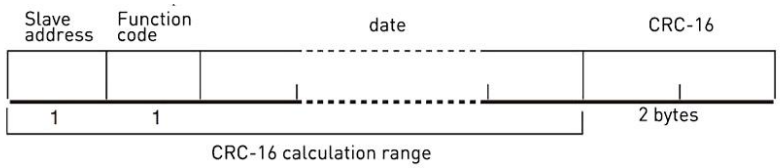


Figure 9-3 Abnormal Response Frame

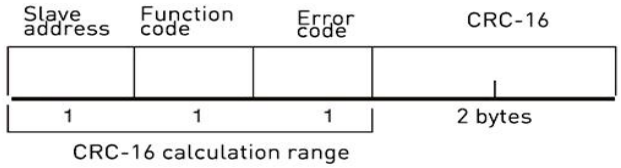


Table 9-2 Description of Abnormal Response Frame

Slave address	1 byte Slave address is returned as received
Function code	1 byte The function code of the command frame is logically OR BIT7 (0x80). For example: 0x03 OR 0x80 = 0x83
Error code	Exception code: 0x01 Function code error (function code is not supported) 0x02 Register error (register not present) 0x03 Data error 0x04 Execution error
CRC-16	2 Bytes, low in front CyclicRedundancy Check Calculated from the slave address to the end of the data to generate the CRC16 check code.

9.1.4 No Response

In the following cases, the instrument will not process or respond, resulting in a communication timeout.

1. Slave address error
2. Transmission error
3. CRC-16 error
4. Digit error: function code 0x03 total digits must be 8 and accepted less than 8 or more than 8 bytes.
5. When the slave address is 0x00, it represents the broadcast address, and the instrument does not respond.

9.1.5 Error Code

Table 9-3 Description of Error Code

Error Code	Name	Description	Priority
0x01	Functional code error	Function code does not exist.	1
0x02	Register error	Register does not exist.	2
0x03	Data error	Wrong number of registers or bytes.	3
0x04	Execution error	Data is illegal, and the written data is not within the allowable range.	4

9.2 Function Code

The instrument only supports the following function codes, and other function codes will respond to the error frame.

Table 9-4 Function Code

Function Code	Name	Description

0x03	Read out the multiple registers	Read out data of a plurality of consecutive registers.
0x04	Same as in 0x03	Use 0x03 instead.
0x08	Echo test	RECEIVE the data of is returned.
0x10	Write multiple registers	Write to multiple consecutive registers.

9.3 Register

The number of registers of the instrument is 2 byte mode, that is, 2 bytes must be written each time, for example, the register of speed is 0x3002, the data is 2 bytes, the value must be written to 0x0001

Data:

The instrument supports the following numerical values:

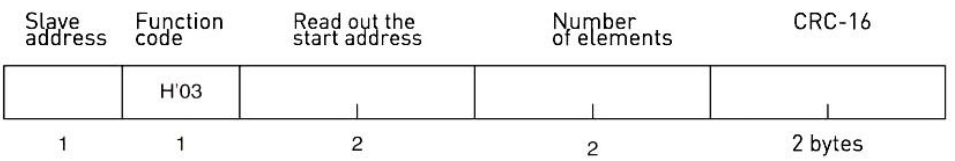
1. 1 register, double-byte (16-bit) integer, e.g.: 0x64 → 00 64
2. 2 registers, four-byte (32-bit) integer, e.g.: 0x12345678 → 12 34 56 78
3. 2 registers, four-byte (32-bit) single precision floating point number, 3.14 → 40 48 F5 C3

Reference:

Our company's "Applent instrument communication test tool ", which has Modbus communication debugging method. The floating point number converter is included.

9.4 Read Out Multiple Registers

Figure 9-4 Read Out Multiple Registers (0x03)

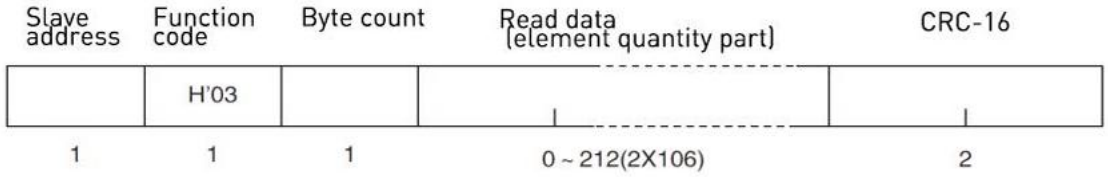


The function code for reading out multiple registers is 0x03.

Table 9-5 Read Out Multiple Registers

Name	Parameter	Description
	Slave address	Defaults to 01 if no RS485 address is specified.
0x03	Function code	
	Start address	Starting address of the register, refer to the Modbus Instruction Set.
	Number of registers to read 0001~006A (106)	Number of consecutive registers to read. Refer to the Modbus instruction Set to ensure that all these register addresses exist; otherwise an error frame will be returned.
CRC-16	Check code	

Figure 9- 5 Read Out Multiple Registers (0x03) Response Frames



Name	Parameter	Description
	Slave address	Return as is
0x03 Or 0x83	Function code	No abnormality: 0x03 Error code: 0x83
	Byte number	= Number of registers x2 For example: 1 register returns 02
	Data	Read data
CRC-16	Check code	

9.5 Write to Multiple Registers

Figure 9- 6 Write to Multiple Registers（0x10）

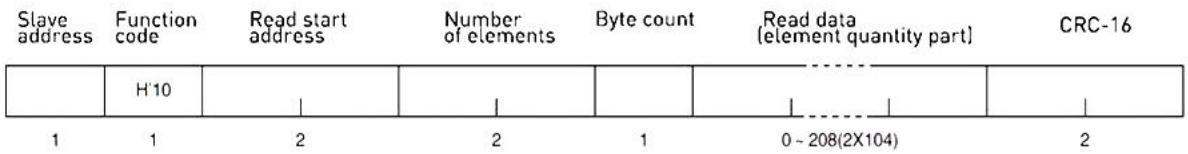
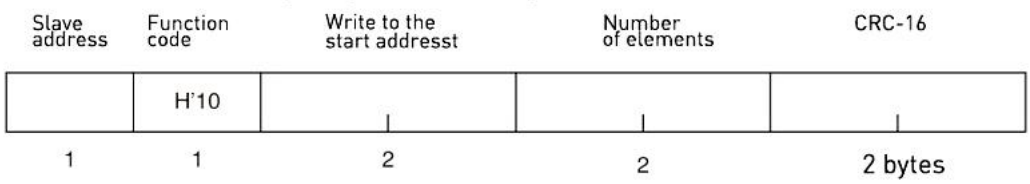


Table 9- 6 Write to Multiple Registers

Name	Parameter	Description
	Slave address	Default is 01 when the RS485 address is not specified.
0x10	Function Code	
	Start address	Register start address, please refer to the Modbus instruction set.
	Number of written registers 0001~0068（104）	Number of continuously read registers. Refer to the Modbus instruction set to ensure that these register addresses are present, otherwise error frames will be returned.
	Byte number	= Number of registers x2
CRC-16	Check code	

Figure 9- 7 Write to Multiple（0x03）Response Frames



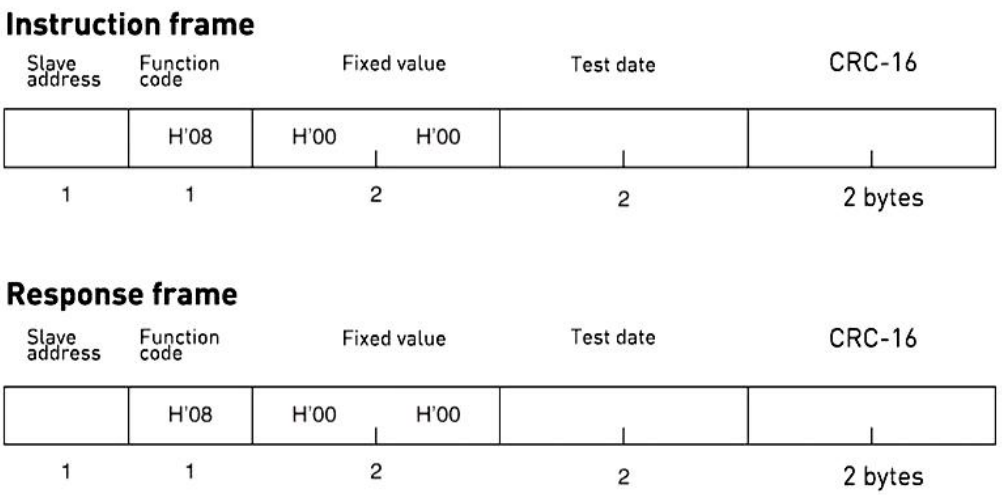
Name	Parameter	Description
	Slave address	Return as is
0x10 or 0x90	Function code	No abnormality: 0x10 Error code: 0×90
	Start address	

	Number of registers	
	CRC-16 check code	

9.6 Echo Test

Echo test function code 0x08 for debugging the Modbus.

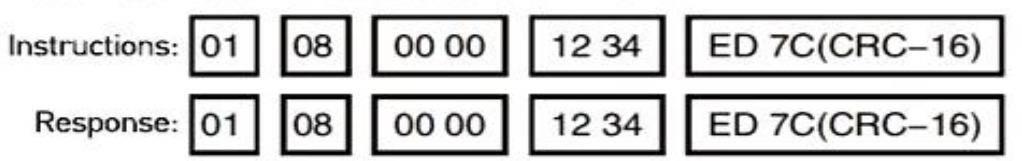
Figure 9-8 Echo Test（0x08）



Name	Parameter	Description
	Slave address	Return as is
0x08	Function code	
	Fixed value	00 00
	Test data	Any numerical value: for example: 12 34
	CRC-16 check code	

For example：

Test data is assumed to be 0x1234：



10. Modbus(RTU) Instruction Set

You will learn the following information in this chapter:

- Register address

Reference

Be sure to contact the sales department of our company to obtain the communication test tool of Applent Instruments, which contains Modbus communication debugging method. Includes CRC-16 calculator and floating-point number,which is converted into Modbus floating-point number format.

Note:Unless otherwise specified,the values of instruction and response frames in the following descriptions are hexadecimal data.

10.1 Register Overview

The following table contains all register addresses for the instrument,and any address not in the table will return error code 0x02.

Table 12-1 Register Overview

Register Address	Name	Data Value	Description
Battery Capacity Test			
2000	Channel 1 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
2002	Channel 2 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
2004	Channel 3 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
2006	Channel 4 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
...	...	...	...
207E	Channel 64 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
3000	Set the test switch register (ON/OFF)	0000: OFF 0001: ON	Read/write register, 2-byte integer
3001	Display page	0~3	Read/write register, 2-byte integer
3002	Set Sensor Model Uniformly	0~7	Read/write register, 2-byte integer

10.1.1 Channel 1 Test Result Register【2000】

Read

1	2	3	4	5	6	7	8
01	**03**	**20**	**00**	**00**	**02**	**CF**	**CB**
	Read	Register		Number of registers		CRC	

Response:

1	2	3	4	5	6	7	8	9
01	**03**	**04**	**41**	**C8**	**00**	**00**	**6F**	**F1**
01	03	Byte	Data				CRC-16	

Among which,bits B4 to B7 are the test data of channel 1 : 41C80000 = 25.0 ,the temperature value is 25.0℃

10.1.2 Channel 2 Test Result Register【2002】

Read

1	2	3	4	5	6	7	8
01	**03**	**20**	**02**	**00**	**02**	**6E**	**0B**
	Read	Register		Number of registers		CRC	

Response:

1	2	3	4	5	6	7	8	9
01	**03**	**04**	**41**	**D0**	**00**	**00**	**EF**	**F6**
01	03	Byte	Data				CRC-16	

Among which, bits B4 to B7 are the test data of Channel 2: 41D00000 = 26.0 , the temperature value is 26.0℃

10.1.3 Sampling Switch Register【3000】

Write

1	2	3	4	5	6	7	8	9	10	11
01	**10**	**30**	**00**	**00**	**01**	**02**	**00**	**00**	**96**	**53**
	Write	Register		Number of registers		Byte	Data		CRC	

Response:

1	2	3	4	5	6	7	8
01	**10**	**30**	**00**	**00**	**01**	**0E**	**C9**
		Register		Number of registers		CRC	

Among them,B8~B9 represents the test mode data: 0000 = 0 , The instrument's sampling is turned off

Read

1	2	3	4	5	6	7	8
01	**03**	**30**	**00**	**00**	**01**	**8B**	**0A**
	Read	Register		Number of registers		CRC	

Response:

1	2	3	4	5	6	7
01	**03**	**02**	**00**	**00**	**B8**	**44**
01	03	Byte	Data		CRC-16	

10.1.4 Display Page Register【3001】

Write

1	2	3	4	5	6	7	8	9	10	11
01	**10**	**30**	**01**	**00**	**01**	**02**	**00**	**00**	**97**	**82**
	Write	Register		Number of registers		Byte	Data		CRC	

Response:

1	2	3	4	5	6	7	8
01	**10**	**30**	**01**	**00**	**01**	**5F**	**09**

		Register	Number of Registers	CRC

Among them,B8~B9 represent the test function data: 0000 = 0 ,at this time,the instrument display page is the 24-font page.

Read

1	2	3	4	5	6	7	8
01	**03**	**30**	**01**	**00**	**01**	**DA**	**CA**
	Read	Register		Number of registers		CRC	

Response：

1	2	3	4	5	6	7
01	**03**	**02**	**00**	**00**	**B8**	**44**
01	03	Byte	Data		CRC-16	

10.1.5 Sensor Register【3002】

Write:

1	2	3	4	5	6	7	8	9	10	11
01	**10**	**30**	**02**	**00**	**01**	**02**	**00**	**00**	**97**	**B1**
	Write	Register		Number of registers		Byte	Data		CRC	

Response：

1	2	3	4	5	6	7	8
01	**10**	**30**	**02**	**00**	**01**	**AF**	**09***
		Register		Number of registers		CRC	

Among them, B8~B9 are the voltage range mode data: 0000 = 0, at which time the instrument's sensors are uniformly set to TC-T.

Read:

1	2	3	4	5	6	7	8
01	**03**	**30**	**02**	**00**	**01**	**2A**	**CA**
	Read	Register		Number of registers		CRC	

Response：

1	2	3	4	5	6	7
01	**03**	**02**	**00**	**00**	**B8**	**44**
01	03	Byte	Data		CRC-16	

11. Modbus(TCP) Command Reference

You will learn the following information in this chapter:

- Data Format——Understanding Modbus Communication Format
- Function——Command Line Syntax Rules
- Variable Domains
- Function Code

This chapter provides all MODBUS commands for instrument operation.With these MODBUS command, all Functions of the instrument can be fully controlled.

11.1 Data Format

We follow the Modbus TCP communication protocol. The instrument will respond to commands from the host computer and return a standard response frame.

11.1.1 Command Parsing Rules

Figure 11-1 Modbus Command Frame

MBAP				PDU		
Transaction Identifier	Protocol Identifier	Following Packet Length	Slave Address	Function Code	Starting Address	Number of Registers to Read
00 01	00 00	00 06	01	03	00 00	00 01

Table 9- 1 Command Frame Description

	At least 3.5 character times of quiet interval are required
Transaction Identifier	Occupies 2 bytes; the transaction identifier of the message frames is consistent between the master and slave during a single communication session
Protocol Identifier	Occupies 2 bytes; 00 00 indicates the Modbus TCP protocol
Length of subsequent message	Occupies 2 bytes; indicates the length of the subsequent message
Slave Address	1 byte Modbus can support 00 to 0x63 slave devices Set to 00 for global broadcast For instruments without the RS485 option, the default slave address is 0x01
Function Code	1 byte 0x03：Read multiple registers 0x04：=03H,not used 0x06：Write single register; can be replaced with 10H 0x08:Echo Test（for debugging use only） 0x10：Write multiple registers
Data	Specifies register address, quantity, and content
	At least 3.5 character times of quiet interval are required

12. Modbus(TCP) Instruction Set

You will learn the following information in this chapter:

- Register Address

Note: Unless otherwise specified, all values in the command and response frames described below are in hexadecimal format.

12.1 Register Overview

The following lists all register addresses used by the instrument. Any address not in the table will return error code 0x02.

Table 12- 1 Register Overview

Register Overview	Name	Value	Description
Battery Capacity Test			
2000	Channel 1 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
2002	Channel 2 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
2004	Channel 3 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
2006	Channel 4 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
…	…	…	…
207E	Channel 64 Temperature Value	4 Byte floating point number	Read-only registers, data occupies 2 registers
3000	Sampling Switch	0000：OFF 0001：ON	Read/write register, 2-byte integer
3001	Display Page	0~3	Read/write register, 2-byte integer
3002	Set Sensor Model Uniformly	0~7	Read/write register, 2-byte integer

12.1.1 Channel 1 Test Result Register【2000】

Read

1	2	3	4	5	6	7	8	9	10	11	12
00	**01**	**00**	**00**	**00**	**06**	**01**	**03**	**20**	**00**	**00**	**02**
Transaction Identifier		Protocol Identifier		Following Package Length		Address	Read	Registers		Number of registers	

Response：

1	2	3	4	5	6	7	8	9	10	11	12	13
00	**01**	**00**	**00**	**00**	**07**	**01**	**03**	**04**	**41**	**C8**	**00**	**00**
Transaction Identifier		Protocol Identifier		Following Package Length		Address	Read	Quantity	Data			

Among them, B4~B7 are the test data of Channel 1:41C80000 = 25.0, and the temperature value is 25.0℃.

12.1.2 Sampling Switch Register【3000】

Read

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
00	**01**	**00**	**00**	**00**	**09**	**01**	**10**	**30**	**00**	**00**	**01**	**02**	**00**	**00**
Transaction Identifier		Protocol Identifier		Following Package Length		Add ress	Re ad	Registers		Number of registers		Byte	Data	

Response:

1	2	3	4	5	6	7	8	9	10	11	12
00	**01**	**00**	**00**	**00**	**06**	**01**	**10**	**30**	**00**	**00**	**00**
Transaction Identifier		Protocol Identifier		Following Package Length		Address	Read	Register Address		Data	

Among them, B11~B12 are the test mode data:0000 = 0, instrument sampling is off at this time.

Read

1	2	3	4	5	6	7	8	9	10	11	12
00	**01**	**00**	**00**	**00**	**06**	**01**	**03**	**30**	**00**	**00**	**01**
Transaction Identifier		Protocol Identifier		Following Package Length		Address	Read	Registers		Number of registers	

Response:

1	2	3	4	5	6	7	8	9	10	11
00	**01**	**00**	**00**	**00**	**05**	**01**	**03**	**02**	**00**	**00**
Transaction Identifier		Protocol Identifier		Following Package Length		Address	Read	Quantity	Data	

Among them, B10~B11 indicate the test status:0000 = 0, sampling is off at this time.

13. Specification

You will learn about the following in this chapter:

- Qualification
- Specifications
- Outline dimension

13.1 Qualification

The following data were measured under the following conditions:

- Temperature condition: 23℃±5℃
- Humidity condition: ≤65% R.H.
- Pre-heating time: >60 minutes
- Calibration time: 12 months

Measurement Environment:

- Index: Temperature 15℃~35℃ Humidity <80%RH
- Operation: Temperature 10℃~40℃ Humidity 10~90%RH
- Storage : Temperature 0℃~50℃ Humidity 10~90%RH

Thermocouple Type: T,K,J,N,E,S,R,B
Display Digits: 5 digits for main parameter
Measurement Speed: Fast,Slow
Maximum Reading: 1800.0
Minimum Reading: -200.0
Data Logging: USB Memory,internal memory
Beep: ON/OFF
Communication: LAN,TYPE-C,RS-232,USB
Programming Language: SCPI,MODBUS

13.2 Specification

- 7-inch touchscreen TFT-LCD true-color display, resolution: 800×480
- Comparator (sorting) function: built-in sorting records
- Chinese/English language switching
- Compatible with SCPI command set and MODBUS command set
- Weight: 5000g

13.3 Measurement Accuracy

The instrument accuracy does not include the accuracy of standard junction compensation.

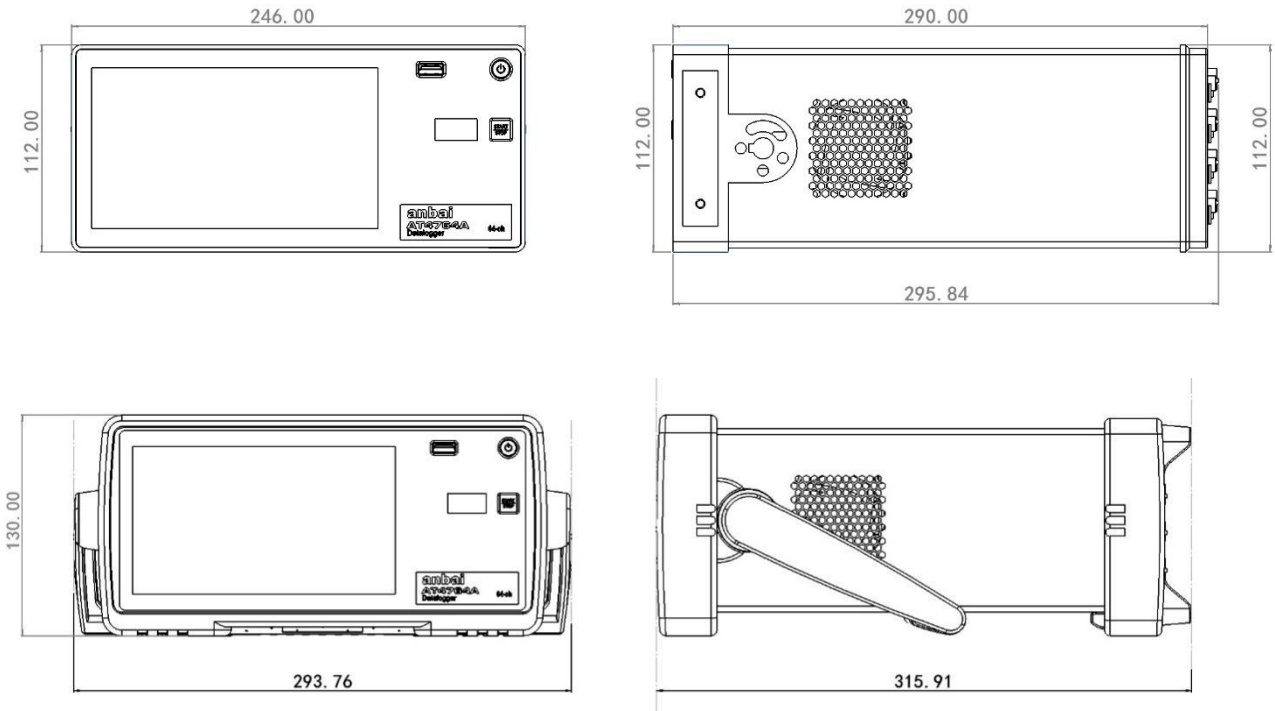
Model	Test Temperature Range (℃)	Measurement Accuracy (℃)
Type T Thermocouple	-200℃ ~ 0℃ 0℃ ~ 400℃	±1.0℃ ±0.8℃
Type K Thermocouple	-200℃ ~ 0℃ 0℃ ~ 1350℃	±1.2℃ ±0.8℃
Type J Thermocouple	-200℃ ~ 0℃ 0℃ ~ 1200℃	±1.0℃ ±0.7℃
Type N Thermocouple	-200℃ ~ 0℃ 0℃ ~ 1300℃	±1.5℃ ±0.9℃
Type E Thermocouple	-200℃ ~ 0℃ 0℃ ~ 850℃	±0.9℃ ±0.7℃
Type S Thermocouple	0℃ ~ 100℃ 100℃ ~ 300℃ 300℃ ~ 1750℃	±4.5℃ ±3.0℃ ±2.2℃
Type R Thermocouple	0℃ ~ 100℃ 100℃ ~ 300℃ 300℃ ~ 1750℃	±4.5℃ ±3.0℃ ±2.2℃
Type B Thermocouple	600℃ ~ 800℃ 800℃ ~ 1000℃ 1000℃ ~ 1800℃	±5.5℃ ±3.8℃ ±2.5℃

Standard junction compensation adds ±0.5℃ to the thermocouple measurement accuracy.

The measurement accuracy of the thermocouple sensor shall be subject to the standards of the sensor manufacturer.

13.4 Outline Dimension

(Schematic diagram)



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