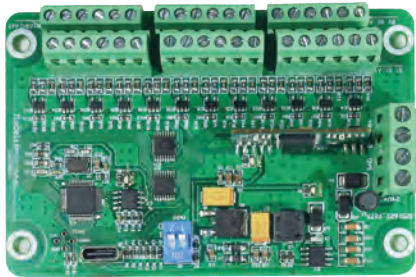# Temperature Acquisition Module
User Manual
(For T52L A Version)
(T52L Series)

Features:

⊙ PT100 input, temperature unit Fahrenheit or Celsius can be selected

⊙ With many functions, measured display, disconnection detection, RS485 communication, etc

⊙ Communication address can be set by toggle switch

⊙ This product is used in lithium battery high vacuum baking equipment

The instruction explain T52L series instrument settings, connections,name and etc, please read carefully before you use the temperature controller. Please keep it properly for necessary reference.

I. Safe Caution

⚠ Warning:Electric-shock

1) Please don`t plug in before completing all the wire.Otherwise it may lead to electric shock, fire, fault.
2) Don't touch power terminal and other high voltage part when the power on, otherwise you may get an electric-shock.
3) Don't remove,repair and modify this product,otherwise it may lead to electric shock, fire, fault and electrical Danger.

⚠ Warning:Forbiddance

1) Not allow to use outside the scope of product specification,otherwise it may lead to fire,fault.
2) Not allow to use in the place where is inflammable and explosive gas.
3) The product should not be used in a nuclear facility and human life associated medical equipment.
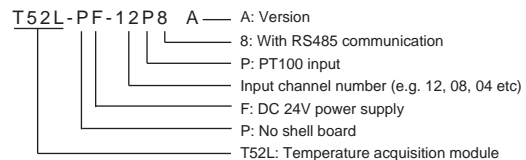
⚠ Caution

1) When the failure or abnormality of this product may lead to serious system accidents, please set proper protection circuits in the external.
2) The product may occur radio interference when it used at home.You should take adequate countermeasures.
3) The product get an electric shock protection through reinforced Insulation. When the product is embedded in the devices and wiring,please subject to the specification of embedded devices.
4) In order to prevent surge occurs,when using this product in the place of over 30m indoor wiring and wiring in outdoor, you need to set the proper surge suppression circuitry.
5) The product is produced based on mounting on the disk.In order to avoid to touch the wire connectors,please take the necessary measures on the product.
6) Be sure to observe the precautions in this manual, otherwise there is a risk of a major injury or accident.
7) When wiring, please observe the local regulation.
8) To prevent to damage the machine and prevent to machine failure, the product is connected with power lines or large capacity input and output lines and other methods please install proper capacity fuse or other methods of protection circuit.
9) Please don't put metal and wire clastic mixed with this product,otherwise it may lead to electric shock, fire, fault.
10) Please tighten screw torque according to the rules.If not,it may lead to electric shock and fire.
11) In order not to interfere with this products to dissipate heat, please don't plug casing around the cooling vent hole and equipment.
12) Please don't connect any unused terminal.
13) Please do the cleaning after power off, and use the dry cleaning cloth to wipe away the dirt. Please don't use desiccant, otherwise, it may casue the deformation or discoloration of the product.
14) Please don`t knock or rub the panel with rigid thing.
15) The readers of this manual should have basic knowledge of electrical,control, computer and communications.
16) The illustrations, data examples and picture examples used in this manual are recorded for the convenience of understanding the manual, and are not guaranteed to be the results of the operation.
17) In order to use this product with safety for long-term,regular maintenance is necessary. The life of some parts of the equipments are by some restrictions, but the performance of some will change for using many years.
18) Without prior notice, the contents of this manual may will be change. We hope these is no any loopholes, if you have questions or objections, please contact us.
19) Our company will not liable for any indirect losses suffered by users or third parties, such as the results impact of using this product, unpredictable product defects, imitations of this product and other indirect losses.

⚠ Caution of Installation & Wiring

1. Installation
1) This product is used in the following environmental standards.
   (IEC61010-1) [Overvoltage categoryⅡ、class of pollution 2]
2)This product is used in the following environment:Temperature range:-20 ~ 125℃;humidity: 45~85%RH; environment condition:Indoor use. The altitude is less than 5000m.

3) Please avoid using in the following places：
   The place will be dew for changing temperature;with corrosive gases and flammable gas; with vibration and impact;with water, oil, chemicals, smoke and steam facilities with dust, salt, metal powder;and with clutter interference, static electric and magnetic fields, noise;where the air from air conditioning or heating is blowing directly; where will be illuminated directly by sunlight; where accumulation of heat will happen caused by radiation.
4) On the occasion of the installation, please consider the following before installation.
   In order to prevent heat saturated, please open enough ventilation space.
   Please consider connections and maintenance environment,and ensure that there is more than 50mm space above and below the product.
   Please avoid to install the product above the machines with high the calorific value (Such as heaters, transformer, semiconductor operations, the bulk resistance).
   The surrounding environment shall not exceed the limit of using conditions.
   In order to improve the anti - interference performance and security, please try to stay away from high pressure machines, power machines to install.
   Don`t install on the same plate with high pressure machine and the product.
   The distance should be more than 200mm between the product and power line.
   The power machine shall be installed at a distance as far as possible.

2. Cable caution：
1) Please use specified compensation wire in the place of TC input; Please use insulated TC if the measured device is heated metal.The influence of external resistance is about 0.3 μ V/Ω。
2) Please use the cable with small wire resistance in the place of RTD input,and the cable (3 wire) must be no resistance difference, The wire should be run in parallel and the cable length should less than 5m.
3) In order to avoid the effect of noise,please wire the input signal away from meter cable,power cable,load cable.
4) In order to reduce the power cables and the load power cables on the effect of this product, please use noise filter in the place where easy to effect. You must install it on the grounding of the disk if you use the noise filter,and make the wiring to be shortest between noise filter output side and power connectors. Don`t install fuse and switch on the wiring of noice filter output side,otherwise it will reduce the effect of noise filter.
5) It takes 5s from input power to output.If there is a place with interlocking actions circuit signal,please use timer relay.
6) Please use twisted pair with a shield for analog output line, can also connect the common-mode coil to the front-end of the signal receiving device to suppress line interference if necessary, to ensure the reliabilty of signal.
7) Please use twisted pair with a shield for remote RS485 communication cable, and deal with the shield on the host side earth, to ensure the reliabilty of signal.
8) This product don't have the fuse; please set according to rated voltage 250V, rated current 1A if you need; fuse type:delay fuse.
9) Please use suitable screw force and suitable crimping terminal
   Terminal screw size: see real object
   Recommended terminal tightening torque: 0.4N.m.
   Proper cables: 0.25 ~ 1.65mm single cable/multiple core cable
10) Please don't put the Crimp terminal or bare wire part contact with adjacent connector.

II. Model Illustration

T52L-PF-12P8 A —— A: Version
　　　　　　　　　　8: With RS485 communication
　　　　　　　　　　P: PT100 input
　　　　　　　　　　Input channel number (e.g. 12, 08, 04 etc)
　　　　　　　　　　F: DC 24V power supply
　　　　　　　　　　P: No shell board
　　　　　　　　　　T52L: Temperature acquisition module

III. Specifications

1. Electrical parameters:

Sampling rate	2 times per second
Power supply	10 ~ 30V DC
Power consumption	< 1VA
Communication port	RS485 port Modbus-RTU protocol
ESD	IEC/EN61000-4-2 Contact ±4KV /Air ±8KV perf.Criteria B
Pulse traip anti-interference	IEC/EN61000-4-4 ±2KV perf.Criteria B
Voltage drop & short interruption immunity	IEC/EN61000-4-29 0% ~ 70%　　　perf.Criteria B
Isolation voltage	Signal input and commnucation port DC500V，1min
Power failure memory	5 years, times of writing: 1 million times

2. Non-electrical parameters:

Total weight	About 150g
Ambient conditions	Indoor use only, temperature: -20-125℃ no condensation, humidity < 85%RH, altitude<5000m
Shell material	Shell and panel base frame PC / ABS (flame retardant UL94V-0)
Storage environment	-40 ~ 140℃,no condensation

3、Measured signal specifications :

Input type	Measuring range	Resolution	Accuracy	Temperature drift	Communication code
PT1	0 ～ 150.0	0.1℃	0.5%F.S±0.3℃	0.005%F.S/℃	0
PT2	0 ～ 150	1℃	0.5%F.S±3digits	0.005%F.S/℃	1

4. Isolation diagram:

PT100 CH1-CH12 input Power	RS485 communication port	▬▬▬ : Functional insulation DC 500V

IV. Dimension and Installation Method
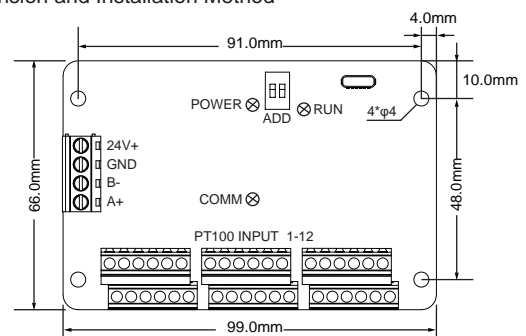
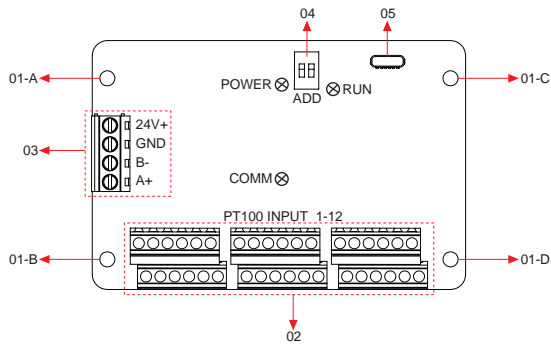# V.Interface function introduction

1. Interface description of temperature acquisition module

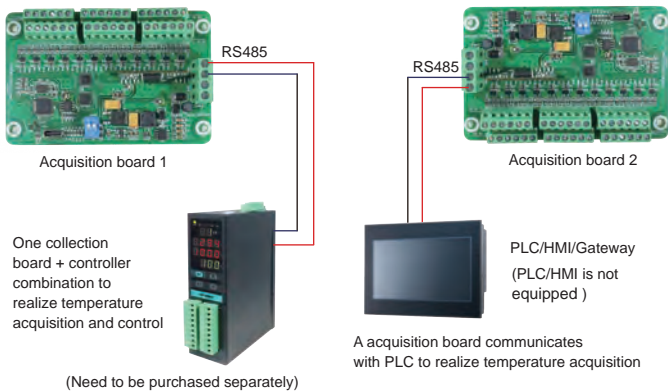| No.	Name	Description	Remark
01	Fixed screw hole	01-A/B/C/D: fixed screw holes of four acquisition boards（φ= 4）	
02	Sensor channel	02: Single/double connecting terminal,used for connecting with PT100 temperature sensor.Note: PT100 sensor is a 3-wire sensor	
03	Power input interface RS485 interface	Power supply:10~30VDC (+24V=positive, GND=negative) Communication: A+/B - connect the upper computer PLC or our temperature controller	
04	485 address selection	Select different communication addresses of the acquisition board 0x01 ~ 0x04	
05	Interface upgrade	used for device firmware upgrade	

2. Wiring description for power supply and RS485
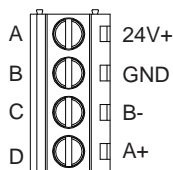
No.	Name	Description
A	+24V	Positive input terminal of power supply
B	GND	Negative input terminal of power supply
C	B-	RS485 "-" terminal, connected to PLC or our temperature controller
D	A+	RS485 "+" terminal, connected to PLC or our temperature controller

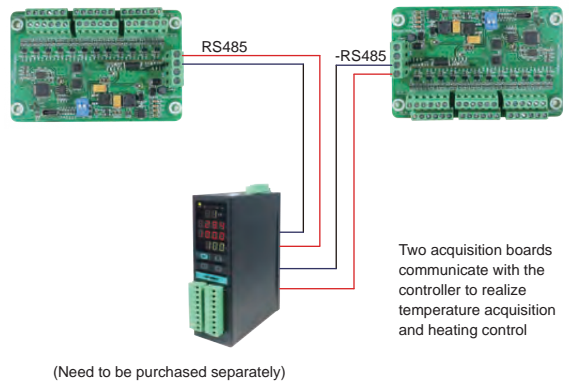3. Sensor wiring description
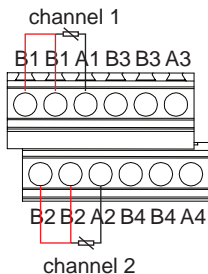
VI.Networking application

1:1 control is applied for 1 patrol inspection,
acquisition 1 is connected to controller,
acquisition 2 is connected to PLC (patrol inspection)

Acquisition board 1

Acquisition board 2

One collection board + controller combination to realize temperature acquisition and control

(Need to be purchased separately)

PLC/HMI/Gateway

(PLC/HMI is not equipped)

A acquisition board communicates with PLC to realize temperature acquisition

Note: 1. Different network application schemes can be customized through communication with our company technician
2. This manual only introduces the application of the acquisition board.
The products used in the scheme other than the acquisition board need to be equipped separately,Our company provides PID controller and Modbus communication gateway. Please contact our relevant personnel for details.

Application 2: The acquisition board is connected with the temperature controller.

Two acquisition boards communicate with the controller to realize temperature acquisition and heating control

(Need to be purchased separately)

VII. Menu Illustration

1. Regular Menu

No.	Name	Illustration	Setting range	Factory setting
1	ADD	Communication address (can be set by toggle switch)	1~4	1
2	BAD	RS485 Baud rate 0：4800；1：9600 2:19200 3:38400 4:57600 5:115200	0~5	3
3	PRTY	Parity bit setting, 0：NONE, 1：ODD parity, 2：EVEN parity	0~2	0
4	DTC	Communication data transmission sequence setting; When it is set to 10, data bytes are exchanged sequentially, and the default value is 0.	See communication protocol	0
5	PV	Measured value	--	
6	INP	Input signal type selection: see the corresponding table of measuring signal parameters for details	0~1	0
7	PS	Amend value, display value= actual measured value + amend value	-1000~1000	0
8	FL	Measure range low limit, the set value must be less than measure range high limit	Refer to measured signal parameter table	0
9	FH	Measure range high limit,the setting value must be more than measure range low limit.	Refer to measured signal parameter table	1500
10	FT	Filter coefficient, the higher of value, the stronger of filter function	0~255	10
11	UNIT	Temperature unit setting:25: Celsius degrees ℃. 26:Fahrenheit degrees ℉	℃/℉	25（℃）
12	PRS	Setting parameter saving address: 0 (EEP): EEPROM has power failure protection; 1 (RAM): RAM no power failure protection	0~1	0
13	RCVF	Write 123 can restore factory settings	0~9999	0
14	RTC	Ambient temperature, 1 decimal place	--	
15	VER	Software version	--	
16	LOOPSUM	Total channels quantity , query total quantity of channels in different application schemes	--	

VIII . Methods of simple fault

Display info	Method
LLLL/HHHH	Check the input whether is disconnected; check the FH value and FL value; check the working environment temperature whether is normal; check the input signal selection whether is correct.

IX. Communication procotol

Meter adopts RS485 Modbus RTU communication protocol, Read function code 0x03 of the holding register in zone 04, write function code 0x10/0x06. Adopt 16 digit CRC check, the meter does not return for error check. The data type is a 16 bit signed or unsigned integer. Data frame format:

Start bit	Data bit	Stop bit	Check bit
1	8	1	None/odd parity/even parity

1. Read register
For example:Host reads SV(PV1 = 200)
The address code of SV is 0x2000 ("0x" represents for hexadecimal), because SV data type is a 16-bit integer (2 bytes),seizes 1 data register. The memory code of decimal integer 200 convert to hexadecimal code is 0x00C8.. Note: When reading data, should determine the decimal point position firstly and then convert the reading data to obtain the actual value.

Read multi-register	Meter ADD	Function code	Start ADD High bit	Start ADD Low bit	Data byte Length high bit	Data byte Length low bit	CRC Code	CRC Code
Host request	0x01	0x03	0x20	0x00	0x00	0x01	0x8F	0xCA
Slave normal answer	0x01	0x03	0x02 bits		0x00	0xC8	0xB9	0xD2
Slave abnormal answer	0x01	0x83	0x02 error code For example:Host request address is 0x2011				0xC0	0xF1

2. Write multi-register

For example:Host use 10 function code write SV (SV=150)
ADD code of SV1 is 0x2110,because SV1 data type is a 16-bit integer (2 bytes),seizes 1 data register. The decimal integer 150 convert to hexadecimal code is 0x0096. Before writing the data, you should convert the data to the corresponding magnification and then writing the data into the instrument.

Host request (write multi-register)										
Meter ADD	Function code	Start ADD High bit	Start ADD Low bit	Data byte Length high bit	Data byte Length low bit	Data byte Length	Data high bit	Data low bit	CRC code	CRC code
0x01	0x10	0x21	0x10	0x00	0x01	0x02	0x00	0x96	0x15	0xAC

Slave normal answer (write multi-register)							
Meter ADD	Function code	Start ADD High bit	Start ADD Low bit	Data byte length high bit	Data byte length low bit	※CRC code low bit	※CRC code high bit
0x01	0x10	0x21	0x10	0x00	0x01	0x0A	0x30

Host write SV with 06 function (SV= 150)

Write single register	Meter ADD	Function code	Start ADD High bit	Start ADD Low bit	Data byte Length high bit	Data byte Length low bit	CRC Code	CRC Code
Host request	0x01	0x06	0x21	0x10	0x00	0x96	0x02	0x5d
Slave normal answer	0x01	0x06	0x21	0x10	0x00	0x96	0x02	0x5d
Slave abnormal answer	0x01	0x86	Function code		0x02 Error Code		0xC3	0xA1

Handling of abnormal communication:
When abnormal response，put 1 on the highest bit of function code. For example: Host request function code 0x03,and slave response function code should be 0x83.
Error code:
0x01---Illegal function: the function code sent from host is not supported by meter.
0x02---Illegal address:the register address designated by host beyond the address range of meter.
0x03---Illegal data: Date value sent from host exceeds the corresponding data range of meter.

Meter parameters address mapping table

NO	Address (Register No①)	Variable name	Register	R/W	Remark
1	0x2000~0x200B(48193~48204)	Measured value PV	1	R	
2	0x200C~0x2017(48205~48216)	Status value	1	R	②
	Reserve				
3	0x2100~0x210B(48449~48460)	Input signal selection INP	1	R/W	
4	0x210C~0x2117(48461~48472)	Display low limit FL	1	R/W	
5	0x2118~0x2123(48473~48484)	Display high limit FH	1	R/W	
6	0x2124~0x212F(48485~48496)	Amend value PS	1	R/W	
7	0x2130~0x213B(48497~48508)	Filter constants FT	1	R/W	
8	0x213C~0x2147(48509~48520)	Measuring Unit UNIT	1	R/W	
	Reserve				
9	0x2400~0x240B(49217~49228)	Paramters saving address PRS	1	R/W	
	Reserve				
10	0x2500(49473)	baud rate BAD	1	R/W	
11	0x2501(49474)	Parity Check PRTY	1	R/W	
12	0x2502(49475)	Communication data transfer sequence DATC	1	R/W	③
13	0x2503(49476)	Restore factory settings RCVF	1	R/W	
14	0x2504(49477)	Ambient temperature of acquisition board RTC	1	R	
15	0x2505(49478)	Software version VER	1	R	
16	0x2506(49479)	Total channels quantity	1	R	

Note①: The register number is the address converted to decimal plus 1 and then the register identification code 4 is added in front; for example: the register number of the data address 0x2000 is 8192 + 1 = 8193 and then 4 is added in front, that is, the register number 48193; Related applications can be seen, such as Siemens S7-200 PLC.
Note ②: Measurement status indication. When the data bit is 1, it means execution, and when it is 0, it means no execution.

D7	D6	D5	D4	D3	D2	D1	D0
----	HHHH	LLLL	℃	℉	----	----	----

Note③: DATC communication data transmission sequence description

DATC:□ □ □ — Reserve
Byte transfer order: when it is 0, 1, 2, and when it is 1, 2, 1
Reserve
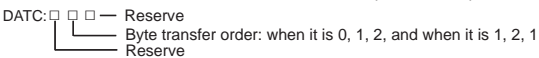
※ 16-bit CRC check code to get C program

```
unsigned int Get_CRC(uchar *pBuf, uchar num)
{
   unsigned i,j;
            unsigned int wCrc = 0xFFFF;
            for(i=0; i<num; i++)
            {
                    wCrc ^= (unsigned int)(pBuf[i]);
                    for(j=0; j<8; j++)
                    {
                            if(wCrc & 1){wCrc >>= 1; wCrc ^= 0xA001; }
                            else
                                    wCrc >>= 1;
                    }
            }
        return wCrc;
}
```

X. Version and Revision History

Date	Version	Revision content
2022.12.02	A/0 Version	1st edition
2023.02.16	A/1 Version	Content modification