

ZS-RTU-400i Product Instructions manual

ZS- RTU-400i is a transmitter module that collects 18B20 temperature sensor, converts 1-WIRE signal of temperature sensor into RS485, so as to facilitate upper computer /PLC/ configuration software/configuration screen to read the temperature directly.

Basic product parameters:

Product model	ZS-RTU-400i	Isolation design	Dual isolation of power supply 485 Optical-coupled isolation 485 Independent power supply isolation The temperature measurement channel is hardware-level isolated
Voltage input	15-35v (1A) (Yaohua + Jin Hongyang double isolation)	Communication parameters	9600bps, 8 data bits, 1 stop bits, no effect test
Temperature resolution	0.1°C	Support chip	DS18B20/CT1820/QT18B20/GX18B20 (Support for two-line system or three-line system)
interface	1 Road power input 2 Road temperature measurement input 1 Road 485 output	485	MODBUS — RTU agreement (Customizable MODBUS-TCP) (Communication optocoupler isolation is adopted.)
Carrying capacity	Single-channel 200 temperature measurement point Single channel 1500m (Note: In heavy interference, points and distances need to be	Number of temperature measuring channels	2 channels

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	reduced)		
Temperature measurement and sampling polling time	4s	working temperature	-30°C-80°C
Case material	Plastic buckle	way to install	Guide rail buckle

Basic pictures and wiring of products:



name	act on	matters need attention
485A	Receive 485A +	Some of the 485A + are called A / TR +/+
485B	Receive 485B-	Some 485B are called B / TR -/-
9-24V-	Connect 24V positive	Due to the new isolated power supply, the voltage should not be lower than 18V
9-24V+	Receive 24V negative	Due to the new isolated power supply, the voltage should not be lower than 18V
The lower six terminal oneself		
GND(the left side)	Ground wire at the temperature measuring end (1 chan	

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	nel)	
DQ 1 (left)	Signal end line at the temperature measuring end (1 channel)	
VCC(the left side)	Power terminal line at temperature measuring end (1 channel)	This line is not required if you use a two-line parasitic mode
GND(right)	Ground wire at the temperature measuring end (2 channel)	
DQ 2 (right)	Signal end line at the temperature measuring end (2 channel)	
VCC(right)	Power terminal line at temperature measuring end (2 channel)	This line is not required if you use a two-line parasitic mode

Note: 18B20 temperature measuring cable or probe, can be used in parallel, series, star connection mode can be, without special requirements.

Each channel should not exceed 200 temperature measurement points. Long distance strong drive version should be used if the extended wire exceeds 700 meters Collector installation use guide rail clips to install the collector.

Protocol analysis:

The factory default configuration of communication parameters is:

Communication rate: 9600bps, 8 data bits, 1 stop bit, none

1 bit stop bit, no module factory default address: 01

Using standard ModbusRTU communication protocol, any software that supports ModbusRTU communication protocol can test this module.

Register address	Function name	Windows default	function declaration
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30001~30400 (04 Function Code) (Note: Some PLC or configuration software defines the first address from 30000)	Sensor temperature value	-1000	The normal temperature example is: 235 temperature reading multiplied by 0.1 Actual temperature value: 23.5°C
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Instructions for using the debugging software:

Open the corresponding serial port.



Fill in the device address in the upper right corner (default is 1)

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Example 1: There are 10018B20 probes, the cable number is 1, and the layer number is 1-100.

The ranking rules are:

Starting cable: 1 ——— maximum number of layers: 100

At this point, the 30001-30100 will then arrange down the temperature order of the 18B20 probe.

30001	Temperature of probe # 1	30006	Temperature of probe # 6	30011	Temperature of probe # 11	30016	The temperature of probe # 16
30002	Temperature of probe # 2	30007	Temperature of probe # 7	30012	The temperature of probe # 12	30017	The temperature of probe # 17
30003	The temperature of probe # 3	30008	The temperature of probe # 8	30013	The temperature of probe # 13	30018	The temperature of probe # 18
30004	Temperature of probe # 4	30009	Temperature of probe # 9	30014	Temperature of probe # 14	
30005	Temperature of probe # 5	300010	Temperature of probe # 10	30015	Temperature of probe # 15	30100	Temperature of probe # 100

Example 2: There are three temperature measuring cables, all with 4 layer points and 1,2,3 cables

The ranking rules are:

Start cable: 1 ——— maximum number of layers: 4

30001	1 Temperature of the cable and 1 layer	30006	Temperature of 2 cables	30011	Temperature of cable 3 layers
30002	1 Temperature of the cable and 2 layers	30007	Temperature of 2 cables and 3 layers	30012	Temperature of cable 4

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30003	1 Temperature of the cable and 3 layers	30008	Temperature of 2 cables and 4 layers	30013	-100
30004	1 Temperature of the cable and 4 layers	30009	3 Temperature of cable-1 layer	30014	-100
30005	Temperature of 2 cable and 1 layer	300010	Temperature of cable 2	30015	-100

Example 3: There is a temperature measuring cable with 1, and one cable has 14 layers

The ranking rules are:

Start cable: 1 ——— maximum number of layers: 14

30001	1 Temperature of the cable and 1 layer	30006	1 Temperature of the cable and 6 layers	30011	1 Temperature of cable 11 layer
30002	1 Temperature of the cable and 2 layers	30007	1 Temperature of cable layer 7	30012	1 Temperature of the cable and 12 layers
30003	1 Temperature of the cable and 3 layers	30008	1 Temperature of the cable and 8 layers	30013	1 Temperature of the cable at 13 layers
30004	1 Temperature of the cable and 4 layers	30009	1 Temperature of the cable and 9 layers	30014	1 Temperature of the cable at 14 layers
30005	1 Temperature of the cable for 5 layers	300010	1 Temperature of 10 layers	30015	-100

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Example 4: There are two temperature measuring cables with 5,6. Cable 5 has 4 points and cable 6 has 8 points.

The ranking rules are:

Start cable: 5 ——— maximum number of layers: 8

30001	5 Temperatur e of the cable-1 layer	30006	-100	30011	6 Temperatu re of the cable to 3 layers	30016	6 Temperatur e of the cable to 8 layers
30002	5 Temperatur e of the cable and 2 layers	30007	-100	30012	6 Temperatu re of cable 4 layers	30017	-110
30003	5 Temperatur e of the cable and 3 layers	30008	-100	30013	6 Temperatu re of cable 5 layers	30018	-110
30004	5 Temperatur e of the cable and 4 layers	30009	6 Temperatu re of cable-1 layer	30014	6 Temperatu re of the cable to 6 layers	-110
30005	-100	30001 0	6 Temperatu re of the cable and 2 layers	30015	6 Temperatu re of the cable at 7 layers	30100	-110

View the cable number:

This function can directly detect the 18B20 chip cable layer number temperature and other information, can use this function to check the 18B20 number, as a reference for sorting parameters.

Advantages and design intention:

advantage	Design original intention	Cost paid
Power supply double isolation	Some field power supply interference is too serious, only in the isolation of power supply input +, will lead to serious abnormal reading, the temperature sensor can not work, return to abnormal timing, all points can not be searched.	It is 30 times higher than low cost power circuit and 4-6 times higher than single isolation power circuit
485 Independent power supply isolation + optical coupling isolation	In some industrial occasions, there is serious interference on the site, the returned 485 data always appears interference symbols, or the front end and back end is always some more interference, or the collector can not return normally, making the whole bus or single equipment communication abnormal.	It costs four times more than the ordinary 485 circuit
Hardware-level isolation of the temperature measuring channel	After the short circuit of the temperature sensor, it will also pull the two pins of the single chip machine (CPU) down to the short circuit state, resulting in the single chip machine dead, restart and other conditions.	
Support the two-line system and the three-line system	Most of the competing products on the market are three-line products, because the three-line programs and driver circuits are easier to write and draw. However, the anti-interference capability and long-distance transmission capacity are stronger than the three-line system.	
Strong drive of temperature measurement channel (200 point, 1500 m)	Most of the competing products on the market are not more than 100 temperature measurement points per single channel, and the transmission distance is generally not more than 300 meters. We do large-scale tests of the driving circuits and the search algorithm	Huge test cost, many engineers repeatedly tested and optimized for more than three months. Customized batches of multi-brand and

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	<p>thms, ranging from 0-1500m, and 1-800 temperature measurement points. Hundreds of combinations of "distance+temperature measurement points" were tested, and the test results were briefly summarized as follows:</p> <p>Maximum drive point number is 550 points at 0-600m-CT1820 is 800 points.</p> <p>At 600 – 1200m, the maximum drive points were 460 points, and the CT1820 number is 560 points.</p> <p>At 1200 – 1600m, the maximum number of drive points was 270 points, and the CT1820 was 180 points.</p> <p>The extended lead line is (0.3 square copper wire*2).</p> <p>Test chip: DS18B20 GX18B20 CT1820 QT18B20</p> <p style="color: red;">Drive 200 points is only an upper limit to drive allowance, the drive circuit can drive over 550 points.</p>	<p>multi-connection temperature cables. It takes more than one year to modify the hardware driver circuit.</p>
<p style="text-align: center;">Crazy dog search algorithm</p>	<p>After verifying with the chip manufacturers, we found that the internal timing of DS18B20, QT18B20 and GX18B20 will change with the temperature. The aging of lines and chips, it will also change the time sequence. Therefore, we have made a full-time adaptive algorithm, which can effectively solve the problems of "it can be detected today, it can not be detected tomorrow", and "it cannot be detected after cable lengthening".</p>	<p>After a year of repeated discussion, finalization and research and development testing process</p>
<p style="text-align: center;">Centralized switching mode/stable switching mode switching</p>	<p>The centralized conversion mode is to convert all the temperature points on the channel at the same time. When the points are too</p>	<p>Modify the MCU program and optimize the underlying logic</p>

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	<p>many, for example: over 150 points / channel (possible), or the line is aging, the pulling current will not meet all the temperature points at the same time. At this time, the temperature will appear at 85 degrees. At this time, it is necessary to switch to a stable conversion mode for a single point conversion. The current consumption is very small. When the number of points is below 100 and the distance is less than 500m, this mode is generally not required. CT1820 chips generally do not require this mode because of their extremely low current consumption.</p>	<p>structure.</p>
<p style="text-align: center;">Supporting the Android debugging APP</p>	<p>During field debugging, there may be no computer. We ported most of the computer-side debugging to the Android APP, and we only needed a data cable connection to do the field debugging.</p>	<p style="text-align: center;">Invest in software development costs</p>
<p style="text-align: center;">Read of the channel status (Check the channel for a short circuit)</p>	<p>When multiple sensors short circuit, the entire channel is unable to read the temperature, as in the open circuit. The previous approach was to disconnect multiple sensors in batches to check for a short circuit or a short circuit. We now transplant the channel status into the collector, and we can use the debugging software to detect the short circuit in the detection room with one key.</p>	<p style="text-align: center;">Change the driver circuit in two versions to add this function smoothly</p>
<p style="text-align: center;">Protocol soft reset</p>	<p>When the modified parameters or other situations occur, it is necessary to restart the collector, and there is no need to run to the site to manually restart. It can be restarted with one key by debugging the software.</p>	

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Size of the shell	The size difference of the box, the price difference is very large. We try to transplant all the product characteristics to a small circuit as possible, which greatly reduces the box volume occupied by the temperature measurement module, thus reducing the cost of the box.	Repeated dozen three circuit board samples, selected more than a dozen cases, to almost all the isolation protection with small cases match.
IAP upgrade	You can use 485 cable to directly upgrade the MCU program. If you encounter problems that can't be solved on the spot, you can help remotely. Use 485 USB cable to upgrade and burn the optimized program.	

Write at the end:

We are located in the "Hometown of China's Temperature Measuring Cables", mainly doing 18B20 multi-point temperature measurement. Parents and grandfathers began to take temperature measurements. I've been in contact with DS18B20 since 2002, and I've been doing multi-point 18B20 temperature measurement for almost 20 years. The most frequently heard word in my grandfather's factory every day is "resistance" (18B20, commonly known as resistance before). DS18B20 has entered China, and now it has spread to all aspects of various industries, which has lasted for more than 20 years in the blink of an eye.

I started to work as a temperature collector of DS18B20 in 15 years, and it has been nearly 6 years since then. I used to work as a granary application of 18B20, and after 18 years, I started to work as a collector of industrial occasions. I encountered many problems that I had never encountered before, such as electromagnetic interference, power interference, harmonic interference, ground pressure difference, terminal reflection, inexplicable changes in time sequence, and various problems followed. Run on the spot one by one, solve problems one by one, and find someone to buy collectors overseas to refer to foreign driving circuits. Finally, the current collectors can meet most industrial occasions.

The problems I listed above are all exchanged for the lessons of blood.

Typical problems that arise	solution
In the subway tunnel of the Guangzhou China Railway project, the temperature point cannot be searched by connecting to the emergency lights	Power double isolation to ensure that the upper power clutter will not interfere with the temperature acquisition circuit and SCM
Dezhou golden arowana powder workshop 300 meter long high voltage power cable monitoring, the collector in the distribution room, 485 can not be read, inexplicable more meaningless interference numbers.	485 Add optical coupling isolation, 485 use isolation power supply power.

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<p>A power group, high voltage power cable monitoring, monitoring temperature can not be out of the full, the site serious interference, collector after grounding sparks.</p>	<p>Improve the drive circuit to ensure the stable transmitted signal waveform.</p>
<p>A group feed plant, granulator temperature monitoring, there is a serious stepping motor interference, individual temperature points are always read after a period of time can not be read. It needs to be reset again.</p>	<p>Change the program, added multiple check, multiple read multiple reset.</p>
<p>China Coal specially dug a drilling site in Shanxi Province with a depth of more than 1300 meters. After the cable reached 1100 meters, the signal was suddenly unstable and all the points could not be searched</p>	<p>For the long distance (1000-2200 m) length, we conducted nearly 100 length + points combination experiments, which improved the drive circuit, and greatly adjusted the program according to the experimental data. Currently, the long-distance drive version can reach the full coverage of 1000-1600 m and 200 points. 1600-2200 m below 120 m.</p>
<p>Guangzhou an electromagnetic heating rod temperature measurement, electromagnetic heating rod releases a large number of electromagnetic interference, as long as the temperature measurement sensor affixed, it can not be normal temperature measurement.</p>	<p>Improved the drive circuit, increase the strong anti-interference design, to ensure the stability of waveform recovery.</p>
<p>A grain station in Yancheng, Jiangsu province, can always measure the temperature in the morning, not the temperature in the afternoon, but today, but not in two days. Chip timing change.</p>	<p>Update of the "mad dog algorithm" adaptive timing adjustment.</p>
<p>Hefei, Anhui province, a temperature measurement cable after a long use time, because of fumigation corrosion and aging, resulting in the resistance is too large, you can search to the point, but the temperature is 85 degrees</p>	<p>The stable mode switching is updated for a single point conversion to reduce the consumption current.</p>