
catalogue

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1.Module profile

QL-MT01 is a digital weighing transmitter integrated with 4-bit digital tube display function. The functional characteristics of the module are as follows:

- The stable resolution power can reach one thousandth of the total range of the external sensor
- Provide 4 digit digital tube display real-time value
- With 1 channel RS485 interface for communication with host computer /PLC
- Field calibration or communication parameter modification can be carried out by pressing buttons or communication instructions
- 12-24V wide operating voltage range
- Support active upload protocol.

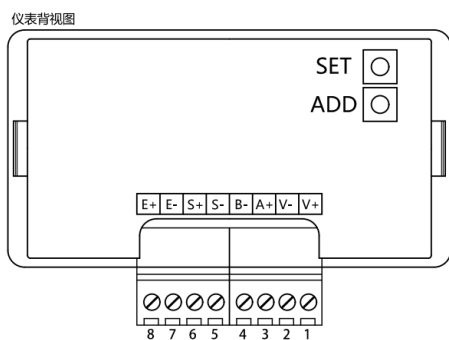
2.Appearance and Wiring

2.1 Module Appearance



2.2 Definition of terminal blocks

Terminal number	Identification	Terminal name	Function definition
1	V+	Power supply positive	Module power supply, 12-24V DC power supply
2	V-	Power supply negative	
3	A+	RS485A+	RS485 communication interface
4	B-	RS485B-	



5	S-	Negative sensor signal	Load cell signal input port, please contact the sensor supplier to determine the line color definition before wiring.
6	S+	Sensor signal positive	
7	E-	Sensor excitation negative	
8	E+	Sensor excitation positive	

3.Electrical parameters

The following parameters are the normal working electrical parameters of the module. In practical application, if they are outside the range, it may cause permanent damage to the module.

Power supply: 12-24VDC

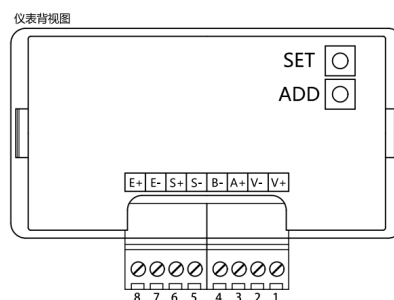
Sensor excitation voltage output: 5.0V

Sensor signal input range: $\pm 18\text{mV}$

4.Push-button operation

4.1 Key Function introduction

There are two buttons on the back of the instrument. The name and position of the buttons are shown in the picture on the right.



The relationship between the functions of the two keys and the working mode of the module is as follows

Module operation mode	Entry mode	Key function
Normal operation	The module enters automatically after it is powered on	In the normal running state, both buttons are reset buttons
Setting mode	Power on the module by pressing any key without letting go	In Setup mode: SET key Long press: OK/Enter Short press SET: Shift ADD key short press: The number +1 is currently

		selected Long press the ADD key: Invalid
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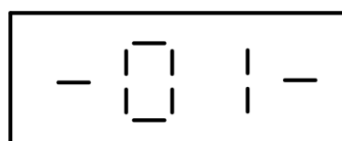
4.2 Key function in normal working mode

After the module is powered on, it automatically enters the normal working mode. In the normal working mode, short press of two keys is manual zero chasing operation, and long press is invalid. In the normal working mode, you cannot enter the setting mode by pressing any key. You must: Long press any key to power on the module to enter the setting mode.

4.3 Detailed description of setting mode

Method to enter setting mode: When the module is powered off, hold down any button and power on the module. After the module is powered on, ---- is displayed indicating that the module has entered setting mode. You can release the button at this time.

After entering the setting mode, the command code selection interface is first entered, and the module is displayed as follows:

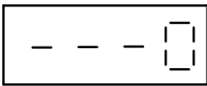



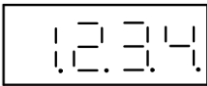
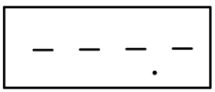
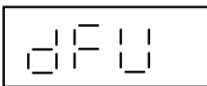

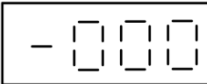
Under this interface, the key function is:

Long press the SET key to enter the set command code

Short press the ADD key: The nixie in the blinking position displays the value +1.

The corresponding table for setting the mode instruction code is as follows:

Instruction codes	Name	Display interface	Function description
00	Go to Normal work		Holding down the SET key in 00 will exit the module into normal working mode (Note: The module can only be entered into configuration mode by pressing the button + re-powering the operation, once the module is in normal working mode, it cannot be entered into configuration mode by pressing the button or communicating)
01	Zero point calibration		Long press the SET key under this interface to set the zero point of the module. The load of the sensor under this interface should be empty.
02	Weight point calibration		Long press the SET key to trigger the module to perform the weight point memory operation. The external sensor in this interface must load the weight. If the sensor is not loaded with the weight or the weight

			is too light, the module will display Err.
03	Weights show numerical values		<p>Short press the SET key: Toggle the selected number position</p> <p>Short press the ADD key: The selected position value +1</p> <p>Long press the SET key: Save the weight corresponding to the displayed value</p>
04	Decimal point position		<p>Long press the SET key: Save the decimal point position</p> <p>Short press the ADD key: move the decimal point position, when the decimal point position in the end of the nixie tube means that the decimal point is not displayed, the meter will not display the decimal point when the normal operation.</p>
05	factory data reset		After entering this option, the module display long press the SET key to allow the module to restore factory Settings.
06	Communication station address		Set the Modbus communications station address for the module
07	Communication parameters		<p>Set the communication parameters of the module.</p> <p>Short press the SET key: Move the selected digit position</p> <p>Short press the ADD key: The currently selected number +1</p> <p>Long press the SET key: Save data.</p> <p>Set the relationship as follows:</p> <p>Hundreds place: 0-9600 1-19200 2-38400</p> <p>Tens place: 0- None check 1- odd check 2- even check</p> <p>The ones bits: 0-1 stop bits 2-2 stop bits</p> <p>(Note: After the communication parameters are modified successfully, the module needs to be restarted to take effect)</p>

4.4 Calibrate using keystrokes

If conditions permit, we first recommend using the upper computer software or the calibration program developed by the user to calibrate the module.

The process of using the button to calibrate the module is as follows:

1. Power off the module, press any key and do not let go to power on the module, let the module enter the setting mode.
2. Enter the command code zero calibration interface, ensure that the load of the sensor is 0 and stable without vibration, long press the SET key for zero calibration, if the calibration is successful, the module will display:



3. Enter the command weight point calibration interface, load the weight on the sensor and keep it stable and vibration-free, long press the SET key for weight point calibration, if the calibration is successful, the module will display: -02- 5000

4. Enter the command code, modify the display value corresponding to the weight, and long press the SET key to save the modification after completion. -03- When performing this step, the given weight on the sensor is not required, regardless of whether the sensor is weighted (if the corresponding display value of the weight does not need to be modified, there is no need to perform this step)

5.Communication interface

5.1 Communication interface parameters

QL-MT01 uses RS485 interface to achieve the function of communication with the host computer, the main parameters are as follows:

Parameter type	Supporting parameter	Factory default parameters
Baud Rate	9600, 19,200, 38400	9600
Verification method	None check, odd check, even check	No check
Stop bit	1 stop bit, 2 stop bit	1 Stop bit
Data Bits	8	8
Communication protocol	Modbus-RTU, Custom protocol	Also supported

The above communication parameters can be modified through the configuration software or the upper computer to modify the module configuration register. **Note that the modification of communication parameters will take effect only after the module is restarted.**

5.2 Communication Protocols

Module communication interface: RS485

Default parameter of communication interface: 9600-8-n-1

The supported communication protocols are Modbus-RTU and Active Upload

Modbus-RTU is a question-and-answer mode of communication protocol, each communication needs to be sent by the upper computer read or write instructions, the lower computer receives the same address as the local station read and write instructions to the upper computer answer. The command format of Modbus protocol is detailed in Modbus Communication Protocol. Users can generate read and write instructions of any register according to the protocol format. Several communication protocol instructions commonly used in this module will

be given examples in the instruction examples chapter in this manual.

5.2.1 Function of Modbus register

All the registers of this module are mainly divided into two parts (real-time data area and configuration parameter area), both of which are located in the hold register area, which need to use 03 instruction code to read the module or 06/16 instruction to write the required register.

Real-time data area, register address 0-19, this part of the register is mainly used to indicate the working status of the module, and has the peel and calibration operation instruction register. In the register of this area, only the three registers of No. 8 weight weight, No. 17 peeling instruction and No. 18 calibration operation can have the user write data to trigger the operation, and do not write values to other registers.

Address	Name	Detailed function
0	Real-time display values	Current nixie display value, integer output, no decimal point. The factory default display is the real-time net weight value, because this module can set the display content of the digital tube through the software, so if the user config the digital tube to display other content, the register content is no longer equal to the real-time net weight.
1	Real time net weight	Current net weight value, real-time gross weight - current tare weight = real-time net weight
2	Real-time Gross weight	Current gross weight value
3	Temporary tare	Temporary tare value. This register indicates the current tare weight. Users can judge whether the peeling instruction has been successfully executed or when the module has executed automatic zeroing according to the change of the register value.
4 5	Real-time internal code	The internal code value collected by the current AD chip of the module is generally used for fault diagnosis. When the value of the register is 0 or 16777215, it indicates that the output signal is out of range. Please check the input wiring of the sensor.
6	Peak hold	This register always holds the maximum value of the real-time net weight since the last clear. The user can clear this register by writing a number to the calibration operation register.
7	Valley hold	This register always holds the minimum value of the real-time net weight since the last clear. The user can clear this register by writing a number to the calibration operation register.
8	Weight of weights	The register indicates the display value corresponding to the calibration weight. The user writes the value to the register to trigger the module's calibration operation of the weight point.
9 ... 14	Not in use	This part of the register is used for the internal work of the module. Do not write values to these registers.
15	485 Communication count	Module each Modbus protocol instruction response, the register value +1, the maximum value of 65535 after zero, can be used for communication stability judgment occasions.

16	AD acquisition and counting	The built-in ADC chip of the module collects the register value +1 for each signal, and the maximum value returns to zero after 65535, which can be used to judge the acquisition speed or ADC working state.
17	Peeling operation instruction	<p>Peeling operation command, write to the register for the following corresponding numbers can trigger the module corresponding operation. After the module completes the corresponding operation, the module automatically clears zero, without the host computer sending write 0 instruction.</p> <p>1-Peeling operation. The peeling value is only saved in the input register and will be lost after power failure. It is generally used for temporary peeling operation during device operation.</p> <p>2-Cancel the peeling operation and clear the temporary tare register.</p> <p>3- Peak and Valley value clear operation, when the peak and valley value test before the first need to clear the peak and valley value register value.</p>
18	Calibration operation instruction	<p>Calibration operation command, write the following corresponding numbers to the register to trigger the module corresponding operation. After the module completes the corresponding operation, it automatically clears zero, without the host computer sending write zero instruction.</p> <p>1-zero calibration operation, when it is necessary to calibrate the zero of the module: the sensor remains unloaded, and the write 1 module will perform the zero calibration operation.</p> <p>2- Weight point calibration operation, when the weight point of the module needs to be calibrated: after the sensor has stabilized the load weight, write the number 2 to perform the weight point calibration operation.</p>
19	Software version	The software version number of the module. The software version inside the module can be judged by the register value.

Address	Name	Detailed function
1000	Station Address	<p>Module Address of the Modbus slave station. Set range 1-250</p> <p>The module will display the communication station address every time the power on self-test</p>
1001	Communication parameters	<p>Used to set the module RS485 interface baud rate, check mode, stop bit parameters, the register value is divided into hundreds, ten, one bit to represent, the corresponding relationship is as follows:</p> <p>Hundred digit set baud rate: 0-9600; 1-19200; 2-38400.</p> <p>Ten digit setting check method: 0- none check; 1-odd check; 2- parity check</p> <p>The units digit sets the stop bit: 0-1 stop bit; 2-2 stop bits</p> <p>For example: 9600- Parity -1 stop bit should write the value 20 to this register</p> <p>If a value not listed above is written, the module executes according to the default value of 0</p>
1002	Acquisition speed	<p>Used to set the acquisition speed of the module, the corresponding relationship is as follows:</p> <p>0-10Hz</p>

		1-40Hz 2-640Hz 3-1280Hz Write other unlisted values are run in accordance with the set value of 10Hz.
1003	Filtering frequency	The number of filtering times for the smooth filtering of the AD acquisition value inside the module, the set range is 1-30.
1004	Not In Use	
1005	Show mode	Used to set the display mode of the nixie tube, the corresponding relationship is as follows: 0-Display real-time net weight 1-Show live gross weight 2-Digital display mode, directly display the numbers issued by the host computer 3-Peak mode, in which the two buttons are used to clear the peak value 4-Valley mode: In this mode, both buttons are cleared for valley value
1006	Decimal point position	Set the decimal point position displayed by the nixie tube, set the range 0-3. Note: the setting of the decimal point position is closely related to the display. All kinds of values such as weight, peeling, calibration and zerochasing inside the module are carried out in integer mode, and the value read out by the host computer is also an integer.
1007	Active upload mode	Working mode of the active upload function Ten: Active upload protocol selection 0- Custom ASCII code 1- Custom protocol with number 2-Modbus master station One bit: Active upload mode selection 0-Disable Active Upload 1- Enable Continuous Active Upload 2- Enable Change Upload Modbus Master Active Send mode, the meter will work in Modbus master mode after starting, according to the slave address and register address parameters configured in the 1008 and 1009 registers, actively write real-time net weight information to the register of this slave station The other two custom protocol message formats and contents are detailed in the Active Upload chapter.
1008	PLC slave address	This register is only valid when the module is operating in active upload mode 3. If the active upload function of Modbus master is not applicable, this register does not need to be concerned. It is used to set the PLC station address in Modbus slave station mode, and be careful not to configure the same station address as the module
1009	PLC register address	This register is only valid if the module is operating in active upload mode 3 and is used to set the register address in Modbus slave mode
1010	Zero tracking range	Used to set the minimum value range of zero tracking, when the sensor load is greater than the value, the module will not perform active zero tracking function, the set value of the register must be less than the minimum load of the device, otherwise it may cause the module to perform frequent zero tracking operation under the condition of small load of the device, so that it can not measure the small

		load. When the value is set to 0, the automatic zero tracking function is turned off.
1011	Stable judgment time	Unit 100mS. This register, in conjunction with the 1012 register below, sets the condition of the stable judgment.
1012	Stable judgment range	When the real-time weight jitter is less than the set value of the register and lasts the "stable judgment time", the module considers that the current load is stable. Only when the load is stable, the module will execute the zero tracking function
1013 ... 1019	Not in use	
1020	Calibrate the weight value of the weights	The display value corresponding to the weight during calibration, the setting range is ± 32767
1021	Tare value	The tare value of the module is saved in this register. The module will automatically write the calculated tare to this register when the user uses the peeling instruction.
1022 1023	Code value inside zero	Calibrate the internal code value corresponding to zero when operating
1024 1025	The inside code value of the weight point	The internal code value corresponding to the weight point during the calibration operation
1026	Sensor sensitivity	20000 corresponds to 2.0mV/V sensor sensitivity, when the use of weight calibration, the register value is automatically calculated by the module, when the use of weightless calibration users can directly write the value to the register. Valid value range (3000-25000), write out of the range of the value will be reset by the module to the default value 20000
1027 ... 1029	Not used yet	

Configuration parameter area, register address 1000-1029, this part of the register is mainly used to save the working parameters of the module, the parameters written by the user will be saved by the module and not lost.

5.2.2 Example of communication instruction

This chapter is mainly aimed at software developers of Android, Windows and embedded platforms. For the development of PLC or configuration software, it is generally not necessary to read this chapter, because PLC or configuration software generally has a complete Modbus protocol software module, which has interpreted Modbus protocol as an interface for several common parameters.

The first word in the Modbus protocol instruction is the address of the communications station of the lower machine. The following take the address of the module station as 1 example of some commonly used instructions:

- Read the real-time display value:

Read the net weight: 01 03 00 00 00 00 01 84 0A, the host computer sends the instruction to read the real-time display value

Module reply: 01 03 02 03 E9 79 3A, the module reply the current display value is 1000

- Manual zero tracing/zero calibration

The upper computer sends: 01 06 00 12 00 01 E8 0F, i.e. writes the number 1 to register 18

Module reply: 01 06 00 12 00 01 E8 0F, the reply after the successful execution of the module is the same as the content of the sent instruction

- Weight calibration/Write weight display value

Before sending the weight calibration instruction, there should be a matching weight on the pan, and the zero calibration instruction should be executed before the weight calibration.

The upper computer sends: 01 06 00 08 01 E8 09 D6, and the written weight display value is 1000

Module reply: 01 06 00 08 01 E8 09 D6

5.2.3 Communication calibration process

The user connects the 485 interface of the computer to the module and uses the test software to calibrate the module. You can also use the industrial control equipment such as PLC/ touch screen to calibrate the module through the 485 communication interface. Before using industrial control equipment such as PLC to calibrate the module, it is necessary to make sure that the communication such as reading is normal.

1. The unloaded state of the pan and stable for a few seconds, write the number 0 to the No. 8 register, perform zero calibration operation: 01 06 00 08 00 00 08 08

2. Place the known weight of the pan and stabilize for a few seconds, write the weight to register 8 corresponding display value: 01 06 00 08 01 F4 08 1F (the display value written in the example instruction is 500)

5.3 Active Upload

5.3.1 Start and Exit of Active Upload

Users can configure the active upload function by configuring the software or the upper computer such as PLC by configuring the relevant register of the module to enable the active upload function. If the active upload function is detected after the module is powered on and running, the active upload function will be automatically enabled.

Log out:

- ① Use the key operation module to enter the 08 instruction to turn off the active upload function.
- ② Use 485 interface to send Modbus command to the module, the module will stop the active upload after receiving any Modbus command, if no Modbus command is received for 5 seconds, the module will automatically resume the active upload.
- ③ Long press any key in the normal working mode to stop the active upload, if no Modbus command is received within 5 seconds, the module will automatically resume the active upload.

5.3.2 Active upload working mode

The module supports 3 active upload protocols and 2 working modes. The configuration work is described as follows:

Communication protocol

Serial number	Name	Profile
1	ASCII plaintext	<p>Real-time net weight push (ASCII plaintext) starting with '=' and ending with '\r\n', with a fixed length of 10 bytes; Examples are:</p> <p>Real-time net weight 1234 when the decimal point position is 0 module upload content: = 01234.(positive when the symbol position behind the equal sign fill the space)</p> <p>When the real-time net weight is -12 and the decimal place is 2, module upload content: =-000.12</p>
2	Custom protocol with number	<p>Hexadecimal encoding, in a fixed 8-byte length format beginning with 0x55 and ending with 0xAA, as follows:</p> <p>0x55 + 2 bytes Upload count + 2 bytes Capture count + 2 bytes Real time Net weight + 0xAA</p> <p>When using this format, the host computer can judge whether there is communication packet loss or upload packet discard caused by insufficient baud rate by the received two count values.</p>
3	Modbus master station	In this mode, the module works in the Modbus master mode, and the PLC or touch screen devices connected to the module need to work in the slave mode. The module will actively write the net weight value to the specified register of the lower machine in the master mode.

Working mode

Serial number	Name	Profile
1	Continuous Active Upload	An active upload operation is triggered whenever the AD collection is refreshed, regardless of whether the weight value has changed
2	Change Upload	The module will trigger an active upload only when the weight value changes, and no data will be uploaded when the weight value remains the same

6.Mechanical Dimensions

6.1 Module dimensions

