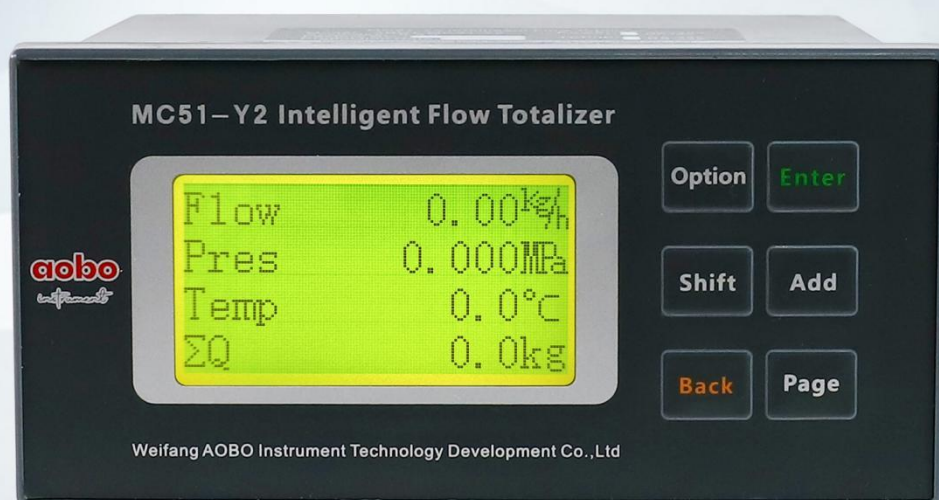




ABDT-MC51-Y2 Intelligent Flow Totalizer

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I. Product Overview

As a general flow totalizer with 16-bit single chip computer with ultra low power consumption as the core and intelligent English menu configuration, MC51-Y2 intelligent flow totalizer can carry out the steam, gas and liquid measurement with faster computing speed, lower power consumption and more reliable performance. It can make real-time online fluid temperature and pressure compensation. It can receive flow, temperature, pressure and other signals at the same time. The signal can be frequency, current, differential pressure, resistance and other types. The technology based on adjustable parts without switch contact and potentiometer is adopted for signal processing, in order to provide more accurate and reliable flow measurement.

The totalizer adopts Watchdog technology, effectively preventing the totalizer breakdown in the industrial fields.

With the new flash technology, the totalizer data can be saved for more than 10 years after power failure.

With MODBUS-RTU communication technology with RS232/485 interface, the totalizer can be networked with various networks or industrial buses to realize remote meter reading.

II. Technical Index

1.Flow input signal

Frequency signals, such as vortex flowmeter and turbine flowmeter;

(4~20)mA current signals, such as electromagnetic flowmeter and ultrasonic flowmeter;

Differential pressure signals, such as orifice flowmeter and V-cone flowmeter.

Notes:

(1) Standard of frequency signal: voltage pulse, $V_{Low} \leq 1V$, $V_{High} \geq 5V$; received frequency range: (0~5000)Hz;

(2) (4~20)mA current received for the differential pressure signal, unsquared differential pressure signal.

2. Pressure input signal

(4-20) mA current signal.

Note:

Steam pressure compensation range: saturated steam 0~2.0MPa;

Superheated steam : 0~4.5MPa (common 0~3.0MPa).

3. Temperature input signal

Pt100 platinum resistance; Temperature transmitter signal for (4~20)mA current output.

Note: The steam temperature range: (0~600)°C (Commonly used: 0°C~400°C)

4. Accuracy: grade 0.5

5. Communication function (equipped according to the customer requirements):

RS232 or RS485 interface, standard MODBUS-RTU protocol.

6. Display function

Instantaneous flow, cumulative flow, pressure, temperature, frequency, current, differential pressure, density, power-off times, power-off time, date, time, the last power-off/power-on time,

7. Automatic compensation function

The temperature and pressure compensation mode is automatically judged for steam measurement. The compensation shall be carried out according to the working mode of the saturated steam if the field temperature is lower than the saturated steam temperature corresponding to the pressure; on the contrary, the compensation shall be carried out according to the superheated steam working mode.

8. Small signal cutoff function

In the environment with slight vibration or disturbance, removing the interference signal improves the measurement stability of the totalizer.

9. Blackout protection function

The results of the operation and the data set by the user will not be lost during power off and it will be saved for more than 10 years.

10. Working power supply

AC220V $\pm$ 15%, power dissipation<5W.

DC12V $\pm$ 5%.

11. Output power supply

There are two groups. One is DC12V/30mA and another is DC24V/200mA.

12. Work environment

Temperature: (-10-60) $^{\circ}$ C, humidity: (5-85)%RH

13. Installation method: horizontal installation

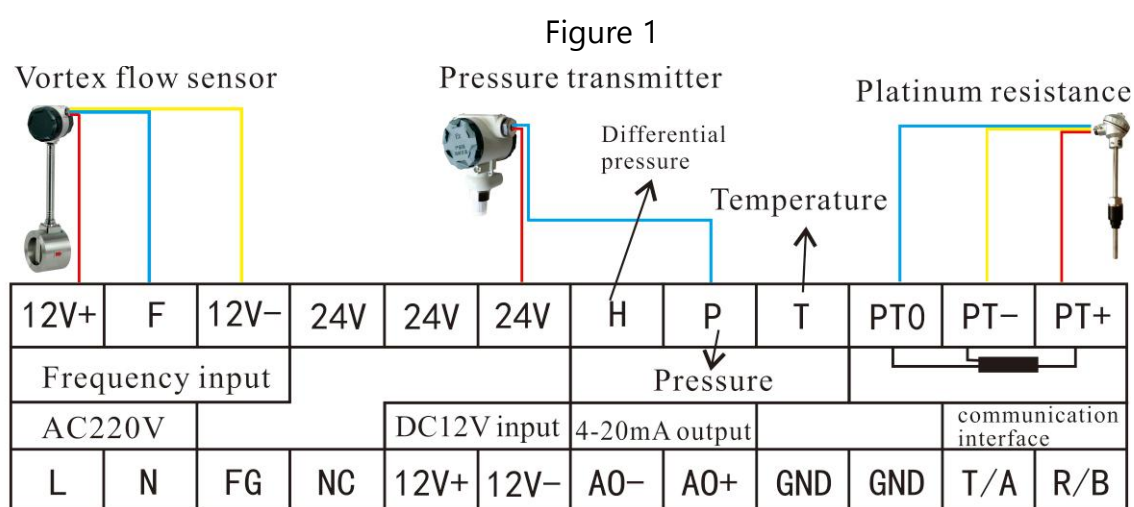
14. Opening size

(152 $\pm$ 0.5) $\times$ (76 $\pm$ 0.5) (W $\times$ H, unit: mm)

15. Outline size

160 $\times$ 80 $\times$ 120 (W $\times$ H $\times$ D, unit: mm)

III. Wiring Diagram

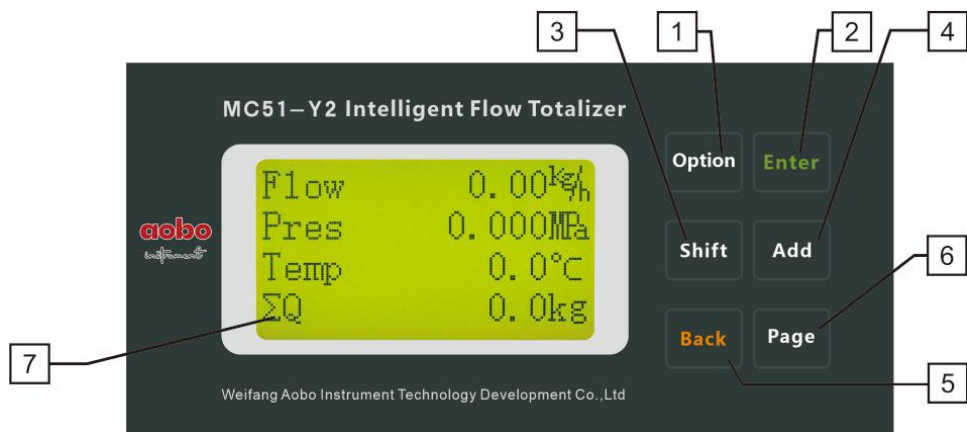


IV. Structure

Standard insert type

V. Display Function

Totalizer panel:



Panel description:

Table 1

No.	Name	Content
1	Option key	Option key for parameter setting.
2	Enter key	Enter totalizer parameter setting; Confirm the set value changed; To enter the current item in changing the set value.
3	Shift key	Set the cursor position when changing the set value.
4	Add key	Increase number when changing the number; Select the current setting item when changing the set value.
5	Back key	Exit the current setting item when changing the set value.
6	Page key	Call the display picture when the working conditions are displayed; Change the current setting item when changing the set value.
7	Display screen	Display the real-time measured value (fixed display or cycle display); Display the setting parameter(s) in the state of parameter setting.

Working condition display interface:

Press the “Page” key to display the desired content. All display pictures can be displayed by the panel keyboard at any time, and which also can be displayed circularly or fixedly through programming. The display pictures of working conditions are as

Flow	8.24t/h
Pres	0.852MPa
Temp	230.2°C
ΣQ	567.8t

Interface 1.

Freq	232.84Hz
Curr	0.000mA
Diff	0.000kPa
Dens	4.271kg/m³

Interface 2.

Current flow: 8.24 t/h

Current frequency: 232.84Hz

Current pressure: 0.852 MPa

Current current: 0.000mA

Current temperature: 230.2°C

Current differential pressure: 0.000kPa

Current accumulation: 567.8t

Current density: 4.271kg/m³

↓ 10-05-08	10:21
↑ 10-05-08	10:32
Σ	12=023:15
10-05-09	14:23

Interface 3.

Last blackout: May 8,2010, 10:21

Last power-on: May 8, 2010, 10:32

Total blackout times and time: 12 times, 23 hours and 15 minutes

System real-time date and time: May 9, 2010 , 14:23

VI. Programming Method of Totalizer

This totalizer is a multifunctional programmable intelligent totalizer. Therefore, before using the totalizer, the user must carry out programming operation for the totalizer, in order to determine the flow sensor type to be used, the output signal type for the sensor selected, and the ranges, measurement ranges and meter coefficients of all measurement sensors.

1. User programming

In working condition display interface, press "Enter" key to enter programming process. Programming work will be carried out with the help of English prompts. Firstly, enter the programming code 2917 at the factory (Figure 1). Press "Shift" key and "Add"key to enter the numbers. After correctly entering the password, press "Enter" key to enter the main menu (Figure 2).

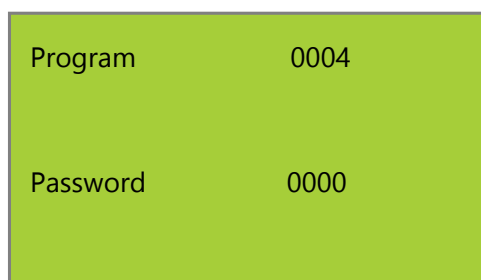


Figure 1

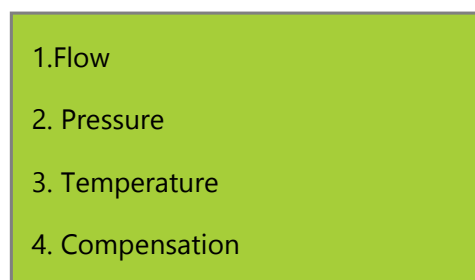


Figure 2-1

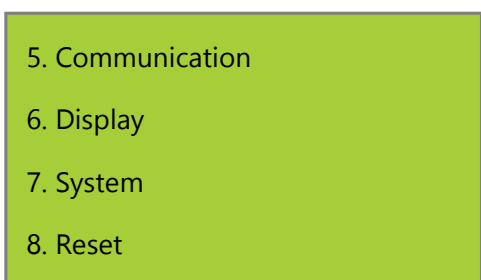


Figure 2-2

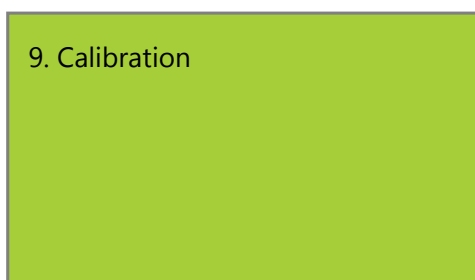


Figure 2-3

Select "Flow" in the main menu with help of the "Option"key, and press "Enter" key to enter the sub-menu "Flow Setting" (Figure 3); press "Back" key to exit the current page and return to the previous menu; press "Page" key to enter the next sub-menu.

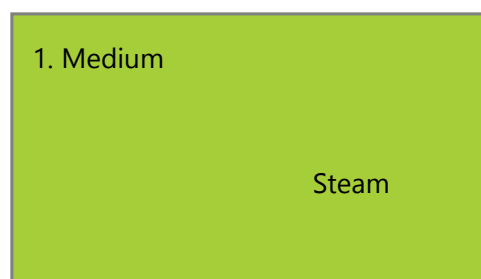


Figure 3

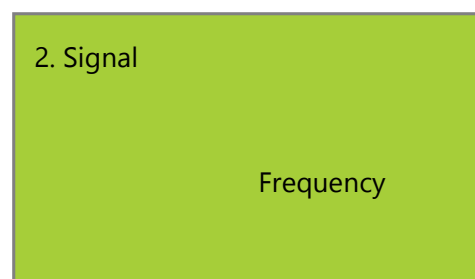


Figure 3-1

2. Flow setting

Steam, gas and fluid are optional for "Medium" setting. The "Add"key is used for item selection, and the "Enter" key is used to save the item selected.

Frequency, current and differential pressure are optional for "Signal" setting. The "Add"key is used for item selection, and the "Enter" key is used to save the item selected (Figure 3-1) .

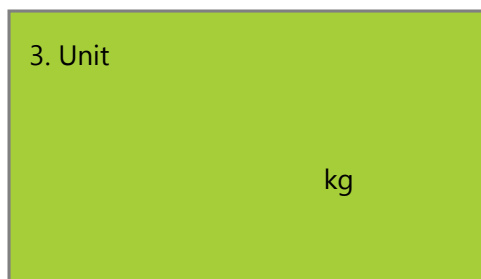


Figure 3-2

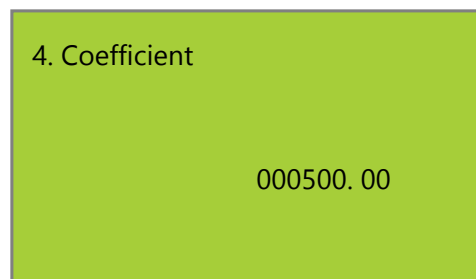


Figure 3-3

Kg, t, m³ and L are optional for "Unit" setting. Kg and t are selected for mass flow measurement, and m³ and L are selected for volume flow measurement. The "Add" key is used for item selection, and the "Enter" key is used to save the item selected (Figure 3-2).

In "Coefficient" setting, the frequency signal is 2 decimal places and the differential pressure signal is 3 decimal places. Press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 3-3).

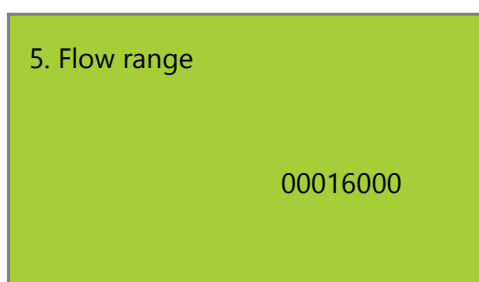


Figure 3-4

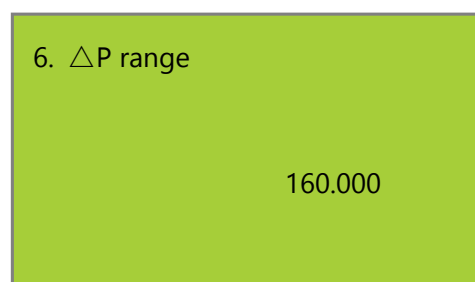


Figure 3-5

"Flow Range" setting is necessary for the current signal. In "flow range" setting, press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 3-4).

Differential Pressure Range(referred to as "ΔP Range") setting is necessary for the differential pressure signal. In "ΔP Range" setting, press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 3-5).

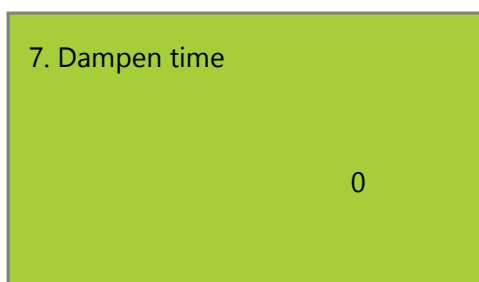


Figure 3-6

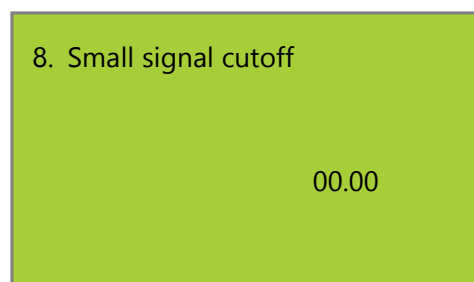


Figure 3-7

"Dampen Time" refers to the time for smooth software digital filtering, and which can be any of the numbers from 0 to 9. The set value by default is 0. In "Dampen Time" setting, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 3-6).

"Small Signal Cutoff" setting is necessary for the small flow removal signal. In "Small signal cutoff" setting, press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 3-7).

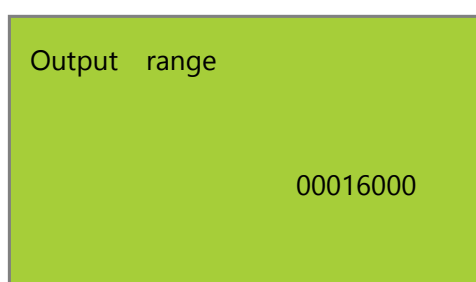


Figure 3-8

In "Output range" setting, press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 3-8).

3. Pressure setting

Select "Pressure" in the main menu with help of the "Option" key, and press "Enter" key to enter the sub-menu "Pressure Setting" (Figure 4); press "Back" key to exit the current page and return to the previous menu; press "Page" key to enter the next sub-menu.

In "Signal" setting, press "Add" key to select "Current" or "Setting", and press "Enter" key to save the item selected.

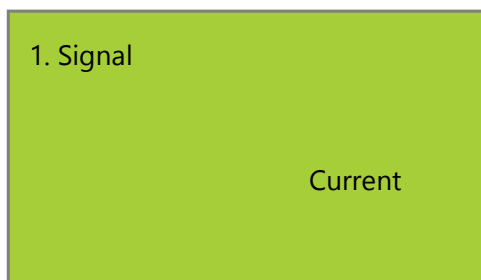


Figure 4

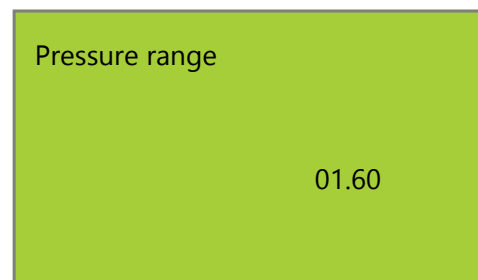


Figure 4-1

In "Pressure range" setting, enter the range value when the current signal is selected for the pressure signal. Press "Shift" key to select the data bit, press "Add"key to enter the number(s), and press "Enter" key to save the number entered (Figure 4-1).

"Dampen Time" refers to the time for smooth software digital filtering, and which can be any of the numbers from 0 to 9. The set value by default is 0. In "Dampen Time" setting, press "Add"key to enter the number(s), and press "Enter" key to save the number entered (Figure 4-2).

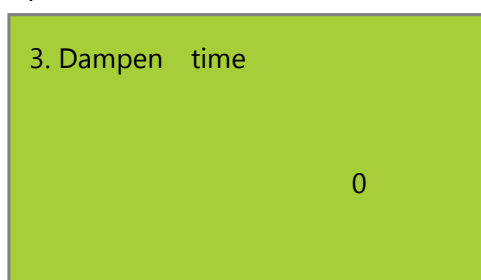


Figure 4-2

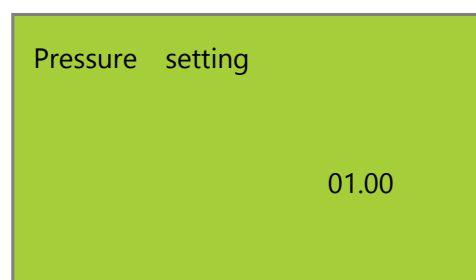


Figure 4-3

"Pressure setting" is necessary for the pressure signal selected. In "Pressure setting", press "Shift" key to select the data bit, press "Add"key to enter the number(s), and press "Enter" key to save the number entered (Figure 4-3).

4. Temperature setting

Select "Temperature" in the main menu with help of the "Option"key, and press "Enter" key to enter the sub-menu "Temperature Setting" (Figure 5); press "Back" key to exit the current page and return to the previous menu; press "Page" key to enter the next sub-menu.

Resistance, current and setting are optional for "Signal" setting. In "Signal" setting, the "Add"key is used for item selection, and the "Enter" key is used to save the item selected.

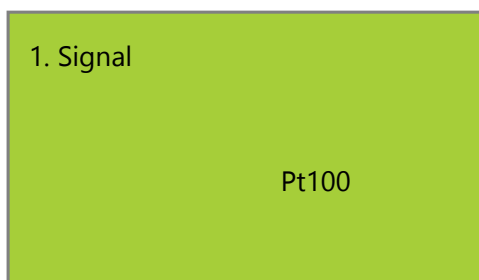


Figure 5

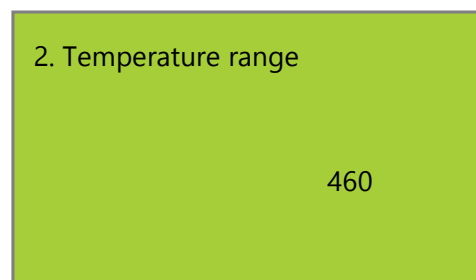


Figure 5-1

In "Temperature range" setting, enter the range value when the current signal is selected for the temperature signal. Press "Shift" key to select the data bit, press "Add"key to enter the number(s), and press "Enter" key to save the number entered(Figure 5-1).

"Dampen time" refers to the time for smooth software digital filtering, and which can be any of the numbers from 0 to 9. The set value by default is 0. In "Dampen time" setting, press "Add"key to enter the number(s), and press "Enter" key to save the number entered (Figure 5-2).

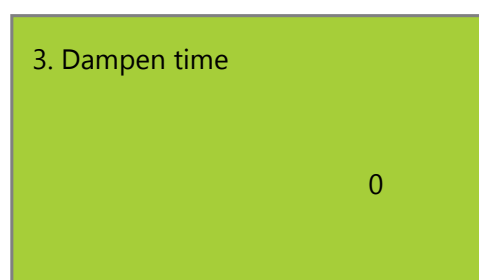


Figure 5-2

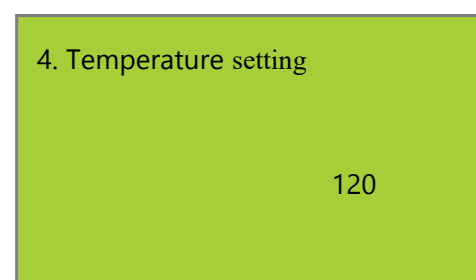


Figure 5-3

"Temperature setting" is necessary for the temperature signal. In "Temperature setting", press "Shift" key to select the data bit, press "Add"key to enter the number(s), and press "Enter" key to save the number entered (Figure 5-3).

5. Compensation setting

Select "Compensation" in the main menu with help of the "Option"key, and press "Enter" key to enter the sub-menu "Compensation Mode "Setting (Figure 6); press "Back" key to exit the current page and return to the previous menu; press "Page" key to enter the next sub-menu.

Temperature and pressure automation compensation(referred to as "P_T_Auto"),

pressure compensation(referred to as "Pressure"), temperature compensation(referred to as "Temperature") and density setting are optional for "Compensation mode" setting. In "Compensation mode" setting, the "Add"key is used for item selection, and the "Enter" key is used to save the item selected(Figure 6).

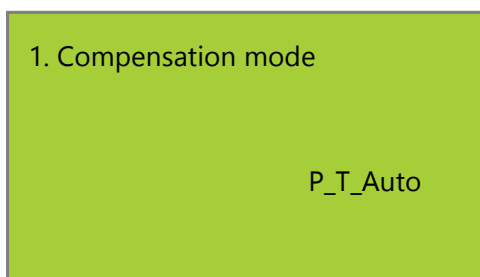


Figure 6

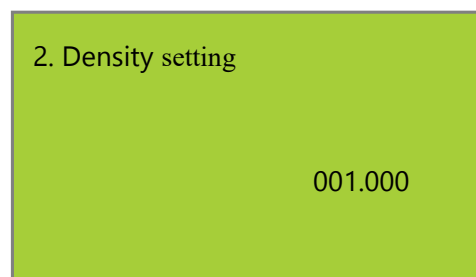


Figure 6-1

In "Density setting", press "Shift" key to select the data bit, press "Add"key to enter the number(s), and press "Enter" key to save the number entered (Figure 6-1).

6. Communication setting

Select "Communication" in the main menu with help of the"Option"key to enter the sub-menu "Communication address" Setting(Figure 7); press "Back" key to exit the current page and return to the previous menu; press "Page" key to enter the next sub-menu.

"Communication address" refers to the communication address of the totalizer. Press "Shift" key to select the data bit, press "Add"key to enter the number(s), and press "Enter" key to save the number entered (Figure 7).

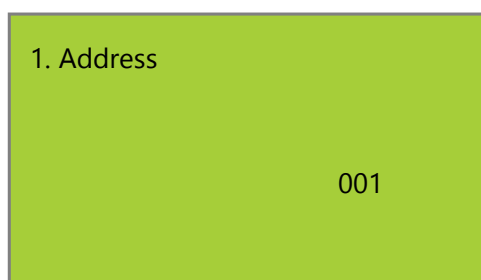


Figure 7

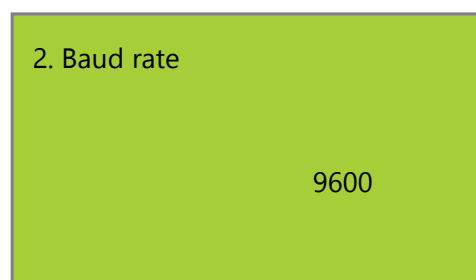


Figure 7-1

9600, 4800, 2400 and 1200 are optional for "Baud rate" selection. In "Baud rate" setting, the "Add"key is used for item selection, and the "Enter" key is used to save the item selected (Figure 7-1).

7. Display setting

Select "Display" in the main menu with help of the "Option" key to enter the sub-menu "Display Setting" (Figure 8); press "Back" key to exit the current page and return to the previous menu; press "Page" key to enter the next sub-menu.

"Fixed" display and "cycle" display are optional for "Display" selection. Fixed display means that the working conditions interface of the totalizer is displayed fixedly, and cycle display means that the working conditions interface of the totalizer is displayed circularly (Figure 8-1). The "Add" key is used for item selection, and the "Enter" key is used to save the item selected

"Backlight time" setting is to control the backlight working time of the LCD screen. Press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 8-1).

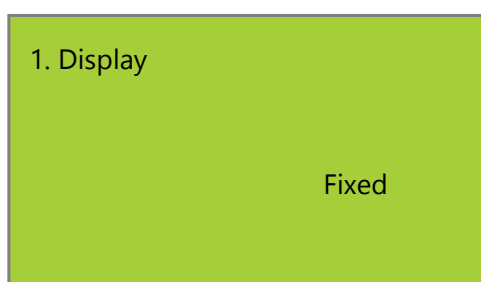


Figure 8

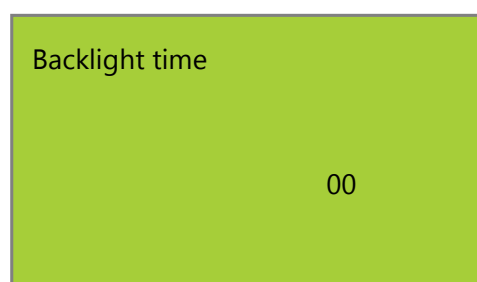


Figure 8-1

8. System setting

Select "System" in the main menu with help of the "Option" key to enter the sub-menu "System Setting" (Figure 9); press "Back" key to exit the current page and return to the previous menu; press "Page" key to enter the next sub-menu.

For "Date setting", the date format is 13-06-18 which is set according to the actual date. Press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 9).

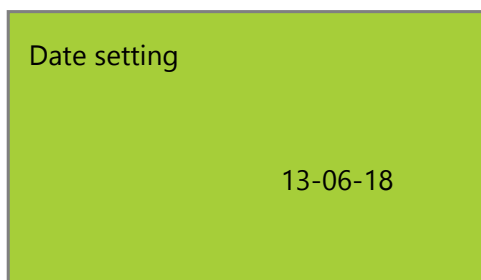


Figure 9

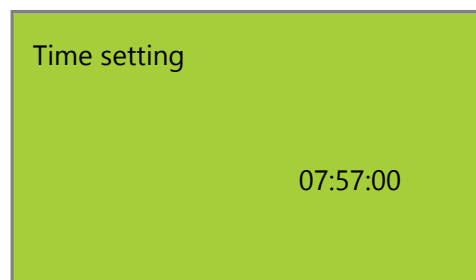


Figure 9-1

For "Time setting", the time format is 07:57:00 which is set according to the actual time. Press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 9-1).

For "Programming code" setting, the initial password is 2917. Press "Shift" key to select the data bit, press "Add" key to enter the number(s), and press "Enter" key to save the number entered (Figure 9-2).

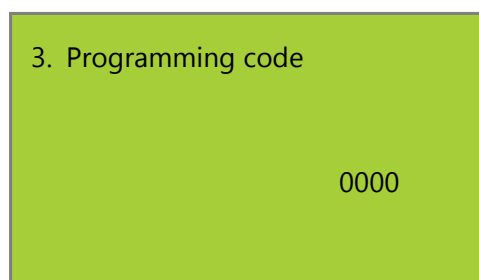


Figure 9-2

9. Reset setting

Select "Reset" in the main menu with help of the "Option" key, and press the "Enter" key to enter the sub-menu "Reset Setting"; press "Back" key to exit the current page and return to the previous menu; press "Page" key to enter the next sub-menu.

In "Cumulative reset", the password is 1688. Press "Shift" key to select the data bit, and press "Add" key to enter the number(s). After the number is entered correctly, press "Enter" key to clear the accumulative amount (Figure 10, Figure 10-1).

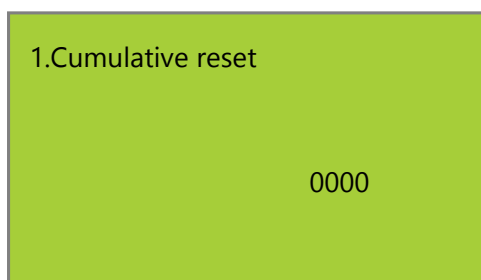


Figure 10

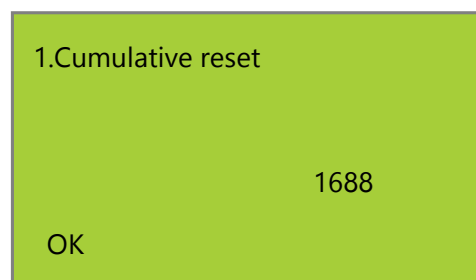


Figure 10-1

In "Blackout reset" setting, password is 2688. Press "Shift" key to select the data bit, and press "Add" key to enter the number(s). After the number is entered correctly, press "Enter" key to clear the total blackout times and time (Figure 10-2, Figure 10-3).

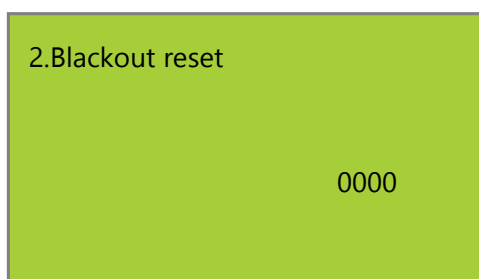


Figure 10-2

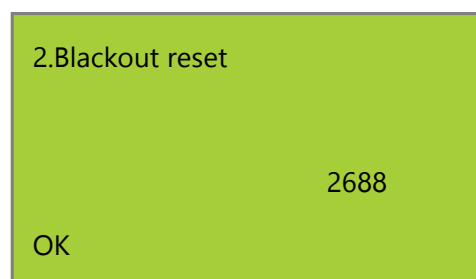


Figure 10-3

In "Program time reset" setting, password is 3688. Press "Shift" key to select the data bit, and press "Add" key to enter the number(s). After the number is entered correctly, press "Enter" key to clear the program times (Figure 10-4, Figure 10-5).

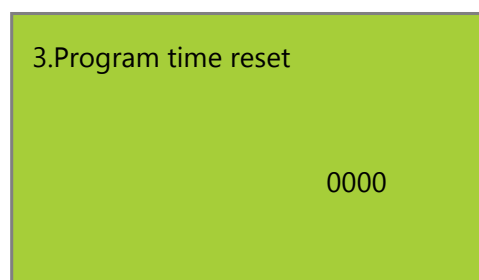


Figure 10-4

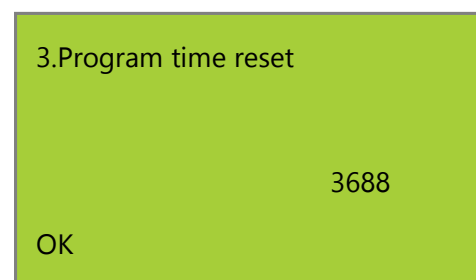


Figure 10-5

Note: totalizer calibration has been carried out in the factory, and non professional personnel do not operate the totalizer. Please return the totalizer to our factory for calibration if necessary!

10. Menu settings

Table 2

Setting item	Item content	Set value	Function and significance	Remarks
Flow	Medium	Steam		
		Gas		
		Liquid		
	Signal	Frequency	Frequency input, such as the vortex flowmeter.	
		Current	The flow is proportional to the input current, such as an electromagnetic flowmeter.	
		ΔP	The flow is square to the input current, such as an orifice flowmeter.	
	Unit	kg		The default unit of mass measurement is kg and the volume measurement unit is m^3 .
		t		
		m^3		
		L		
	Coefficient	000000.00		2 decimal places for frequency signal and 3 decimal places for differential pressure signal.
	Flow range	00000000(m^3)	The corresponding flow range when simulating the current inputs.	It is to be set when receiving current signal.
	ΔP range	000.000	Differential pressure range kPa	Setting necessary for the differential pressure signal.
	Dampen time	0~9	Time of the software digital smooth filtering	0 at the factory
	Small signal cutoff	00.00	When the flow signal is current, the small signal cutoff is current.	
	Output range	000000000	Flow range of the analog current output	
Pressure	Signal	Current	Analog current input (4~20mA DC)	
		Set	Set pressure	
	Pressure range	00.00	Set pressure range	1.6 for 1.6MPa.
	Dampen time	0~9	Time of the software digital smooth filtering	0 at the factory
	Pressure setting	00.00	Set pressure value	Used for pressure setting.
Temperature	Signal	Pt100	Platinum resistance input	

		Current	Temperature transmitter standard current input	
		Set	Set temperature	
	Temperature range	000	Set temperature range	
	Dampen time	0~9	Time of the software digital smooth filtering	0 at the factory
	Temperature setting	000	Set temperature value	Used for temperature setting.
Compensation	Compensation mode	P_T_Auto	Temperature and pressure automation compensation	
		Pressure	Pressure compensation	
		Temperature	Temperature compensation	
		Density setting	Density setting	
	Density setting	000.000		
Communication	Address	000	Set the instrument communication address.	0-255
	Baud rate	1200	Select to set the meter baud rate (Bps)	
		2400		
		4800		
		9600		
Display	Display	Fixed	Fixed display of a working condition interface	
		Cycle	Cycle display of three working condition interfaces	
	Backlight time	00	Control the LCD backlight light time.	
System	Date setting	10-06-24	System date	
	Time setting	09:12:24	System time	
	Programming code	2917	Change the programming code	
Reset	Cumulative reset	1688	Enter this password, press "Enter" and the accumulation is zero.	
	Blackout reset	2688	Enter this password and press the "Enter" key. The total power-off times and time is zero.	
	Program time reset	3688	Enter this password and press "Enter". The programming time is zero.	
Calibration				Note: totalizer calibration

				has been carried out in the factory, and non professional personnel do not operate the totalizer.
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VII. Programming Examples

Example 1:

Measured media: superheated steam

Matched instruments:

Vortex sensor DN100 for pulse output with the meter coefficient of 1138.6 and the lower cutoff frequency limit of 5Hz.

Pressure transmitter with the range of 0~1.6MPa, the output current of 4~20mA and the Pt100 platinum resistance.

Analog output of secondary instrument: (4~20) mA corresponding to the upper flow limit of 7500kg/h.

According to the above conditions, the parameters are set as follows:

Item	Content	Set value
Flow	Medium	Steam
	Signal	Frequency
	Unit	Kg
	Coefficient	1138.6
	Small signal cutoff	05.00
	Output range	7500
Pressure	Signal	Current
	Pressure range	1.60
Temperature	Signal	Resistance
Compensation	Compensation mode	Temperature and pressure automation compensation

Table 3

Example 2:

Measured media: compressed carbon dioxide gas

Matched instruments:

Vortex sensor DN80 for pulse output with the meter coefficient of 2248.5 and the lower cutoff frequency limit of 7Hz.

Pressure transmitter with the range of 0~2.5MPa and the output current of 4~20mA.

Temperature transmitter with the range of (0~100) °C and the output current of (4~20)mA.

Note: carbon dioxide density of 1.829kg/m³.

According to the above conditions, the parameters are set as follows:

Table 4

Item	Content	Set value
Flow	Medium	Gas
	Signal	Frequency
	Unit	Kg
	Coefficient	2248.5
	Small signal cutoff	07.00
Pressure	Signal	Current
	Pressure range	2.5
Temperature	Signal	Resistance
	Temperature range	100
Compensation	Compensation mode	Setting density
	Density setting	1.829

VIII. Communication Function

Standard MODBUS RTU protocol and RS485 or RS232 communication interface are available for this totalizer for data communication. GPRS transmission or bus mode transmission can be selected for data transmission. When bus mode transmission is selected,

an individual instrument number and a proper baud rate are necessary for each instrument. Instrument number and baud rate shall be set in the set menu.

IX. Totalizer Calibration

1. No frequency adjustment is required for the totalizer, and which is defined by the crystal oscillator.

2. Each analog quantity acquisition channel has been calibrated in the factory. Non professional personnel do not carry out totalizer calibration, otherwise incorrect measurement results may be caused.

Note: In addition, the company also can supply UPS power and rechargeable battery, and which shall be packed in a box with the totalizer.

X. Totalizer Computation Model

1. Equipped with frequency sensor

$$Q = 3600 \times \frac{F \cdot d}{k}$$

2. Equipped with current sensor

$$Q = \frac{(I - 4)}{16} \times Q_{\max} \cdot d$$

3. Equipped with differential pressure sensor

3.1 Mass flow

$$Q = U\sqrt{\Delta P \times d}$$

3.2 Volume flow

$$Q = U\sqrt{\Delta P \div d}$$

4. Differential pressure value calculation

$$\Delta P = \frac{(I - 4)}{16} \times \Delta P_{\max}$$

5. Density calculation

5.1 Steam density: temperature and pressure automation compensation

5.2 Gas density:

$$\text{Volume density under standard conditions} = \frac{(\text{pressure} + 0.101325) \times 293.15}{0.101325 \times (\text{temperature} + 273.15)}$$

Mass density under standard conditions=Volume density under standard conditions×set density

Where:

F: Sensor output frequency, unit: Hz

Q: Instantaneous mass flow

D: Medium density, unit: kg / m³

I: Actual current unit: mA

K: Instrument coefficient,unit: N / m³

U: Orifice coefficient

Q_{max}: Maximum value of instrument setting, unit: m³/ h

△P: Differential pressure value, unit: KPa

XI. Communication Agreement

The instrument adopts MODBUS-RTU communication regulations, and the instrument acts as a query command from the slave equipment to the main equipment. All data is transmitted in hexadecimal.

I. Instrument communication characteristics

1. Byte bit format: 1 bit start bit, 8 bit data bit, 1 bit stop bit, no verification bit;
2. Baud rate: 1200~9600, programmable setting;
3. Instrument address: 0~255, programmable setting and the communication line transmission is 0x00~0xff(hexadecimal).

II.The main device launches query command format

The main device launches query message format

Instrument address	Function code	Register start address	Number of registers	CRC verification
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1 byte	1 byte	2 byte	2 byte	2 byte
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For example:

Instrument address is 10(0x0A), Register Start Address is 40000(0x00,0x00),

The number of registers to be obtained is 4 (0x00, 0x04)

The main device sends commands: 0A 03 00 00 00 04 45 72

III. Analysis of response and return data from the slave device

Message format returned from the slave device

Instrument address	Function code	Byte number	Data*1	Data*2	CRC verification
1 byte	1 byte	1 byte	2 byte	2 byte	2 byte

Byte order:4-3-2-1

For example:

Return command from the slave device:

0A 03 08 31 03 00 00 96 03 00 00 9C A3

0A The slave device address

03 Function code

08 Byte number

31 03 00 00 Instantaneous flow rate(Analysis:00 00 03 31=>817/100=8.17)

96 03 00 00 Pressure(Analysis:00 00 03 96=>918/1000=0.918)

9C A3 CRC Verification (low byte first, high byte last)

IV. Register content definition

Register address	Data content	Register number	Data type	Magnification
0x00	Instantaneous flow	2	Unsigned long integer	100
0x02	Pressure	2	Unsigned long integer	1000
0x04	Temperature	1	Unsigned integer	10
0x05	Accumulative flow	2	Unsigned long integer	10
0x07	Frequency	1	Unsigned integer	10

0x08	Current	1	Unsigned integer	1000
0x09	Differential pressure	2	Unsigned long integer	1000
0x0B	Density	2	Unsigned long integer	1000

Note: If the register address is error or beyond its range, the instrument returns error information or unpredictable error data.

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