FC2000 FLOW COMPUTER
FC2000 -TBIAH FLOW COMPUTER

Summary

FC2000-TBIAH is a multi-functional flow computer in FC2000 series products, which can be adapted to a variety of flow meters and the measured medium. It has a variety of functions, such as dynamic compensation of the full parameters of flow, historical data storage, measurement supervision, trade settlement, and network communication, etc. It can achieve volume and mass flow measurement. Especially in support of the standard nozzle flowmeter to measure natural gas, it has the function of wide range (double differential), remote assignment, energy measurement, etc.

Function Features

FC2000-TBIAH has a flexible software and hardware platform, which can realize special function applications for users. It adopts 32-bit ARM processor as the core of the multi-CPU structure, ensuring the accuracy and real-time calculation. The use of 24-bit A/D converter with reference source improves the accuracy of analog signal acquisition. All input and output signals and communication interfaces are fully isolated, which improves the reliability of the machine.

The FC2000-TBIAH flow calculation software has passed the national authority certification. The FC2000-TBIAH flow calculation is one of the FC2000 series of flow computers. FC2000 series flow computer products also include FC2000-TBIAD single flow computer, FC2000-TBIAD (G) two-way wall-mounted flow computer, FC2000-TBIAE, FC2000-TBIAE (M), FC2000-TBIAE (G) flow calculation conversion unit, etc.

Function Features

Human-Machine Interface

- 5.0-inch true-color LED-backlit TFT LCD, 5 operation buttons, full Chinese interface.
- It can display cumulative flow rate, instantaneous flow rate, temperature, pressure, density, compression coefficient, as well as historical data, alarm records, audit records, etc.

Flow Channel

- This machine can measure 2 flow rates, and the external module can be extended to 4 flow rates, which can be configured in various ways for different needs. This machine can not only measure 2 independent flow rates, but also can be used as a redundant backup for single flow rate measurement, thus greatly improving system reliability.

Plug-In Module

- The FC2000-TBIAE(G) flow conversion unit mounted on DIN 35 rail can be used as a plug-in module, and the FC2000-TBIAH communicates with the plug-in module via the 2nd RS485 interface.

Measurable Medium

- Natural gas, artificial gas, superheated steam, saturated steam, general purpose gas, water, hot water, liquids (oil, chemical products), etc.

Function Introduction

- Standard flow element: standard orifice plate, ISA1932 nozzle, long diameter nozzle, venturi nozzle, classic venturi.
- Non-standard flow element: V-cone flow meter, multi-hole orifice plate, wedge-shaped orifice plate, 1/4 round orifice plate.
- Differential pressure flowmeter: measuring tube flowmeter, uniform velocity tube flowmeter (Weiliba, Annuba), elbow flowmeter.
- Pulse flowmeter: dual parametric mass flowmeter, vortex (with insertion) flowmeter, turbine (with insertion) flowmeter.
- Ultrasonic flow meters.
- Electromagnetic flow meters.

Flow compensation and calculation of physical parameters

- Real-time dynamic calculation of the discharge coefficient C and stream expansion coefficient ε of the standard flow elements is available the formula of which conforms to the provisions of GB/T2624-2006 and ISO5167-2003 standards.
- The flow rate can be calculated based on the meter's calibrated meter coefficients, with up to ten non-linear segmental compensations.
- The calculation of steam density or heat conforms to GB / T 34060-2017 standard (IAPWS-IF97), IFC1967 formula to adapt to the superheat, saturation, and all other states of steam.
- The calculation of natural gas flow rate by orifice plate flow meter conforms to SY/T6143-1996, SY/T6143-2004, GB/T21446-2008 and other standards.
- The calculation of natural gas flow rate by nozzle flow meter conforms to GB/T 34166-2017 for natural gas flow rate measurement with standard nozzle flow meter.
- The calculation of compression factor of natural gas conforms to GB/T17747.2-2011 (equivalent to AGA8 report).
- The calculation of natural gas heat generation conforms to the GB/T11062-2014.
- Universal gas compression factor Z is according to the Redlich-Kwong equation.
- Gas humidity compensation can be performed to calculate the wet gas flow rate and the flow rate of the dry portion of the wet gas.
- Oil measurement conforms to the provisions of GB/T 9109.5-2017 "Oil and liquid petroleum products oil measurement: dynamic measurement" and GB/T 1885-1998 "Petroleum measurement tables".
- It's available to customize the software version of the special flow calculation function according to the characteristics of the flow meter and the medium under test.

Wide Measuring Range

When matched with the standard nozzle flowmeter, it can not only calculate the working density, discharge coefficient and expansion coefficient in real time according to the temperature, pressure, differential pressure, medium composition and Reynolds number, but also automatically switch between two differential pressure transmitters with different ranges with the change of differential pressure signal, so that the measurement range can meet required accuracy and reach the measuring range of 1~6 or even 1~20.

Energy measurement

It can calculate the energy of energy medium such as steam, hot water, natural gas, and artificial gas, etc.

Network Heat Loss Assessment

A built-in pipe network heat loss model allows you to calculate theoretical values of pipe network heat loss based on parameters such as pipeline length and insulation factor. By using wired or wireless communication to obtain the actual heat at the upstream measuring point, the actual network heat loss for that section of the pipeline is calculated. The theoretical heat loss of the pipe network and the actual heat loss of the pipe network at each measuring point will be compared and analyzed, which facilitates users to find out the causes of the heat loss of the pipe network and provides data support for reducing the heat loss of the pipe network.

Carbon Data Measurement

Carbon measurement is the basis of carbon trading. The unique carbon measurement algorithm for steam, hot water and natural gas facilitates companies to accurately measure their own carbon emissions data. The carbon measurement model and algorithm has obtained the national invention patent certificate (invention patent authorization number: ZL201410132364.5).

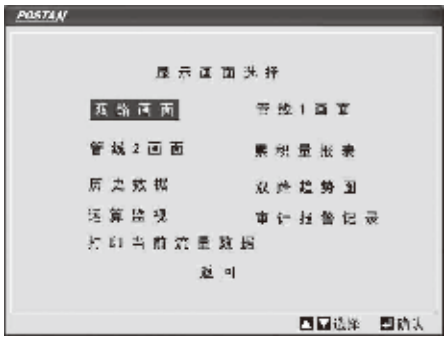
Communications and Networking

- Standard serial communication interface: RS232, RS485, standard Modbus-RTU communication protocol.
- RJ45 Ethernet (Ethernet) network interface, Modbus TCP/IP communication protocol.
- HART protocol interface, supports HART protocol communication with differential pressure transmitters, pressure transmitters, temperature transmitters and multiparameter transmitters. As the digital quantity obtained by HART protocol is not affected by A/D conversion, it can improve the measurement precision.
- Supporting GPRS, CDMA remote mobile communication.
- It can be equipped with many kinds of configuration software, such as Power Control, Configuration King, iFix, Intouch, etc., and the users of these configuration software can "plug and play".
- The FC2000-TBIAH can compile communication program according to the protocol of your existing network.

Measurement and Monitoring

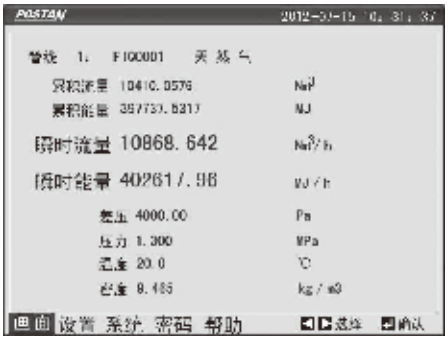
- History record contains 3 kinds of record mode: minute, hour and day, which is convenient for users to search. 180 days of historical data can be stored (once every 5 minutes). Each storage includes a set of data such as flow rate, temperature, pressure, accumulation and energy. Data storage time interval can be customized. At the same time, 200 audit records and 200 alarm records can be stored.
- It contains audit logs of power outages, system settings, parameter modifications, and clearing accumulations, etc.
- All parameters setting and modification need to be confirmed by double password identification.
- Historical data can be downloaded through RS232, RS485, TCP/IP communication from "FC2000-TBIAH Instrument History Data Acquisition System". This System can store, report, trend graph, query, print and convert the historical data into EXECL table for easy use. The operation interface of "FC2000-TBIAH Instrument Historical Data Acquisition System" is shown below.

Display Scree



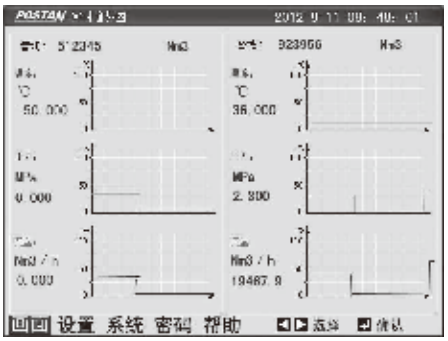
1. Selection

2. Dual channel operation

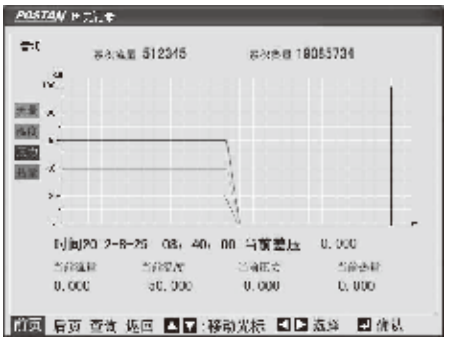


3. Single channel operation

4. Cumulative quantity report



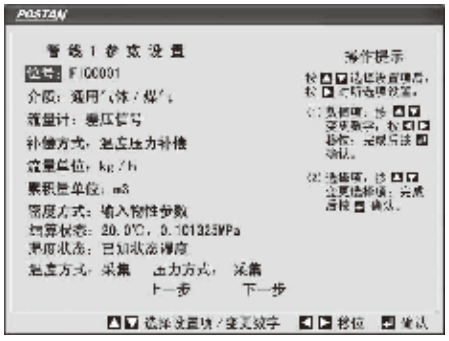
5. Two way trend



6. Historical data

7. Audit alarm recording

8. Password setting



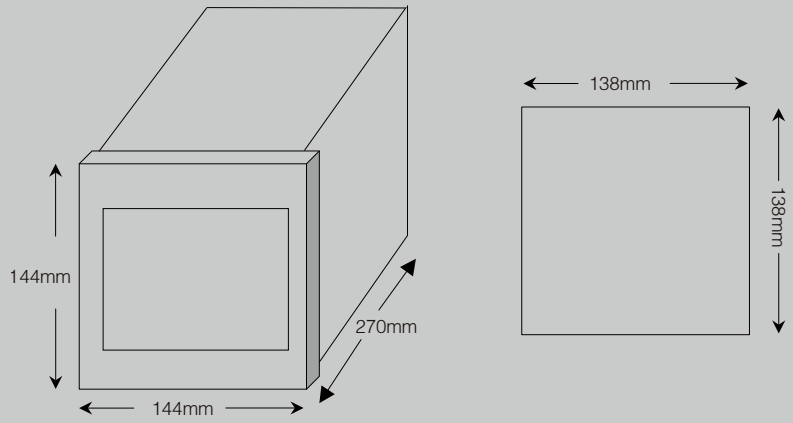
9. Pipeline parameter setting

10. Natural gas component input

Technical Parameters

Processors	32-bit ARM processors
Memory	On-board FLASH, SRAM, FRAM multiple memory, up to 32MB
A/D Converter	24-bit high-resolution A/D with internal reference source
Display	5.0" 65K Color True Color LED Backlight TFT LCD
Buttons	5 buttons
Local input signal	Six channel fully isolated 4 ~ 20mA analog signal
	Two pulses (0.2Hz ~ 10.0KHz, 4 ~ 11V), configurable as voltage pulse, current pulse, open collector pulse, NAMUR standard pulse, with DC24V and DC12V power supply options.
	Two way Pt100 RTD signal (-50℃ ~ 500℃) or 2 way thermocouple signal (with K, S, B, J, R, N, E, T multiple thermocouple options)
	One channel HART protocol digital signal, support temperature, pressure, differential pressure transmitters.
Local output signal	2 channels fully isolated 4 ~ 20mA analog signal output
Uncertainty	4-20mA conversion uncertainty: ±0.1%
	Pt100 RTD conversion uncertainty: ±0.1%
	Thermocouple Conversion Uncertainty: ±0.2%
	4-20mA output conversion uncertainty: ±0.1%
	Calculation uncertainty: 0.05%
Maximum cumulative display	999,999,999 Engineering units
Communication interface	1 RS232/RS485 interface
	1 10M/100M network card interface (optional)
	1 RS485 interface
	1 HART protocol interface
External power supply	6-channel fully isolated DC24V/0.03A
Data retention time	10 years
Working power	220VAC±10%，50Hz、Power：25W
Working conditions	Ambient temperature -20 ~ 55℃, relative humidity less than 85%.
External dimensions	144L x 144 H x 270W (mm)
Mounting Type	Disc Horizontal Mounted
Aperture size	138W x 138H (mm) Note: For the original 150W x 150H (mm) aperture, special mounting brackets can be provided without

FC2000-TBIAH Outline Dimension Drawings



Dimensional Drawing of Aperture

Model Selection Table

Model	Basic Codes	Additional codes	Description
FC2000-TBIAH			Multiple Flow Computers
FC2000-TBIAH（G）			Enhanced Multiple Flow Computers
Software Versions	/ZTY		Version for steam, general purpose gas and liquid
	/TRQ		Version for natural gas
	/ ZY		Version for dedicated software
Additional functions		/C1	HART protocol communication interface
		/C2	Serial Interface 1 RS485
		/C3	Serial Interface 2 RS232
		/C4	Serial Interface 2 RS485
		/N2	LAN communication function
		/FA	4 ~ 20mA flow signal output
		/EX4	Expanded to 4 flows
Mounting Type		/H	Disk mounted horizontal

Note:

Only three of C1/C2/C3/C4 can be selected from the additional functions, and C3 and C4 cannot be selected at the same time.

Terminal Definitions

FC2000-IAH(G) Flow Computer Terminal Definitions

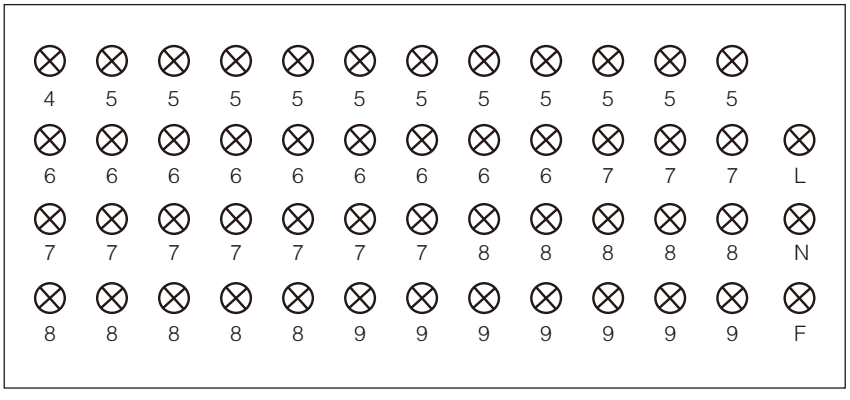
Terminal Codes	Terminal definitions	Terminal Codes	Terminal definitions
49	+24V	73	Pipeline 2 Platinum Resistor A-Phase Input
50	+12V	74	Pipeline 2 Platinum Resistor B-Phase Input
51	Pipeline 1 Pulse Input+	75	Pipeline 2 Platinum Resistor C-Phase Input
52	Pipeline 1 Pulse Input -	76	+24V Power Supply
53	+24V	77	Pipeline 2 Temperature Signal +
54	+12V	78	Pipeline 2 Temperature Signal -
55	Pipeline 2 Pulse Input +	79	+24V Power Supply
56	Pipeline 2 Pulse Input -	80	Pipeline 2 Pressure Signal +
57	Pipeline 1 Flow 4 ~ 20mA Output+	81	Pipeline 2 Pressure Signal -
58	Pipeline 1 Flow 4 ~ 20mA Output -	82	+24V Power Supply
59	Pipeline 2 Flow 4 ~ 20mA Output +	83	Pipeline 2 Flow Signal +
60	Pipeline 2 Flow 4 ~ 20mA Output -	84	Pipeline 2 Flow Signal -
61	Pipeline 1 Platinum Resistor A-Phase Input	85	Protective grounding
62	Pipeline 1 Platinum Resistor B-Phase Input	86	
63	Pipeline 1 Platinum Resistor C-Phase Input	87	
64	+24V Power Supply	88	
65	Pipeline 1 Temperature Signal+	89	Blank（Do not connect to any wires.）
66	Pipeline 1 Temperature Signal-	90	
67	+24V Power Supply	91	
68	Pipeline 1 Pressure Signal +	92	
69	Pipeline 1 Pressure Signal -	93	Line 1 RS485+
70	+24V Power Supply	94	Line 1 RS485-
71	Pipeline 1 Flow Signal +	95	Line 2 RS485+
72	Pipeline 1 Flow Signal -	96	Line 2 RS485-
L	AC220V Live Wire		
N	AC220V Neutral Wire		
FG	Power Protection Grounding		

FC2000-TBIAH(G) Flow Computer Terminal Definitions

Terminal Codes	Terminal definitions	Terminal Codes	Terminal definitions
49	Pipeline 1 Platinum Resistor A-Phase Input	73	24V+
50	Pipeline 1 Platinum Resistor B-Phase Input	74	Pipeline 2 Flow Input +
51	Pipeline 1 Platinum Resistor C-Phase Input	75	Pipeline 2 Flow Input -
52	+24V Power Supply	76	24V-
53	Pipeline 1 Temperature Signal+	77	24V+
54	Pipeline 1 Temperature Signal-	78	Pipeline 2 Flow Input +
55	+24V Power Supply	79	Pipeline 2 Flow Input -
56	Pipeline 1 Pressure Signal +	80	24V-
57	Pipeline 1 Pressure Signal -	81	Pipeline 1 Flow 4 ~ 20mA Output+
58	+24V Power Supply	82	Pipeline 1 Flow 4 ~ 20mA Output -
59	Pipeline 1 Flow Signal +	83	Pipeline 2 Flow 4 ~ 20mA Output +
60	Pipeline 1 Flow Signal -	84	Pipeline 2 Flow 4 ~ 20mA Output -
61	Pipeline 2 Platinum Resistor A-Phase Input	85	Line 1 RS485+
62	Pipeline 2 Platinum Resistor B-Phase Input	86	Line 1 RS485-
63	Pipeline 2 Platinum Resistor C-Phase Input	87	Line 2 RS485+
64	+24V Power Supply	88	Line 2 RS485+
65	Pipeline 2 Temperature Signal+	89	Reserved, user should not wire.
66	Pipeline 2 Temperature Signal-	90	
67	+24V Power Supply	91	
68	Pipeline 2 Pressure Signal +	92	Blank Terminals, Unused.
69	Pipeline 2 Pressure Signal -	93	
70	+24V Power Supply	94	
71	Pipeline 2 Flow Signal +	95	
72	Pipeline 2 Flow Signal -	96	
L	AC220V Live Wire		
N	AC220V Neutral Wire		
FG	Power Protection Grounding		

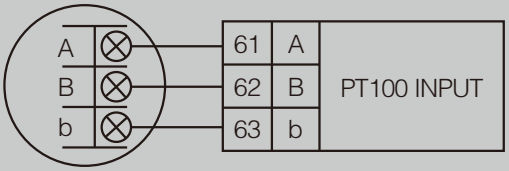
Wiring Terminal Location Diagram

The independent power supply terminal is designed to partition the power supply terminal and signal terminal, greatly reducing the chance of the AC high voltage being mistakenly connected to the signal terminal.



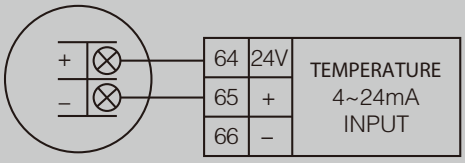
Wiring Diagrams

PT100 RTD Wiring



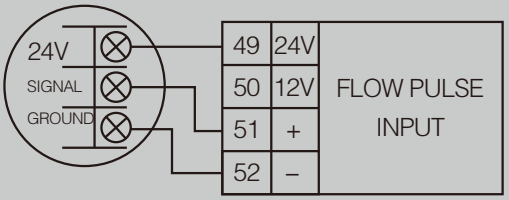
PT100 RTD

Temperature Transmitter Local Power Wiring



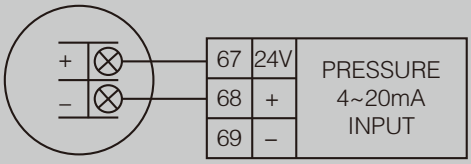
Temperature Transmitter

Pulse Signal Flow Meter Local Power Wiring



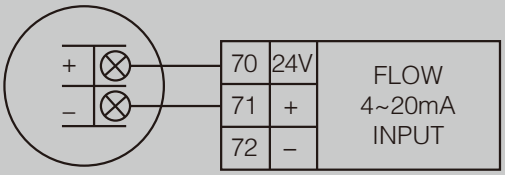
Pulse Signal Flow Meter

Pressure Transmitter Local Power Wiring



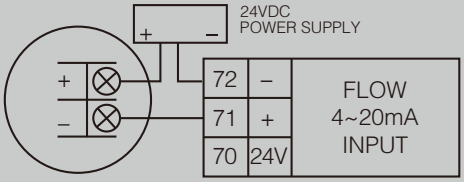
Pressure Transmitter

Differential Pressure Transmitter Local Power Wiring



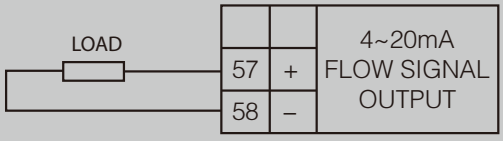
Differential Pressure Transmitter

Differential Pressure Transmitter or Flowmeter External Power Supply Wiring

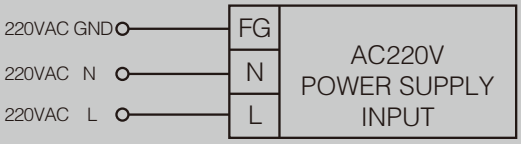


Differential Pressure Transmitter

4~20mA Flow Signal Output Wiring



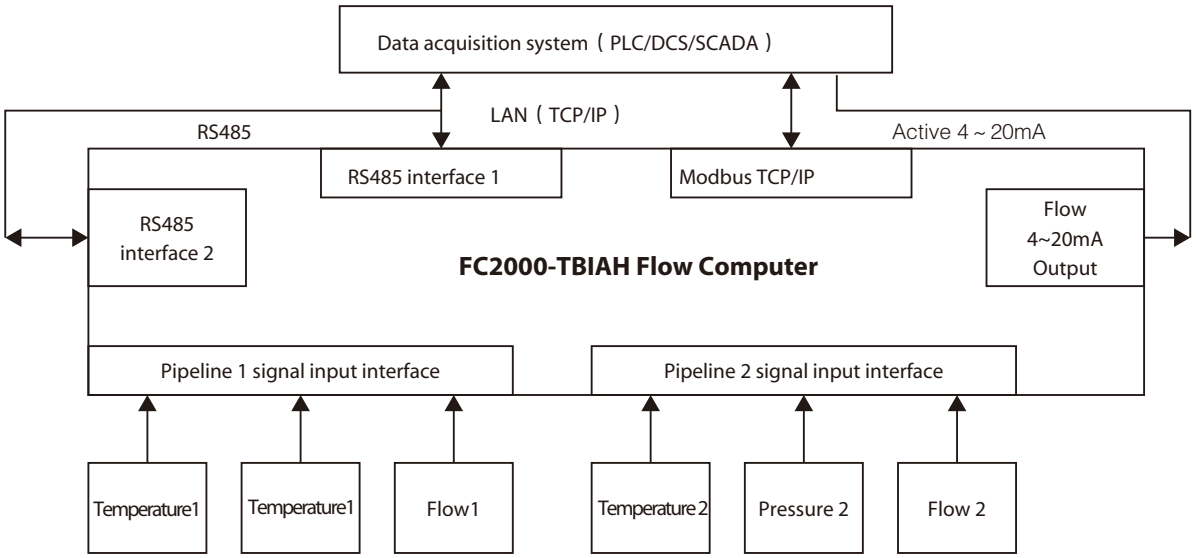
AC220V Power Supply Wiring



Typical Applications and Configurations

1. Dual natural gas flow measurement

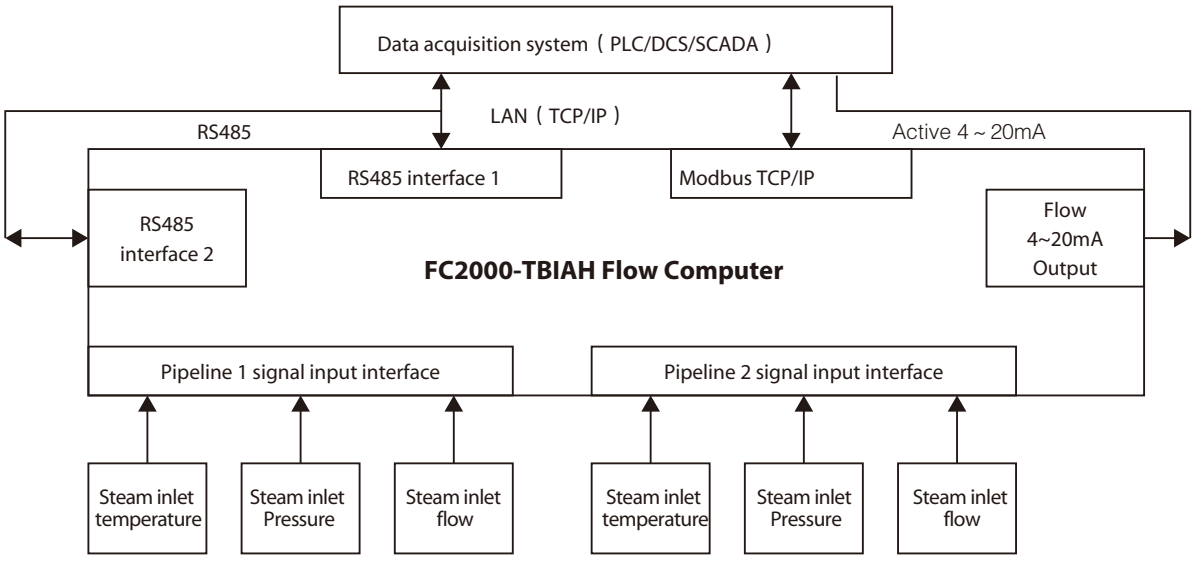
FC2000-TBIAH can collect temperature, pressure and flow signals from two natural gas pipelines. Since the composition of natural gas has a significant impact on the accuracy of natural gas flow measurement, the FC2000-TBIAH allows the user to connect to a composition analyzer (or to remotely assign values to modify the gas composition) via RS485 to automatically capture changes in the composition of natural gas. The FC2000-TBIAH communicates the calculated data from the 2 lines to the data acquisition system (SCADA) via Modbus Rtu (RS485 interface), or Modbus TCP/IP protocol.



Dual Natural Gas Flow Measurement Function Block Diagram

2. Vapour Mass + Energy Measurement

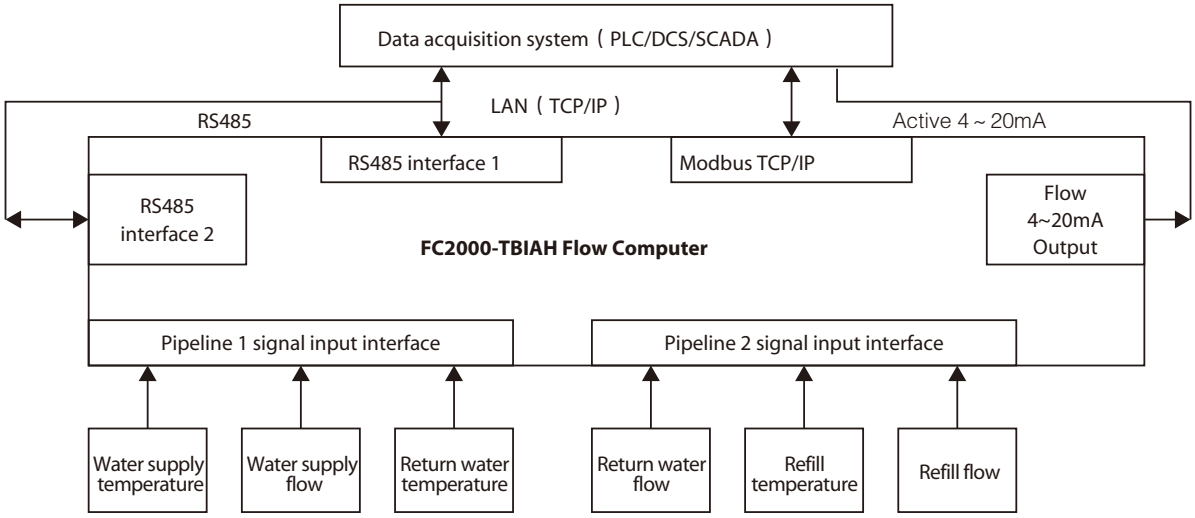
The FC2000-TBIAH collects the temperature, pressure, and flow rate signals from the steam inlet and outlet of a device respectively. The energy consumption of the device will be calculated by calculating the energy at the inlet and outlet and also calculating the mass flow rate of the steam.



Steam Energy Measurement Function Block Diagram

3. Energy measurement of heating systems

The FC2000-TBIAH flow computer collects the temperature and flow signals of the water supply, return water and make-up water of the heating system and calculates the flow rate and heat of the water supply, return water and make-up water respectively, to calculate the energy consumption of the whole heating system.



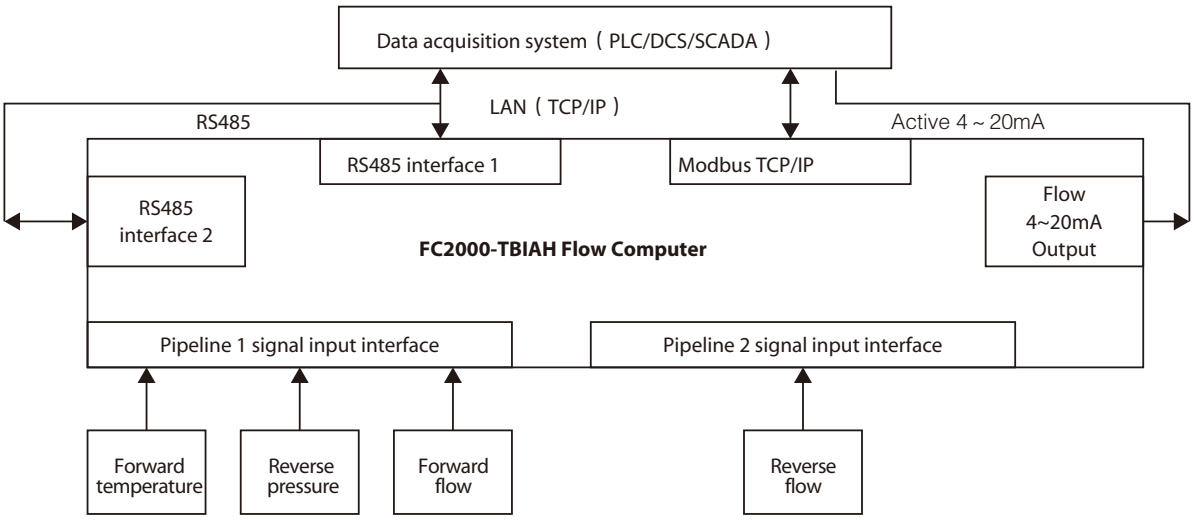
Energy Measurement Function Block Diagram of The Heating System

4. Gas Mix Metering

Some devices use natural gas or gas as fuel, while sometimes natural gas (high heat generation) and dry gas (low heat generation) are mixed or blast furnace gas and coke oven gas are mixed for use as fuel in the devices. Since it is a mixture of 2 different gas sources, calculating the flow rate according to the physical properties of one gas source alone can lead to inaccurate flow rate calculation due to the difference in gas density of the mixture. In order to solve this problem, FC2000-TBIAH collects the temperature, pressure, flow rate and component data of 2 pipelines respectively (components can be manually entered, collected by component analyzer or remotely assigned), and calculates the flow rate and density before mixing, to calculate the gas density and flow rate after mixing.

5. Two-way flow measurement

When there is bi-directional flow on a pipeline, the user needs to compensate for the 2 flow directions using the same set of temperature and pressure signals.The FC2000-TBIAH collects 1 temperature, 1 pressure, and 2 flow signals to complete the bi-directional flow measurement. If the forward flow uses the collected temperature and pressure signals, the reverse flow directly sets the temperature and pressure in the FC2000-TBIAH to share with the forward.

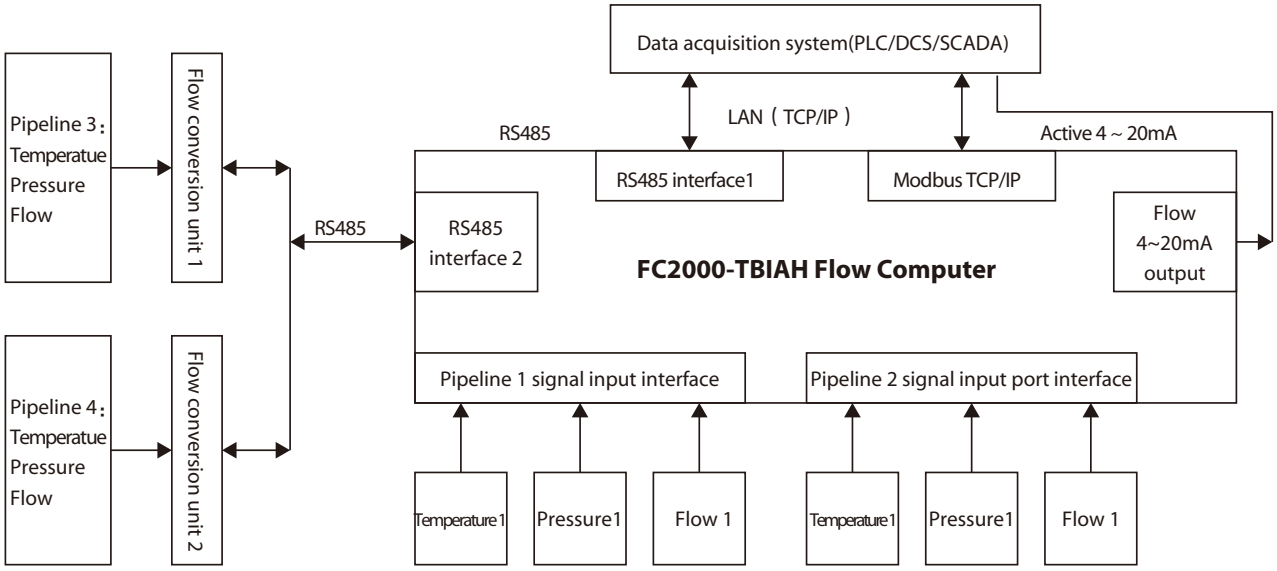


Two-Way Flow Measurement Function Block Diagram

6. Expansion of 4-way flow measurement

The FC2000-IAH is designed to measure the flow rate of 2 pipelines. With an external flow calculation conversion unit, the flow measurement can be extended to 4 pipelines. The FC2000-IAH communicates with the Flow Calculation Conversion Unit via RS485 interface.

And the flow calculation conversion unit is powered by a separate 24V DC power supply module.



7. Using the HART interface to read temperature, pressure, flow signals

FC2000-TBIAH has a HART digital signal interface, which can easily communicate with intelligent transmitters with HART digital interface. Up to 4 HART transmitters can be connected. As the digital quantity obtained by HART protocol is not influenced by A/D conversion, it can improve the measurement precision.

8. Measurement of oil products

The FC2000-TBIAH can collect temperature, pressure, and flow signals from oil pipelines, and be connected to an online densitometer to obtain real-time changes in density. Or it can use the input standard density, oil moisture content, oil saturated vapor pressure for density calculation, and then calculate the mass flow of oil. It can be adapted to positive displacement, ultrasonic and other flowmeter. It can be adapted to positive displacement type, ultrasonic and other flowmeter, and make segmental correction for the pulse output type flowmeter instrumentation coefficient (e.g.: scraper flowmeter). When using pulse output flowmeter, it can measure the flow of up to two pipelines.

FC2000-TBIAH Flow Computer Selection Inquiry Form

This is a kind of flow element. It has the characteristics of simple structure, cost saving, short production cycle and no leakage. It is especially suitable for industrial high temperature and high pressure pipeline medium flow and vapor flow measurement.

Contact Person _____

Company & Department _____

Address _____

Post code _____

Tel. _____

Fax No. _____

Email _____

Items	Options
Type of Flow Meter	Differential Pressure: ☐ Standard Flow Element ☐ Non-standard Flow Element ☐ Other differential pressure flow meters Pulse output type (e.g. turbine, vortex, etc.): ☐ voltage pulse ☐ current pulse ☐Namur Signal Linear current output type (e.g. ultrasonic, electromagnetic, etc.): flow input signal unit ☐ m^3/h ☐ Nm^3/h ☐ kg/h ☐ t/h ☐ other
Double Differential Wide Range	☐ Yes ☐ No
Measured Medium	☐ natural gas ☐ steam ☐ hot water ☐ general purpose gas
	☐ liquid ☐ Others
Gas Composition	Composition acquisition method: ☐ Communication ☐ Manually input
	Composition:
Energy measurement	☐ Yes ☐ No
Input Signal	Flow Signal: ☐ 4 ~ 20mA ☐ HART ☐ Pulse ☐ RS485
	Pressure Signal: ☐ 4 ~ 20mA ☐ HART
	Temperature Signal: ☐ Pt100 ☐4 ~ 20mA ☐ HART
Output Function	Line 1 4 ~ 20mA Output: ☐ Flow ☐ Energy
	Line 2 4 ~ 20mA Output: ☐Flow ☐ Energy
Communication Interface	☐ 1 RS232 interface+1 RS485 interface ☐ 2 RS485 interfaces
	☐ Internet Interface (TCP/IP)
	☐ HART Protocol Interface
Remarks	

Filled in by _____

Checked by _____

Date filled in _____

(YYYY/MM/DD) _____

FC2000-TBIAE FLOW CALCULATION CONVERSION UNIT

Summary

FC2000-TBIAE flow calculation conversion unit is a modular product of FC2000 flow computer series that integrates flow (energy) calculation, data conversion and network function. It can be used with flow transmitters and other primary instruments to form a flow measurement system with network functions, and can also be easily embedded in the original DCS, PLC and other control and measurement systems to achieve high-precision flow compensation operation. The product is divided into two categories: general-purpose type and special-purpose type. General-purpose type includes: FC2000-TBIAE Basic Type, FC2000-TBIAE (G) Enhanced Type, FC2000-TBIAE (Q) Energy Measurement Type. Specialized types include: FC2000-TBIAE (Y) Multiparameter Throttling Flowmeter Specialized type, FC2000-TBIAE (T) Natural Gas Nozzle Flowmeter Specialized type, FC2000-TBIAE (K) Measuring Pipe Flowmeter Specialized type, FC2000-TBIAE (Z) Dual-Parameter Mass Flowmeter Specialized type.

FC2000-TBIAE has the function of dynamic compensation of the flow rate of all parameters. The FC2000-TBIAE can be adapted to a variety of flowmeters and a variety of measured medium to achieve volume, mass flow and energy measurement. The flow calculation software used by the equipment follows the relevant national standards and has passed the certification of the national authority (reserve the ability to upgrade to new national standards). It can be used for trade settlement, measurement supervision, historical data (including audit records) storage and query. The product has several software copyrights.
The FC2000-TBIAE, as a new concept of networked flow measurement equipment, has a flexible software and hardware platform that can be customized to meet individual user needs.

Configuration and Application

One set of primary meters meets both measurement and control needs.

• The FC2000-TBIAE(G) has four fully isolated and independently powered 4-20mA analog input channels and can output four isolated active 4-20mA output signals. It's particularly suitable for only one set of primary meters that require both measurement and control of the measuring point. FC2000-TBIAE(G) collects temperature, pressure and flow signals for flow measurement and connects them to a third-party acquisition system such as DCS/PLC through an isolated 4-20mA output. That is, FC2000-TBIAE(G) = 1 flow accumulator + 4 4 ~ 20mA signal isolator. The biggest advantage is that the measurement retrofit is done without adding primary meters, which reduces system costs.

Use of the same measurement data for three different data collection systems

• FC2000-TBIAE(G) has powerful communication function, with 1-channel RS485, 1-channel RS232/RS485 and 1-channel TCP/IP interface, and supports Modbus RTU and Modbus TCP/IP two kinds of protocols. Through the above communication interfaces, the data of one measuring point can be easily used for multiple data collection systems, which solves the requirements of data collection of both parties of trade transition and trade supervision departments.

Connection to primary meter via HART digital signal, input channels do not need to be calibrated

• The FC2000-TBIAE(G) has a built-in HART digital interface, which allows the FC2000-TBIAE(G) to read temperature, pressure, differential pressure and multiparameter transmitter data through the HART interface to complete the flow calculation. As the HART protocol to obtain the digital volume is not affected by the A/D conversion, you can eliminate the ambient temperature-induced signal conversion and acquisition errors, thus eliminating the need for the FC2000-TBIAE (G) input channel calibration.

No new cabling is required for non-temperature-compensated measuring point modifications

• Some measurement points do not have temperature and pressure measurement, with only flow element and a differential pressure transmitter directly through the 2-wire current and DCS/PLC for signal transmission. The DCS/PLC calculates the flow rate with or without constant compensation, which greatly reduces the accuracy of the measurement. In the traditional way to install temperature and pressure measurement points need to install another cable, while to read the temperature, pressure, differential pressure transmitter signals with the FC2000-TBIAE (G) HART interface, you can use the original cable, using two wires to collect three signals into the FC2000-TBIAE(G). This solution is suitable for measurement system modifications.

Converting the digital output of the HART transmitter to 4-20mA analog signal

• Some measurement points use multiparameter transmitters with HART interface for temperature, pressure, differential pressure (or flow) signal transmission. However, most DCS/PLCs lack HART interface, and can only receive the flow 4-20mA signal from the multiparameter transmitter, but cannot collect temperature, pressure and other signals.

• FC2000-TBIAE(G) can convert the digital quantity from multiparameter transmitter (or multiple HART transmitters) to 4～20mA signal for DCS/PLC. Up to four 4 to 20 mA signals can be used. The FC2000-TBIAE(G) simultaneously accumulates and compensates the flow rate, and transmits the calculation results to other data acquisition systems via RS485, TCP/IP and other interfaces. In other words, FC2000-TBIAE(G) = 1 accumulator + 1 HART converter.

Reading instrument data (mass flow meters, etc.) via RS485 interface

• For the use of mass flow meters and other measurement points for the trade transition, direct reading of the digital output of the flow meter is a way to ensure the accuracy of measurement. The FC2000-TBIAE(G) can read data such as flow rate, temperature, accumulated inventory, density, etc. of mass flow meters such as Micro Motion 2000, E+H Promass 83, KROHNE MFC300, etc. through the RS485 interface. This eliminates errors in signal transmission, conversion, and acquisition compared to output methods such as pulses and 4-20 mA analog signals.

Reading the data of the multiparameter differential pressure transmitter via the RS485 interface.

• Some multiparameter differential pressure transmitters use Modbus protocol based on RS485 interface for communication, while the FC2000-TBIAE(G) can read its temperature, pressure, differential pressure and other data to calculate the flow rate. For example, the FC2000-TBIAE(G) can read temperature, pressure and differential pressure measurements from the FOXOBORO IMV25-M transmitter for natural gas flow calculations. This model reduces the number of transmitters and improves reliability due to the use of multiparameter differential pressure transmitters. And the use of digital transmission eliminates the transmission, conversion, and acquisition errors associated with the use of 4-20mA analog signals and improves flow measurement accuracy.

Flow Processing + Modbus TCP/IP Gateway

• The main feature of this configuration is that it gives full play to the powerful communication function and calculation function of FC2000-TBIAE (G). While completing the flow temperature and pressure compensation of one pipeline, the FC2000-TBIAE(G) communicates with the third party's instrument that supports Modbus RTU protocol through one RS485 interface, and communicates with the host computer through TCP/IP interface. FC2000-TBIAE(G) firstly determines whether the communication request from the host computer is to read the local data or the data of the 3rd party instrument. If the request is to read the local data, the data will be sent directly to the host computer via TCP/IP interface; if the request is to read the data of the third party instrument, the Modbus TCP/IP command from the host computer will be converted into Modbus RTU format and then sent to the third party instrument. The FC2000-TBIAE(G) receives data from the 3rd party instrument and sends the data to the host computer via TCP/IP interface. This type of application solves the problem of high-precision compensation of flow and also provides Modbus TCP/IP communication services for decentralized measuring points.

Flow Compensation + Uncompensated Accumulation

• FC2000-TBIAE (G) has four 4 ~ 20 mA analog signal input channels. The 3-channel signal channel is used to collect the temperature, pressure, flow signal of the measured medium, and the medium flow compensation operation. One reserved 4-20 mA signal channel can be used to acquire a flow signal without temperature and pressure compensation, and to accumulate two flow signals simultaneously. This configuration can reduce the cost of measurement instruments that do not need to compensate for flow points. For example, it is possible to calculate the temperature and pressure compensation for one steam channel and simultaneously accumulate the flow rate of one water channel.

Wide Range (Double Differential)

• When equipped with a standard differential pressure flowmeter, FC2000-TBIAE(G) can not only calculate the working condition density, discharge coefficient, expansion coefficient in real time according to temperature, pressure, differential pressure, medium composition, Reynolds number, but also automatically switch between two different ranges of differential pressure transmitters as the differential pressure signal changes. This enables a measurement range of 1 to 10 or even 1 to 20 to be achieved while still meeting accuracy requirements.

Two-Way Flow (Steam, etc.) Measurement

• The FC2000-TBIAE(G) compensates for flow in both directions with the same set of temperature and pressure signals when there is a bi-directional flow of fluid in a pipeline.

• FC2000-TBIAE(G) collects a temperature, a pressure, two flow signals to complete the bi-directional flow measurement. Its features are: positive and negative flow compensation using the same set of temperature and pressure signals.

Energy Measurement for Heating Systems (Multi-Channel)

• FC2000-TBIAE(G) can separately collect the steam flow, temperature and pressure signals of the heating system or the flow and temperature signals of hot water supply and return water, respectively, and calculate the flow rate and heat of steam and hot water supply and return water, as well as the energy consumption of the whole heating system.

Function Introduction

Measurable Medium

• Natural gas, refinery dry gas (gas), coal gas, mixed coal gas, superheated steam, saturated steam, air, oxygen, nitrogen, single gas, mixed gas, water, hot water, liquid (oil, chemical products), etc.

Applicable Flow Meters

• Standard flow elements: Standard Orifice Plates, ISA1932 Nozzles, Long Diameter Nozzles, Venturi Nozzles, Classic Venturi Tubes.
• Non-standard flow elements: Balanced Flow meter, V-Cone Flow meter, Wedge-Shaped Orifice Plate, 1/4 Round Orifice Plate.
• Other differential pressure flowmeters: tube-measuring flowmeter, Averaging Pitot Tube (Willyba, Aniuba), bent tube, balanced flowmeter.
• Pulse output flowmeters: full tube vortex, insertion vortex, vortex mass flowmeter, turbine, insertion turbine, etc.
• Electromagnetic, ultrasonic, and various 4-20mA current output type flowmeters.

Signal input/output

• 4-channel 4～20mA signal input with independent 24VDC power supply for flow, pressure and temperature transmitters.
• 1 pulse flow signal input, 24VDC power supply.
• 1 way Pt100 RTD input, measuring range -50～500℃.
• 6-channel active 4-20mA output, can output instantaneous flow, temperature, pressure, energy, and other signals after compensation.

Flow Compensation and Calculation of Physical Parameters

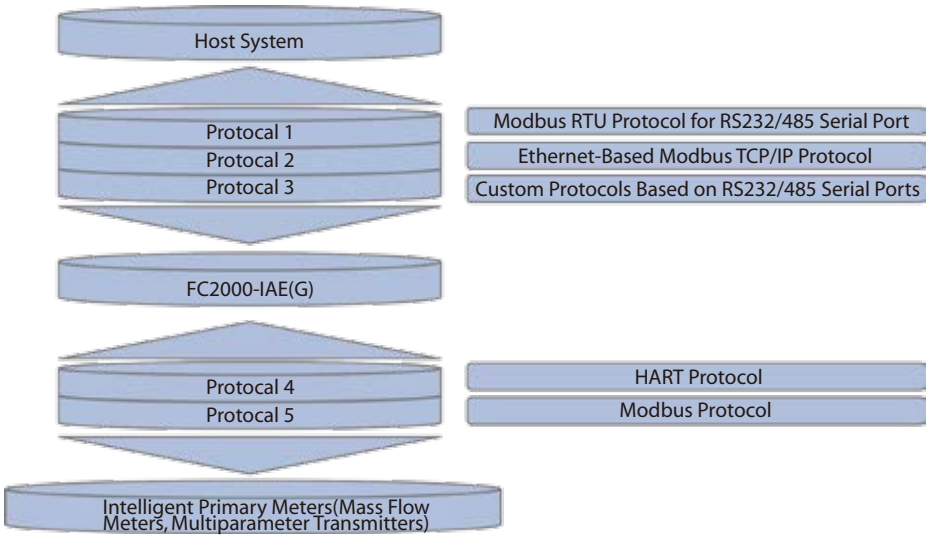
• Real-time dynamic calculation of the discharge coefficient C and stream expansion coefficient ε of the standard flow elements is available, the formula of which conforms to the provisions of GB/T2624-2006 standard.
The flow rate can be calculated based on the meter's calibrated meter coefficients, with up to seven non-linear segmental compensations.
• Using the IAPWS-IF97 formula for steam density calculation to adapt to the superheat, saturation, and all other states of steam. The errors associated with the ideal gaseous equation for steam temperature and pressure compensation are avoided.
• Calculation of natural gas orifice plate flow rate conforms to SY/T6143-1996, SY/T6143-2004, GB/T21446-2008 and other standards.
• Calculation of the compression factor of natural gas conforms to GB/T17747.2-1999 (equivalent to AGA8 report).
• Calculation of heat output of natural gas conforms to GB/T11062-1998 standard.
• Universal gas compression factor Z is according to the Redlich-Kwong equation.
• Gas humidity compensation can be performed to calculate the wet gas flow rate and the flow rate of the dry portion of the wet gas.
• It's available to customize the software version of the special flow calculation function according to the characteristics of the flow meter and the medium under test.

Energy Measurement

• The energy measurement function is limited to FC2000-TB1AE(Q) energy measurement products.
• It can calculate the energy of natural gas, steam, hot water, gas, mixed gas and other medium.
• Simultaneous acquisition of temperature and pressure upstream and downstream of steam, and calculation of steam energy along with steam mass flow.
• The temperature of the water supply and return can be measured simultaneously to calculate the heat of the hot water.

Communications and Networking

- Standard serial communication interface: RS232, RS485, standard Modbus-RTU communication protocol.
- RJ45 Ethernet (Ethernet) network interface, Modbus TCP/IP communication protocol.
- Supporting GPRS, CDMA remote mobile communication.
- The users of Power Control, Configuration King and other configuration software which already have drivers for this product, can "plug and play".
- It can compile communication program according to the protocol of your existing network.



Measurement and Monitoring

- 1000 historical data can be stored, each including a set of data such as flow, temperature, pressure etc.
- The data storage interval can be customized, and 100 audit records and 100 alarm records can be kept simultaneously.
- It contains audit logs of power outages, system settings, parameter modifications, and clearing accumulations, etc.

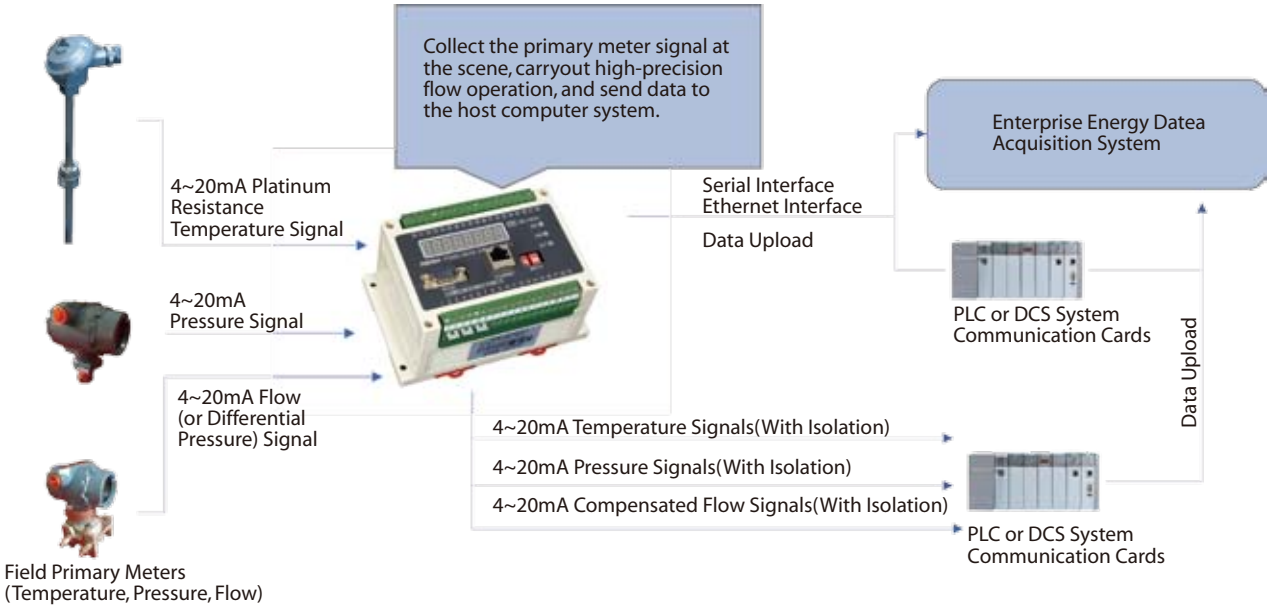
Function in Trade Settlement

- Prepayment method: the purchased gas quantity could be input and the output signal will close the gas supply valve when the quantity reaches the lower limit.
- Segmented tariffs: upper and lower limits on the amount of gas consumed could be set, and when the limit is exceeded, the tariff is calculated in accordance with the tariff method of the gas supply agreement.
- Customize software versions for users according to their billing method.

Examples of Applications

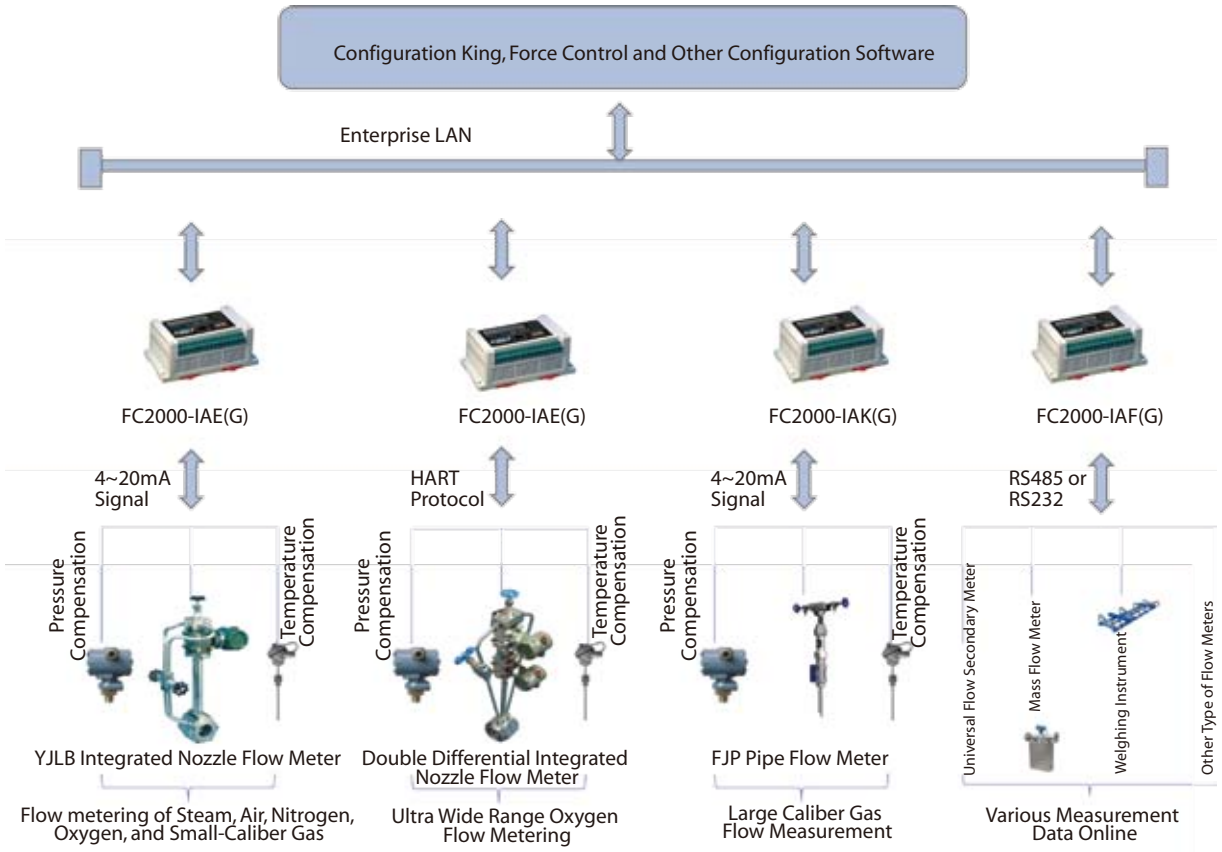
Application I. High-precision flow calculation link embedded in DCS and PLC systems

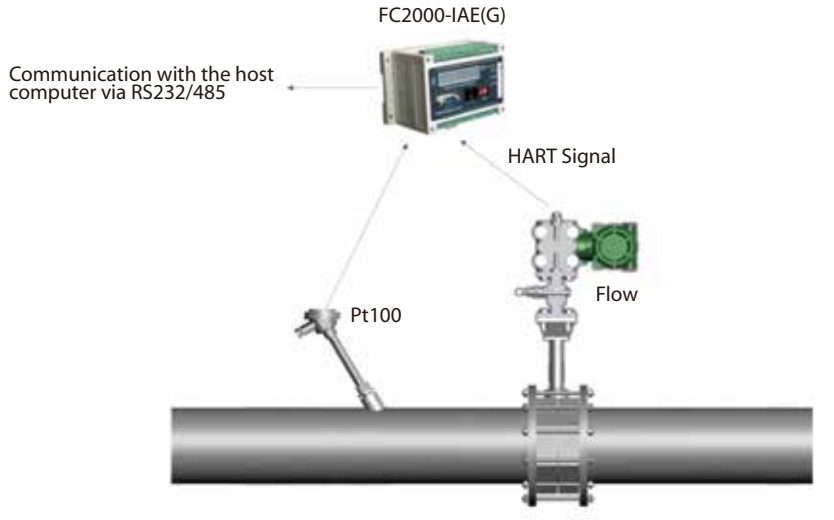
At present, most of the production device automatic control system using DCS or PLC, flow measurement point must also be introduced into it. However, DCS and PLC functions focus on monitoring and control, but lack of flow high-precision compensation calculation function, only using a simplified formula for flow compensation calculation. The FC2000-TBIAE(G) flow calculation conversion unit makes it easy to incorporate high-precision flow calculation into DCS and PLC systems, thereby greatly improving the accuracy of measurement. The FC2000-TBIAE(G) flow calculation conversion unit can transmit a digital signal of the temperature, pressure, and compensated flow of a medium to a DCS or PLC via a communication interface (RS485, RS232, or Ethernet). The FC2000-TBIAE(G) can also send 4-20 mA signals of temperature, pressure, and compensated flow to the analog input of the DCS/PLC through the FC2000-TBIAE(G)'s multiple isolated analog output ports. As shown in following figure:



Application 2: Implementation of a Decentralized Web-Based Measurement Data Management System

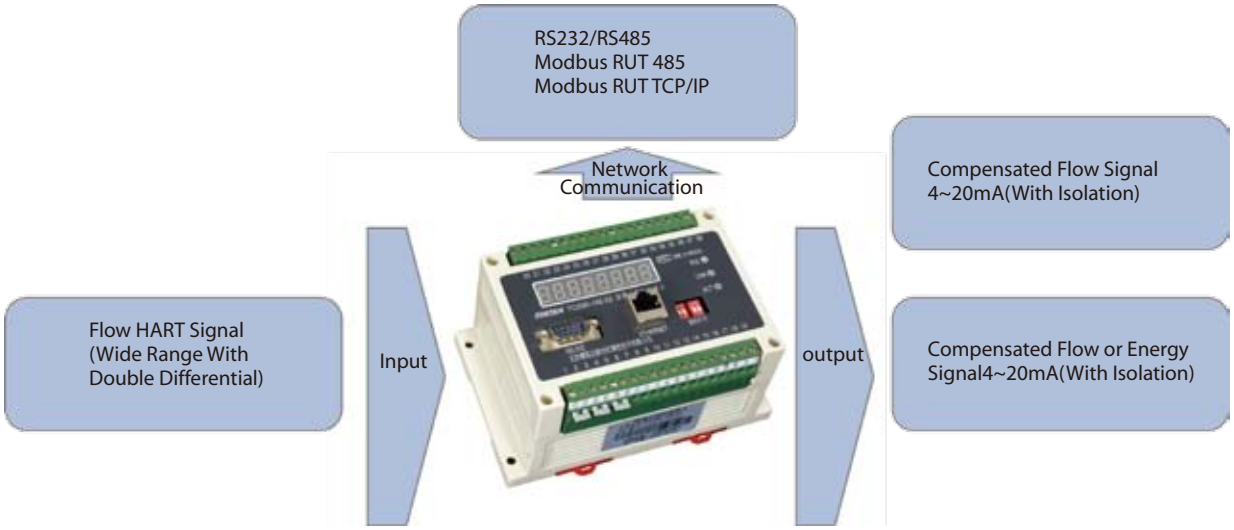
With the increasing maturity of network technology and its widespread use in enterprises, most enterprises need to access the Internet for their measurement data (such as access to MES systems, energy management systems, energy measurement systems, etc.). FC2000-TBIAE has a variety of network interfaces (RS232, RS485, RJ45 Ethernet, mobile communication, etc.) and communication protocols (Modbus, TCP/IP, etc.). It can package and upload data such as temperature, pressure, flow rate and history records through various communication methods while completing flow compensation calculations. As shown in following figure:





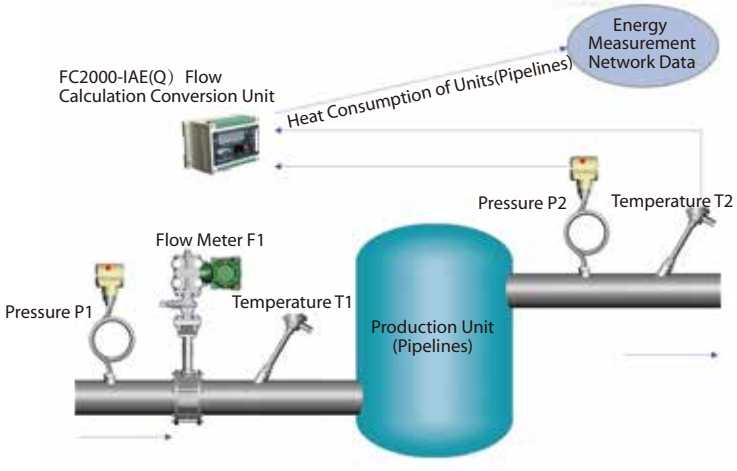
Application 3: Steam Flow Measurement System with Highly Accurate Wide Range HART Signals

Range ratio 10:1 (double differential 20:1), accuracy ± 1.5% of the steam flow system: to read the differential pressure transmitter differential pressure, membrane box positive side static pressure, the membrane box temperature , and other data through the HART protocol, so there is no need to install a separate transmitter for pressure compensation. At the same time, it has a differential diaphragm temperature overrun alarm function. The primary instrument adopts the YJLB-TB integrated nozzle flowmeter with the support of national standards, which is stable and reliable and has a long calibration period of 4 years. According to the GB/T2624-2006 (equivalent to ISO 5167-2003E) standard, the discharge coefficient C, expansion coefficient ε , compression coefficient Z can be calculated in real time, which realizes wide range calculation and high-precision flow compensation calculation. Double differential range ratio can reach 20:1. Temperature, pressure, differential pressure (or multiparameter) transmitter data can be read through the HART protocol to improve signal acquisition precision and reduce measurement error.



FC2000-IAE(G)

Application 4 Steam Energy Measurement for Devices (Piping)



Technical specifications

A single FC2000-TBIAE(Q) can be used to monitor the steam energy consumption of a production unit (or transmission pipeline). If the production unit is operating with no (or negligible) mass loss of steam, a flow meter, temperature, and pressure compensation instruments can be installed at the steam inlet and temperature and pressure measurement instruments at the steam outlet, and then all signals can be connected to the FC2000-TBIAE(Q). FC2000-TBIAE(Q) calculates the steam energy E1 at the inlet of the device based on the measured flow rate F1, temperature T1, and pressure P1; the steam energy E2 at the outlet of the device is calculated based on the measured temperature T2 and pressure P2. The calculation (ΔE=E1-E2) gives the energy consumption of the entire installation and the data will be transferred to the enterprise's energy measurement data network via the Ethernet port (or RS485).

	Display	8-digit digital display
	input signal	One channel 4 ~ 20mA flow signal
		One pulse flow signal (0.2 to 6000Hz, 4 to 11V)
		One Pt100 RTD temperature signal (-50 ~ 500℃)
		Two channels 4-20mA temperature signal (FC200-TBIAE(Q) two channels only, others one channel)
		Two 4 ~ 20mA pressure signals (FC2000-TBIAE(Q) two channels only, other one channel)
		One 4 ~ 20mA standby signal (FC2000-TB1AE does not have this function.)
Signal Output Function	FC2000-TBIAE Basic Type	One non-isolated 4-20mA compensated flow signal output
	FC2000-TBIAE（G） FC2000-TBIAE（Y） FC2000-TBIAE（T） FC2000-TBIAE（K）	Two isolated 4 ~ 20mA compensated flow (energy) signal outputs (optional)
		One isolated 4 ~ 20mA raw flow signal output
		One isolated 4 ~ 20mA temperature signal output
		One isolated 4 ~ 20mA pressure signal output
		One isolated 4 ~ 20mA backup signal output
	Accuracy	Uncertainty of 4 ~ 20mA conversion: ±0.1%
		Pt100 RTD conversion uncertainty: ±0.5%
		4 ~ 20mA output conversion uncertainty: ±0.2%
		Calculation uncertainty: 0.05%
	Communication Interface	1 HART protocol interface (FC2000-TB1AE does not have this feature)
		1 RS232/RS485 interface
		1 RS485 interface
		1 Ethernet interface (optional) (not available for FC2000-TB1AE)
	Power Output	DC24V/30mA
	Data Retention Time	5 years
	Working power	DC24V/0.3A
	Working conditions	Ambient temperature 0 ~ 45℃, relative humidity < 85%
	External dimensions	145 L x 90 W x 72 H (mm)
	Mounting Type	DIN 35 standard rail mounting

Note:

Functions marked with "(optional)" must be selected at the time of purchase, otherwise the function may not be available.

Model

LGPF-1005A balance flow meter, nominal caliber DN100, basic, pressure class 300, no transmitter.

Model		Basic Codes	Additional Codes	Description
FC2000	General Purpose	-TBIAE		Basic version of flow calculation conversion unit
		-TBIAE（G）		Enhanced signal output of the flow calculation conversion unit
		-TBIAE（Q）		Specialized version for energy measurement
	Purpose-Built	-TBIAE（Y）		Specialized version for multi-parameter Throttle Flow Meter
		-TBIAE（T）		Specialized version for Natural Gas Nozzle Flow Meter (Note 1)
		-TBIAE（K）		Specialized version for metered pipe flowmeter
		-TBIAE（Z）		Specialized version for Mass flowmeter (Note 2)
Software Versions		-TBZTY		Universal version for all media except natural gas
		-TBTRQ		Natural gas version, for natural gas medium only
		-TBD		Single measuring tube (note 3)
		-TBS		Three measuring tubes (note 3)
		-TBZY		User-defined software version
Additional Function Code			/□□	Please see additional function code list

Additional Function Code List

Additional Functions	Codes	Description
Output Functions（Note 4）	/TO1	1 4-20mA (transferred from Pt100) temperature isolated signal output (Temperature input is Pt100 RTD) (Note 5)
	/TO2	1 4 ~ 20mA temperature isolated signal output （Temperature input is 4 ~ 20mA）（Note 5）
	/FO1	1 4 to 20 mA isolated signal output after compensation of flow rate (Note 6)
	/FO2	2 4 to 20 mA isolated signal outputs after compensation for flow (heat) (Note 6)
	/FO3	3 customized 4 to 20mA isolated signal outputs (Note 6)
	/FO4	4 customized 4 to 20mA isolated signal outputs (Note 6)
Communication Functions	/C1	HART Protocol communication interface
	/C2	Serial Interface 1 RS485
	/C3	Serial Interface 2 RS232 (Note 6)
	/N2	LAN communication function（Note 4）
	/H1	1 HART Differential Pressure Transmitter
	/H2T	1 HART Differential Pressure Transmitter and 1 HART Temperature transmitter
	/H2D	2 HART Differential Pressure Transmitters
	/H3	Temperature, pressure, differential pressure, total of 3 HART transmitters
	/H3M	HART multiparameter differential pressure transmitter
	/M1	Reading of instrument data (e.g. mass flow meter) via RS485 (note 7)
	/M2	Reading of multiparameter differential pressure transmitter (note 7) via RS485

Note:

1. If FC2000-TBIAE(T) is selected, the additional code -ZTY is invalid.
2. When FC2000-TBIAE(Z) is selected, the additional codes -ZTY and -TRQ are invalid.
3. D and -S are only for FC2000-TBIAE(K).
4. This function is not available for the FC2000-TBIAE basic model.
5. Only one of the two functions, /TO1 and /TO2, can be selected.
6. Only one of the four functions, /F01, /F02, /F03, /F04, can be selected.
7. Only one of the three functions, /C3, /M1, /M2, can be selected.

Special Accessories

1. GDM-1AE Power Supply Module

The GDM-1AE type power module is designed to solve the problem of not having a 24VDC power supply in the instrument panel. It can convert a wide range of input voltages from 85 to 265VAC to 24VDC power supply for FC2000-1AE flow calculation conversion units.

Model	Code	Description
GDM-1AE		
Number of supply lines	/2	Provides 24VDC power to two FC2000-TB1AEs.

2. FCT-TB2000 portable set-up terminal

FCT-TB2000 portable setting terminal is a special equipment for setting parameters of FC2000-TB1AE. It is used for setting and debugging the parameters of FC2000-TB1AE in the field or laboratory.

3. BYbx-S explosion-proof instrument box

Model BYbx-S explosion-proof instrumentation box is a necessary accessory (with display window) for installation of FC2000-TB1AE in explosion-proof sites. Applicable: FC2000-TBIAE, FC2000-TBIAE(G) enhanced type, FC2000-TBIAE(Y) multiparameter throttling flowmeter specialized type, FC2000-TBIAE(T) natural gas nozzle flowmeter specialized type, FC2000-TBIAE(Z) dual parameter mass flowmeter specialized type, FC2000-TBIAE(K)-D single branch measuring pipe flowmeter specialized type.

Code	Description	Terminal Definitions
1	TO+	Temperature 4 ~ 20mA Output
2	TO-	(Not available for FC2000-TBIAE)
3	PO+	Pressure 4 ~ 20mA Output
4	PO-	(Not available for FC2000-TBIAE)
5	QO+	Flow 4 ~ 20mA Output
6	QO-	(Not available for FC2000-TBIAE)
7	O+	Reserve 4 ~ 20mA Output
8	O-	(Not available for FC2000-TBIAE)
9	A1+	Compensated flow 4 ~ 20mA Output 1
10	A1-	
11	A2+	Compensated flow 4 ~ 20mA Output 2
12	A2-	(Not available for FC2000-TBIAE)
13	A+	
14	B-	RS485
15		
16		Reserve
17		
18	Power Supply +	
19	Power Supply –	24VDC Power Supply

Code	Description	Terminal Definitions
20	A	Pt100 RTD Inputs
21	B	
22	B'	
23	24V	Temperature 4 ~ 20mA Output
24	TH	
25	TH-	
26	24V	Pressure 4 ~ 20mA Output
27	PH	
28	PH-	
29	24V	Flow 4 ~ 20mA Output
30	QH	
31	QH-	
32	24V	Reserve 4 ~ 20mA Output (Not available for FC2000-TBIAE)
33	I+	
34	I-	
35	24V	Flow Pulse Output
36	+	
37	-	
38		Reserve

Application:

FC2000-TBIAE(K)-S Three-Branch Pipe Flowmeter Specialized Type

Signal Terminal 1		
Code	Description	Terminal Definitions
1	TO+	Temperature 4～20mA Output
2	TO-	
3	PO+	Pressure 4～20mA Output
4	PO-	
5		Reserved
6		
7		
8		Reserved
9		
10		
11	A1+	Compensated Flow 4～20mA Output 1
12	A1-	
13	A+	RS485 Communication
14	B-	
15		Reserved
16		
17		
18	(+)	24VDC Power Supply
19	(-)	

Signal Terminal 2		
Code	Description	Terminal Definitions
20	A	Terminal DefinitionsPt100 RTD Input
21	B	
22	B′	
23	24V	Temperature 4～20mA Input
24	TH	
25	TH-	
26	24V	Pressure 4～20mA Input
27	PH	
28	PH-	
29	24V	Differential Pressure Transmitter A Input
30	QAH+	
31	QAH-	
32	24V	Differential Pressure Transmitter B Input
33	QBH+	
34	QBH-	
35	24V	Differential Pressure Transmitter C Input
36	QCH+	
37	QCH-	
38		Reserved

Application:

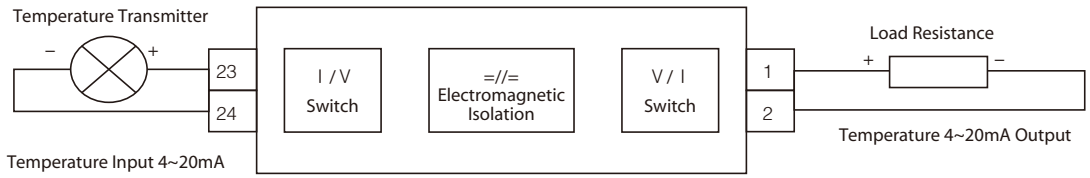
FC2000-TBIAE(Q) Energy Measurement Type

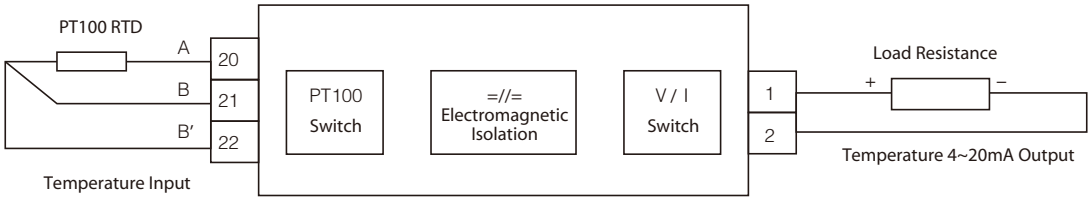
Signal Terminal 1		
Code	Description	Terminal Definitions
1	TO+	Temperature 4～20mA Output
2	TO-	
3	PO+	Pressure 4～20mA Output
4	PO-	
5	QO+	Flow before compensation 4～20mA Output
6	QO-	
7		Reserved
8		
9	A1+	Flow after compensation 4～20mA Output
10	A1-	
11	A2+	Energy Flow 4～20mA Output
12	A2-	
13	A+	RS485 Communication
14	B-	
15		Reserved
16		
17		24VDC Power Supply
18	(+)	
19	(-)	

Signal Terminal 2		
Code	Description	Terminal Definitions
20	A	Upstream Pt100 RTD Input
21	B	
22	B′	
23	24V	Upstream temperature 4～20mA Input 23 and 24 terminals are powered from the transmitter itself, and the 24 and 25 terminals are powered from outside the transmitter.
24	TH	
25	TH–	
26	24V	Upstream pressure 4～20mA Input 26 and 27 terminals are powered from the transmitter itself, and the 27 and 28 terminals are powered from outside the transmitter.
27	PH	
28	PH–	
29	24V	Flow 4～20mA Input
30	QAH+	
31	QAH–	
32	24V	Downstream Temperature 4～20mA Input 32 and 33 terminals are powered from the transmitter itself, and the 33 and 34 terminals are powered from outside the transmitter.
33	TBH+	
34	TBH–	
35	24V	Downstream Pressure 4～20mA Input 35 and 36 terminals are powered from the transmitter itself, and the 36 and 37 terminals are powered from outside the transmitter.
36	PBH+	
37	PBH–	
38		Reserved

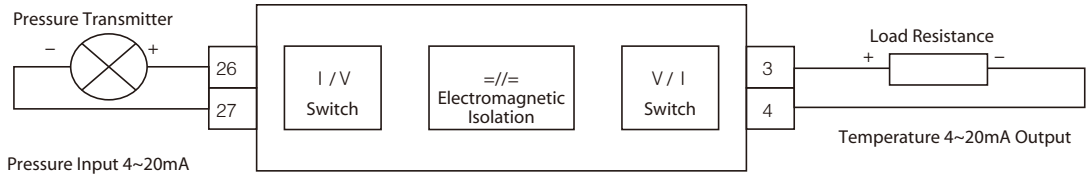
Wiring Diagrams

1. Temperature signal input/output

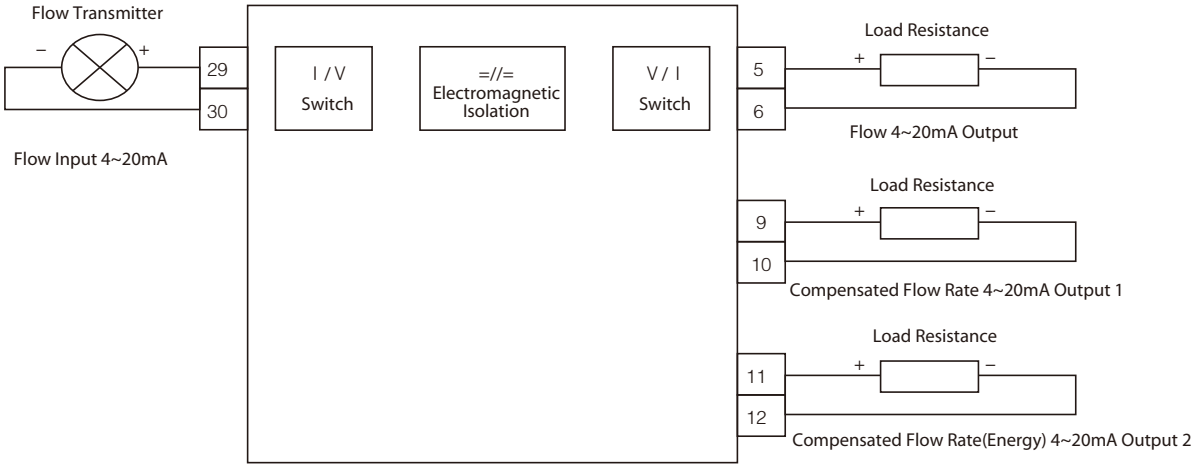




2. Pressure signal input/output



3. Flow (differential pressure) signal inputs/outputs



4. Instrument power supply

FC2000-TBIAH Flow Calculation Conversion Unit Selection Inquiry Form

Contact Person: _____

Company & Department: _____

Address: _____

Post code: _____

Tel.: _____

Fax No: _____

Email: _____

Items	Function Description	Options
Type of flow meter	Flow Meter with Single Measuring Tube	☐Yes ☐No
	Flow Meter with Three Measuring Tubes	☐Yes ☐No
	Natural Gas Nozzle Flow Meter	☐Yes ☐No
	Multi-parameter Mass Flow Meter	☐Yes ☐No
	Double Parameter Mass Flow Meter	☐Yes ☐No
measured medium	natural gas	☐Yes ☐No
Energy measurement	Whether energy measurement is required	☐ Required ☐ Not Required
Input signal	one 4 ~ 20mA flow signal	☐ Required ☐ Not Required
	one pulse flow signal	☐ Required ☐ Not Required
	one Pt100 RTD temperature signal	☐ Required ☐ Not Required
	One 4 ~ 20mA temperature signal	☐ Required ☐ Not Required
	one 4 ~ 20mA pressure signal	☐ Required ☐ Not Required
Output function	4 ~ 20mA Compensated flow signal output	☐1 Way Required☐2 Ways Required☐Not Required
	4 ~ 20mA Raw flow signal output	☐ Required ☐ Not Required
	4 ~ 20mA Energy Signal Output	☐ Required ☐ Not Required
	4 ~ 20mA Temperature Signal Output	☐ Required ☐ Not Required
	4 ~ 20mA Pressure Signal Output	☐ Required ☐ Not Required
Communication interface	RS232 interface	☐ Required ☐ Not Required
	RS485 interface	☐ Required ☐ Not Required
	Internet interface	☐ Required ☐ Not Required
	HARTR Protocol interface	☐ Required ☐ Not Required
Equipment Accessories	24VDC power supply module for GDM-1AE	☐ Required ☐ Not Required
	Portable Setup Terminal for FCT-2000	☐ Required ☐ Not Required
	Explosion-proof instrument box for BYbx-S	☐ Required ☐ Not Required
Remarks:		

Filled in by: _____

Checked by: _____

Date filled in: _____

(YYYY/MM/DD): _____

FC2000-TBIAD FLOW COMPUTER

Summary

FC2000-TBIAD is a single flow computer product in the FC2000 series products, with a variety of functions, such as flow full parameter dynamic compensation, historical data storage, measurement supervision, trade settlement, and network communication, etc. It can be adapted to a variety of flow meters and the measured medium, can measure the volume, mass, and energy flow.

FC2000-TBIAD has a flexible software and hardware platform, which can be used to achieve special functions for the user's application.

The flow calculation software that the FC2000-TBIAD uses has been certified by national authorities.
FC2000 series flow computer products also include FC2000-TBIAH dual flow computer, FC2000-TBIAE (G) flow calculation conversion unit, etc.

Function Features

Human-Machine Interface

- 3-inch LCD (128×64 dot matrix, field of view 62.0×44.0mm) display, 16 operation buttons, full Chinese screen.
- Display cumulative flow rate, instantaneous flow rate, temperature, pressure, density, compression coefficient, as well as historical data, alarm records, audit records.

Measurable Medium

- Natural gas, artificial coal gas, superheated steam, saturated steam, air, oxygen, nitrogen, other single gases, gas mixtures, water, hot water, liquids (oil, chemical products), etc.

Applicable Flow Meters

- Standard flow elements: Standard Orifice Plates, ISA1932 Nozzles, Long Diameter Nozzles, Venturi Nozzles, Classic Venturi Tubes.
- Non-standard flow elements: V-Cone Flow Meter, Wedge-Shaped Orifice Plate, 1/4 Round Orifice Plate.
- Other differential pressure flowmeters: Tube-Measuring Flowmeter, Averaging Pitot Tube (Willyba, Annuba), Bent Tube, Balanced Flowmeter.
- Pulse output flowmeters: Full Tube Vortex, Insertion Vortex, Vortex Mass Flowmeter, Turbine, Insertion Turbine, Etc.
- Electromagnetic, ultrasonic, and various 4-20mA current output type flowmeters.

Signal input/output

- 3-channel 4-20mA signal input, all with independent 24VDC power supply for flow, pressure, and temperature transmitter.
- 1 road pulse flow signal input, with 24VDC and 12VDC two kinds of power supply voltage for users to choose.
- 1 road PT100 RTD input, measuring range -50 ~ 500℃.
- 1 way active isolated 4-20mA instantaneous flow output after compensation.
- 1 group of relay passive contact (dry contact) output.

Flow Compensation and Calculation of Physical Parameters

- Real-time dynamic calculation of the discharge coefficient C and stream expansion coefficient ε of the standard flow elements is available, the formula of which conforms to the provisions of GB/T2624-2006 standard.
- The flow rate can be calculated based on the meter's calibrated meter coefficients, with up to seven non-linear segmental compensations.
- The calculation of steam density or heat conforms to GB / T 34060-2017 standard (IAPWS-IF97), IFC1967 formula to adapt to the superheat, saturation, and all other states of steam.
- Calculation of natural gas orifice plate flow rate conforms to GB/T21446-2008 and other standards.
- Calculation of natural gas nozzle flow rate conforms to GB/T34166-2017 standard.
- Calculation of compression factor of natural gas conforms to GB/T17747.2-2011 (equivalent to AGA8 report).
- Calculation of heat output of natural gas conforms to GB/T11062-2014.
- Universal gas compression factor Z is according to the Redlich-Kwong equation.
- Gas humidity compensation is available to calculate the flow rate of wet gas and the flow rate of the dry part of the wet gas.
- It's available to customize the software version of the special flow calculation function according to the characteristics of the flow meter and the medium under test.

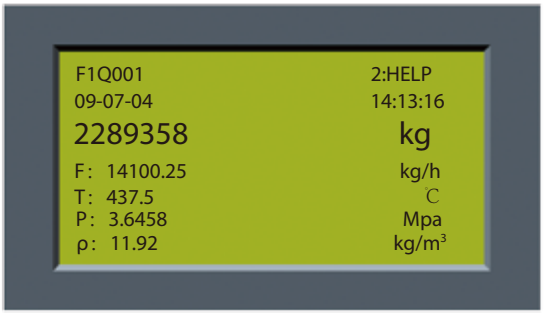
Energy Measurement
- It can calculate the energy of energy medium such as steam, hot water, natural gas, and artificial coal gas.

Communications and Networking
- Standard serial communication interface: RS232, RS485, standard Modbus-RTU communication protocol.
- RJ45 Ethernet (Ethernet) network interface, Modbus TCP/IP communication protocol.
- Supporting GPRS, CDMA remote mobile communication.
- The users of Power Control, Configuration King and other configuration software which already have drivers for this product, can "plug and play".
- FC2000-TBIAD can compile communication program according to the protocol of your existing network.

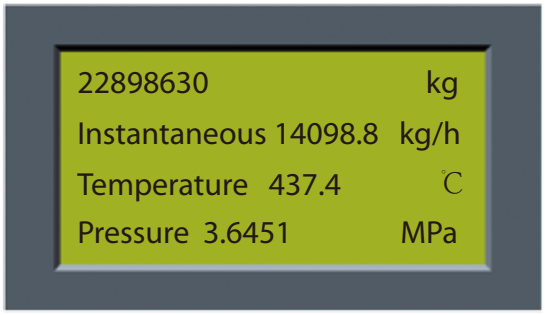
Measurement and Monitoring
- 1000 historical data can be stored, each including a set of data such as flow, temperature, pressure etc.
- The data storage interval can be customized, and 100 audit records and 100 alarm records can be kept simultaneously.
- It contains audit logs of power outages, system settings, parameter modifications, and clearing accumulations, etc.
- All parameter settings and changes are confirmed by double password identification.

Function in Trade Settlement
- Prepayment method: the purchased gas quantity could be input and the output signal will close the gas supply valve when the quantity reaches the lower limit.
- Segmented tariffs: upper and lower limits on the amount of gas consumed could be set, and when the limit is exceeded, the tariff is calculated in accordance with the tariff method of the gas supply agreement.
- Customize software versions for users according to their billing method.

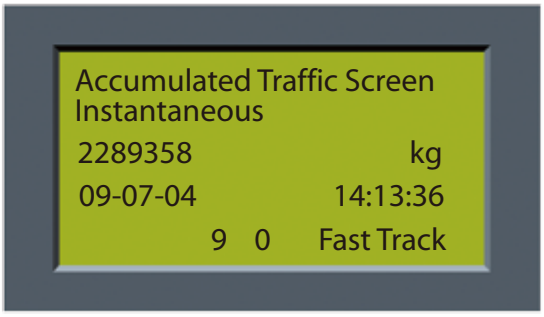
Display screen



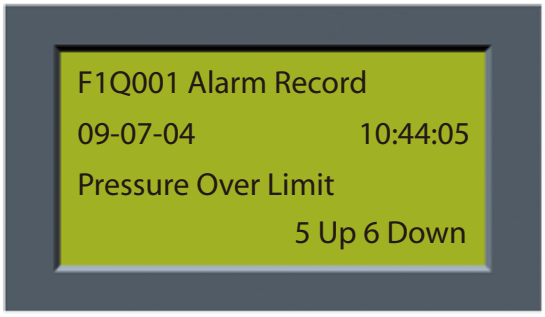
1. Operation Screen



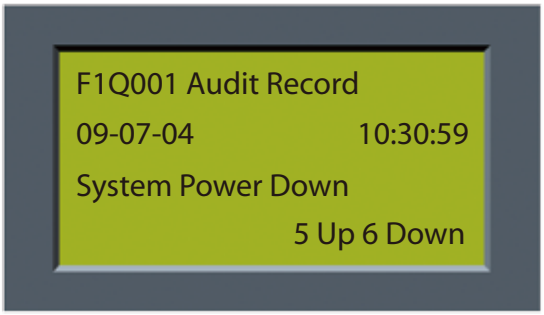
2. Instantaneous Flow Scree



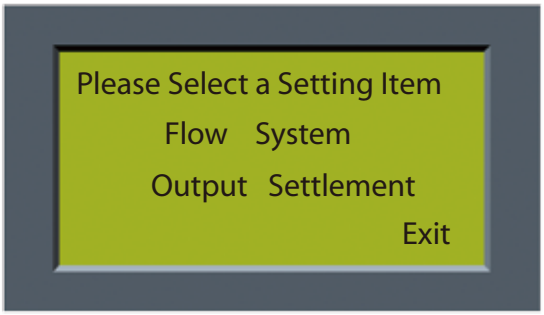
3. Cumulative Flow Screen



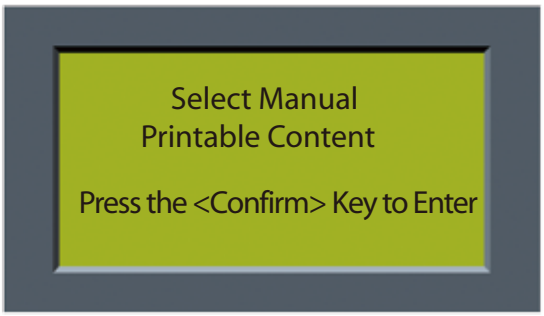
4. Alarm Record Screen



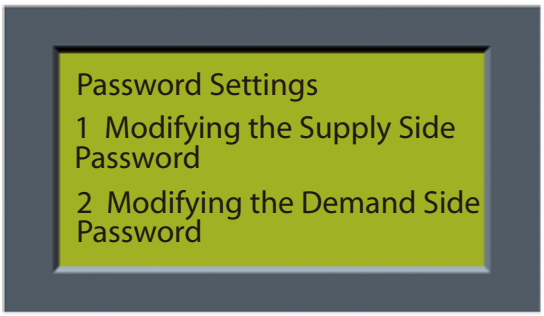
5. Audit Record Screen



6. Instrument Setting Screen



7. Print Screen

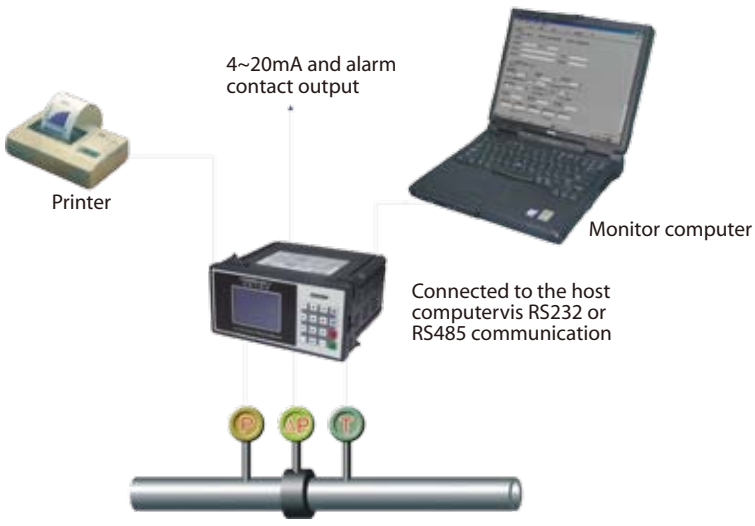


8.Password Setting Screen

Typical Application

Steam Measurement System

• In this system, primary instrument will complete the measurement of flow, temperature, and pressure at the site. The flow measuring instruments preferred YJLB-TB type multiparameter throttling flowmeter (the flowmeter is the YJLB-TB integrated nozzle flowmeter upgrade products). Its flow element is the ISA1932 nozzle - small pressure loss, wear and tear resistance, long calibration cycle and accuracy is standardized. It uses intelligent differential pressure transmitter - with the functions of online zero adjustment and range modification. It has a patented antifreeze design - no need to keep heat accompanying the winter operation. FC2000-TBIAD flow computer can calculate temperature, pressure, discharge coefficient C, stream expansion coefficient ε can be real-time point by point, so that the accuracy of the system in the range of 10:1 can reach 1%.



Flow computer functions used in steam measurement systems.

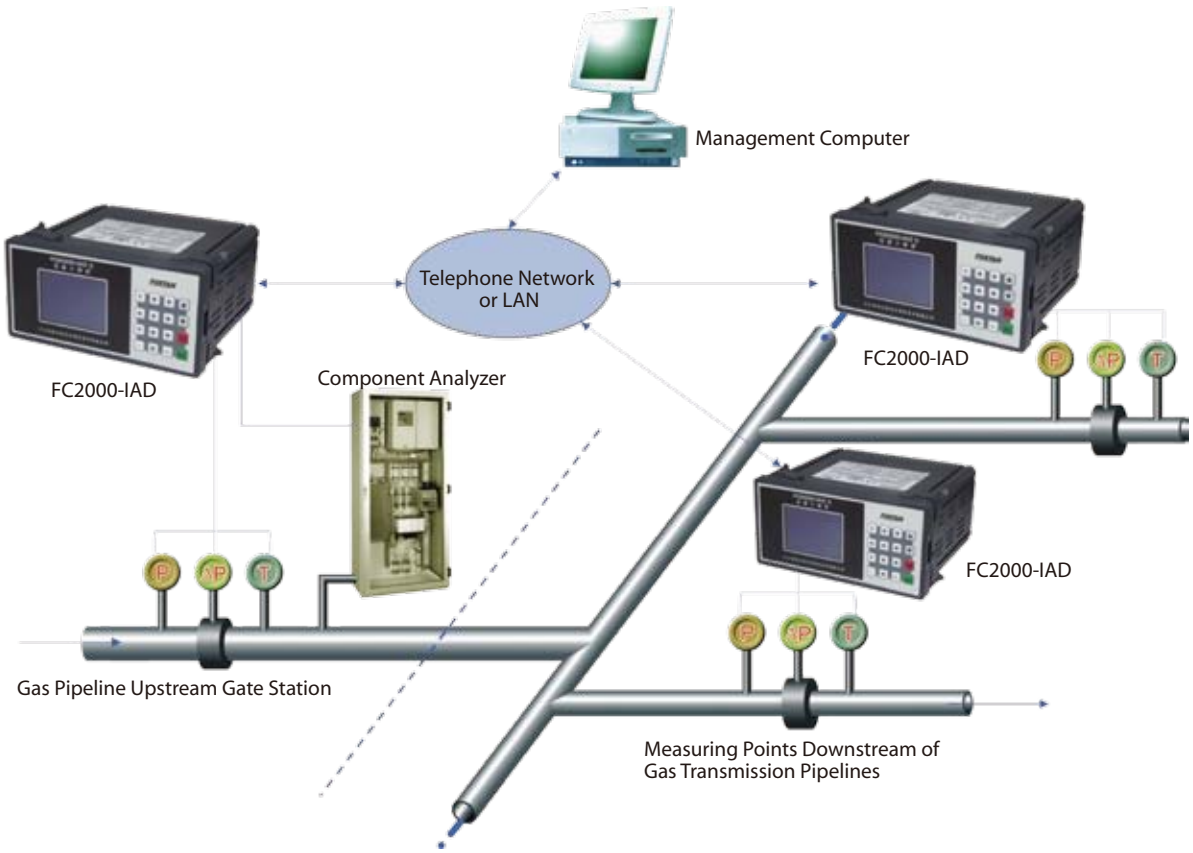
• Realize the complete function (temperature, pressure, density, humidity) high-precision compensation operation.
• The compensation calculation conforms to ISO5167-2003, GB/T2624-2006 real-time calculation of the discharge coefficient, stream expansion coefficient.
• Data retention time: 5 years
• Output 4 to 20 mA, alarm contact signals
• With RS232, RS485 (it can be used as printer interface and interface for each communication protocol).

Natural gas measurement system

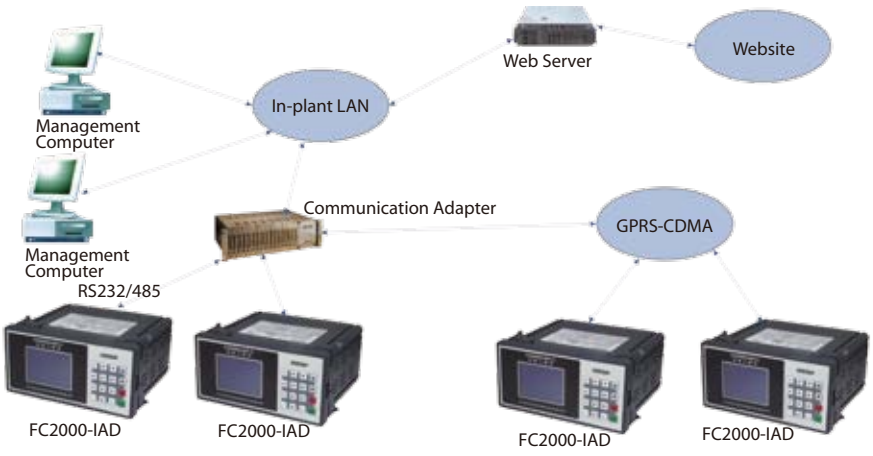
Natural gas measurement must consider the natural gas component variation factors. Equipped with a component analyzer in the pipeline upstream gate station, with the powerful communication function of FC2000, the component analyzer will real-time collection of component data through the telephone network or local area network to each measuring point, thus realizing the real-time correction of natural gas components.

Flow computer related functions

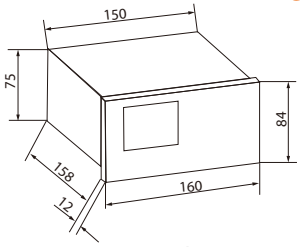
- All components of natural gas and other flow parameters can be set.
- Can be connected to real-time density meter, component analyzer or set density value.
- Compensation calculations conform to national industry standards (GB/T17747.2-2011, GB/T21446-2008, GB/T 34166-2017).
- Real-time calculation of discharge coefficient C, compression factor and stream expansion coefficient ε.
- Provide perfect historical data records, field parameter changes records and fault alarm records.



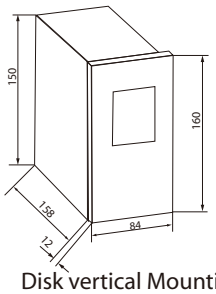
FC2000-TB1AD used in measurement management network system



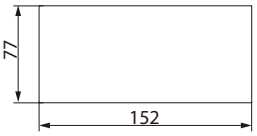
Outline Dimension Drawings



Disc Horizontal Mounting



Disk vertical Mounting



Aperture size

Technical Specifications

Human-Machine Interface		3-inch 128×64 dot matrix LCD, 4×4 array with 16 keys
Input Signal		Three 4-20mA signals (expandable to four)
		One pulse signal（0.2Hz ~ 10KHz，4 ~ 11V）
		One Pt100 RTD signal（-50℃ ~ 500℃）
Output Signal		One flow active 4 ~ 20mA signal（maximum load 500Ω）
		One Auxiliary active 4 ~ 20mA signal（Optional, Maximum Load 500Ω）
		One set of passive relay contacts（Optional, Capacity 0.3A）
Uncertainty		4~20mA Converting to uncertainty：±0.1%
		Pt100 Converting to uncertainty：±0.5%
		4~20mA Converting to uncertainty：±0.2%
		Calculating Uncertainty：0.05%
Maximum cumulative display		999,999,999 Engineering units
communication interface		one RS232 interface (DB9 pin)
		one RS485 interface (2-wire terminal)
		one 10M NIC interface (RJ45) (optional)
External power supply	4-20mA Signal Instruments	DC24V/200mA
	Pulse Signal Instruments	DC24V/50mA
		DC12V/50mA
Data retention time		5 Years
Working power supply		220VAC±10%，50Hz
		DC24V
Power		10W
Working conditions		Ambient temperature -20 ~ 55℃, relative humidity less than 85%.
Dimensions（mm）		See section "Outline Dimensional Drawing"

Specification Code

Mode	Basic Codes			Description
FC2000-TBIAD				Single-channel flow computer
Software Version	-ZTY			Universal version for all medium except natural gas
	-TRQ			Natural gas version, for natural gas media only
	-ZY			User-defined software version
Power supply specifications		-A		Local 220VAC power supply
		-D		Local 24VAC power supply
mounting type			H	Disk-mounted horizontal
			S	Disk-mounted vertical
Additional Function Codes				/□□Please see additional function code list

Additional Function Code List

Additional Features	Code	Description
Output Function	/FA2	1 Auxiliary 4 to 20 mA signal output (Note 1)
Communication Function	/DO	1 set of relay outputs (Note 1)
	/C1	HART protocol interface (note 2)
	/C2	Serial 1 RS485
	/C3	Serial 2 RS232 (Note 2)
	/N2	LAN communication function
Additional Power Supply	/P2	12VDC power supply for pulse signal
Trade Settlement	/TM	With trade settlement function

Note1:

Only one code can be selected for /FA2 and /DO in the output function.

Note2:

/C1 is selected when HART protocol communication is required, /C3 is selected when printer connection is required, and only one of /C1 and /C3 can be selected.

Example of selection:

Integral nozzle to measure steam, 220VAC power supply, horizontal mount, RS485 communication for model.
FC2000-TB1AD-ZTY-AH/C2

Terminal Definition Table

Code	Description	Terminal Definitions	Code	Description	Terminal Definitions	Code	Description	Terminal Definitions
1	Pt-A	RTD Phase A Input	14	Pt-B	RTD Phase B, B' Input	27	485A+	Line 2, 485 Communications
2	24V	Temperature 4~20mA Input	15	Pt-B'		28	485A-	
3	T+		16			29	24V	Small-Range Differential Pressure Transmitter With 4~20mA Input
4	T-		17	A+	Flow 4 to 20mA Output	30	QR+	
5	24V	Pressure 4~20mA Input	18	A-		31	QR-	
6	P+		19	485+	RS485 Communication	**Note 3**: When /C3 is selected, terminals 27 and 28 are invalid, and no signal is allowed to be input. **Note 4**: Only when double differential is selected in the order, terminals 29, 30, 31 can be connected to the low range differential. If no double differential has not been selected, the differential pressure transmitter should be connected to terminals 8, 9, 10.			
7	P-		20	485-				
8	24V	Flow 4 to 20mA Input	21		Multi-functional Terminals			
9	Q+		22					
10	Q-		23					
11	24V/12V	Flow Pulse Inputs	24		Power Supply Input Terminal			
12	F+		25					
13	F-		26					

Multi-Function Terminals Definitions

Relay Output		
Code	Description	Terminal Definitions
21	COM	Public Terminal
22	NC	Normally Closed Contacts
23	NO	Normally Open Contacts

4 ~ 20Ma Output		
Code	Description	Terminal Definitions
21	A2+	Positive Current Output
22	A2-	Negative Current Output
23		

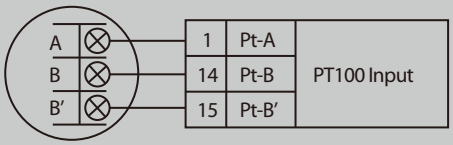
Power Input Terminal Definitions

AC220V Power Supply		
Code	Description	Terminal Definitions
24	GND	AC220V Ground Line
25	N	AC220V Null Line
26	L	AC220V Live Line

DC24V Power Supply		
Code	Description	Terminal Definitions
24		
25	24V-	DC24V Negative
26	24V+	DC24V Positive

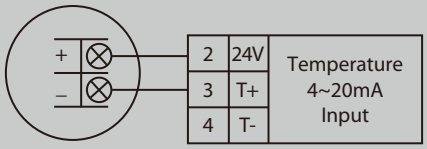
Additional Function Code List

PT100 RTD Wiring:



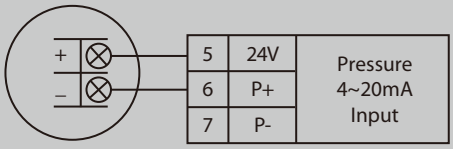
PT100 RTD

Temperature Transmitter Local Power Wiring:



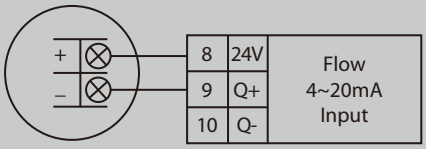
Temperature Transmitter

Pressure Transmitter Local Power Wiring:



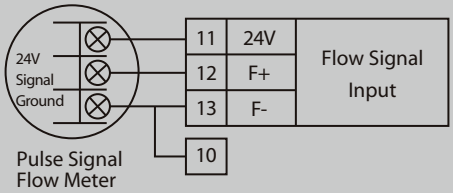
Pressure Transmitter

Differential Pressure Transmitter Local Power Wiring:



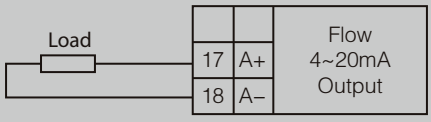
Differential Pressure Transmitter

Pulse Signal Flow Meter Local Power Wiring:

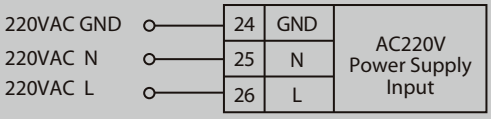


Pulse Signal Flow Meter

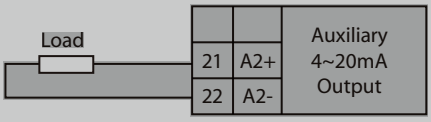
4~20mA Flow Signal Output Wiring:



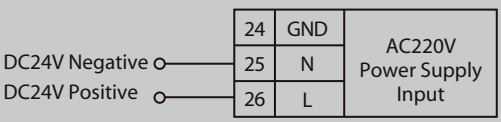
AC220V Power Supply Wiring:



Auxiliary 4~20mA Output Wiring:



DC24V Power Supply Wiring:



Electric Relay Output: