FC-722C-JM Ultrasonic Gas Metering Module

Datasheet

1 Product Features

Wide-range, high-precision ultrasonic gas metering module

Exceeds 1.5-level metering accuracy requirements

Adaptive switching between multiple operating modes

UART interface

Power supply voltage: 3.0V~3.6V

Low current consumption: comprehensive operating current ≤30uA

Support temperature and pressure compensation

Operating temperature range：-25℃ ~ +55℃

Operating humidity：≤95%

Operating pressure：≤30kPa

1.1 Overview

The independently developed ultrasonic gas metering module launched by Friendcom is a core component of ultrasonic gas meters. The product is based on key technological breakthroughs by Friendcom, covering the flow range of G1.6, G2.5, G4, G4+ (full range) residential gas meters. While ensuring product metering accuracy, it also ensures the long-term reliability of the product. Friendcom is committed to providing stable and precise customized ultrasonic gas metering solutions for gas companies and meter manufacturers.

1.2 Features

High precision, wide range, high sensitivity, a single module structure covering G1.6/G2.5/G4/G4+

Independently developed electronic and flow channel structure, with multiple related patents.

Utilizing Hilbert transform + linear correlation algorithm to improve signal robustness and ensure long-term stability of time measurement

High-precision flow calculation model, combined with one-time calibration under the high-order flow correction model, ensures accurate and reliable flow information output.

Supports adaptive switching between different operating modes to easily handle flow fluctuations, achieving dynamic balance between accuracy and power consumption

Utilizing a unique sensor performance matching mechanism to reduce performance differences and improve signal source consistency; implementing a rational design of hardware and algorithms for handling small signal processing; incorporating zero-drift correction algorithm to automatically calibration and return to zero; eliminating the zero-drift phenomenon in three steps

Real-time online monitoring of performance, including module status, abnormal flow monitoring, empty/full gas monitoring, medium sound velocity, virtual sound path, medium temperature, signal gain, and signal-to-noise ratio, with timely alarms for anomalies.

Support volume conversion between working conditions and standard conditions to reduce the gap between supply and sales

Other functions include water intrusion detection, pulse output (optional), pressure detection (optional), and firmware upgrade

2 Operating principle
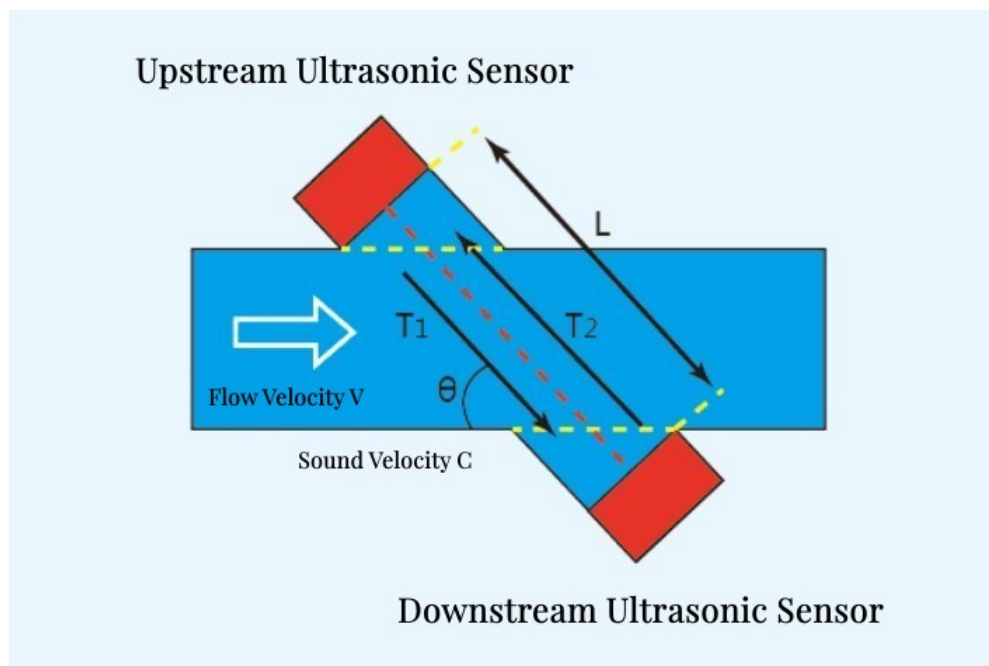
Ultrasonic metering uses the time difference method for measurement. The main principle involves alternately transmitting and receiving ultrasonic signals through a pair of sensors installed upstream and downstream of the flow channel. By collecting the different flight times upstream and downstream, the gas flow velocity V is calculated, and the instantaneous gas flow-rate Q is obtained. Finally, integrating Q over time yields the gas volume V.

3 Specifications

3.1 Basic metering parameters

Ultrasonic gas metering module				
Model	G1.6M	G2.5M	G4M	G4+M
Maximum flow-rate	2.5 m³/h	4 m³/h	6 m³/h	6 m³/h
Minimum flow-rate	0.016 m³/h	0.025 m³/h	0.04 m³/h	0.016 m³/h
Transitional flow-rate	0.25 m³/h	0.4 m³/h	0.6 m³/h	0.25 m³/h
Overload flow-rate	3 m³/h	4.8 m³/h	7.2 m³/h	7.2 m³/h
Start-up flow-rate	≤3 dm³/h	≤4 dm³/h	≤5 dm³/h	≤3 dm³/h
Metering level	Meets level 1.5 metering accuracy requirements			
Basic error	$q_{min} \leq q < q_t$ error ≤±3％； $q_t \leq q \leq q_{max}$ error ≤±1.5％			
Operating temperature	-25℃~55℃			
Temperature compensation	Support			
Comprehensive working current	≤30uA（24-hour static + 4-hour constant current + 1-hour pulsation）			
Working power supply	3.0V-3.6V external power supply			
Interface mode	UART			

3.2 Product Overview

Item	Content	
Measurement method	Ultrasonic flow metering	
Measured gas	Air, natural gas, CH4	
Measurement data output	Output Mode	Serial communication (UART communication)
	Output data composition	Hexadecimal code

	Output data type	Option 1: All data related to metering supports output, including upstream and downstream flight time, flight time difference, instantaneous flow-rate, cumulative usage, abnormal flow-rate, operating parameters, status, etc. Option 2: Pin-to-pin compatible with Panasonic module, outputting instantaneous flow-rate, upstream and downstream absolute flight time, temperature, gain, status, etc.	
Measurement mode	Normal mode	Data sampling period	1 second
	Detection mode	Data sampling period	125 milliseconds
	Low power mode	Data sampling period	2 seconds
	Pulsation mode	Data sampling period	125 milliseconds
Measurement in abnormal conditions	The sensor automatically resets internally and reports abnormal information		
Temperature measurement	Name: Thermistor Model: MF52A103F3950 Supplier: Jinyang Electronics		
* Integrated temperature and pressure measurement (optional)	Name: Temperature and pressure integrated sensor Model: HSPPAD143A Supplier: ALPS		

3.3 Rated values

Item	Symbol	MIN	TYP	MAX	Unit
Power Supply	VCC	3.0	3.3	3.6	V

Note: Do not exceed 5% of VCC changing rate in 1 second. At this stage, metering accuracy cannot be guaranteed

3.4 Basic indicators

Item		Content
Current consumption	Normal mode	TYP：32uA　　　　　(VCC=3.6V) MAX：38uA

	Detection mode	TYP：200uA　　　　　(VCC=3.6V) MAX：220uA
	Low power mode	TYP：22uA　　　　　(VCC=3.6V) MAX：26uA
	Pulsation mode	TYP：200uA　　　　　(VCC=3.6V) MAX：220uA
	Comprehensive power consumption	Take "24-hour static + 4-hour dynamic + 1-hour pulsation " as an example: TYP：29.5uA　　　　　(VCC=3.6V) MAX：34.3uA
	Temperature measurement	TYP：0.4uA　　　　　(VCC=3.6V) MAX：0.5uA （Temperature measured per second）
Pressure loss		≤150Pa　　　（25°C air, 6m³/h, installed as a whole）
Temperature measurement error		-25°Cto +55°C　　　VCC=3.6V ±0.607°C(max)

3.5　Working conditions

Item	Working environment/conditions
(1)　Working temperature	-25°C to +55°C
(2)　Working humidity	≤95%
(3)　Working pressure	≤30kPa

(4) Installation location　　→　　Installed inside the meter housing

Installation location: Installed inside the meter housing
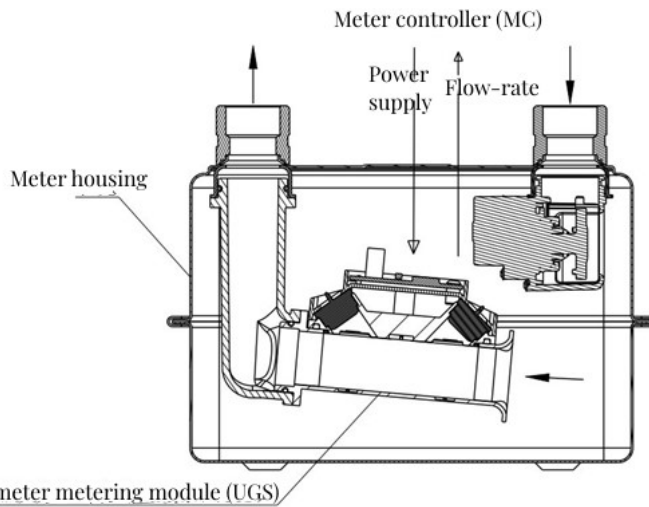
4 Function list

Function name	Function Description
Basic metering data output	Supports basic metering data output, including upstream absolute flight time, downstream absolute flight time, and flight time difference.
Comprehensive flow-rate management	Supports output of forward cumulative flow, reverse cumulative flow, instantaneous flow-rate, maximum flow-rate, and minimum flow-rate, and saves the time when maximum and minimum flow-rate occur.
Pulse output function (optional)	Supports cumulative flow output in pulse form, with configurable pulse constants
Working condition/standard condition conversion	Supports conversion and output of working condition flow and standard condition flow
Flow-rate correction	Supports external flow coefficient correction K writing to ensure metering accuracy is not affected by factors such as structure, connection, and platform difference.
Normal mode	Samples metering at a frequency of 1Hz.
Detection mode	Samples metering at a frequency of 8Hz.
Low power mode	Samples metering at a frequency of 0.5Hz.
Pulsation mode	Automatically identify airflow fluctuations and enter pulsation mode, sampling and measuring at a frequency of 8Hz
Automatic mode switching	Supports automatic switching between operating modes

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Sound velocity measurement	Supports sound velocity measurement and output in different media and environments
Virtualized sound path	Supports the measurement and output of virtualized sound path, serving as the basic criterion for channel qualification.
Temperature measurement	Support environmental temperature measurement and output
Water intrusion monitoring	Supports detection and output of abnormal status after water intrusion, only applicable to horizontal installed UGS.
Gas quality monitoring and parameter adaptive switching	It can automatically identify the gas medium in the working environment and switch appropriate parameters for metering, also equipped with abnormal gas quality monitoring function.
Abnormal flow-rate monitoring	Supports monitoring and output of various abnormal flow-rates, including abnormal small flow-rates, abnormal large flow-rates, overload flow-rates, reverse flow-rates, constant flow-rates timeouts, etc.
Zero drift correction	It has a zero-drift self-correction function to ensure metering accuracy is not interfered by external factors.
Signal-to-noise ratio & gain	It can output the real-time signal-to-noise ratio of the echo signal (including upstream and downstream), and it can also output the gain of the overall metering module.
Operating parameter output	Outputs parameters including factory address, operating time, metering count, communication count, power supply voltage, pulse constant, reporting interval, etc.
Active reporting	Supports active reporting of metering-related data, with configurable reporting intervals.
Real time clock	The real-time clock inside the UGS can be read and configured
Time interval setting	Including active reporting time interval and instantaneous flow-rate unit time settings
Communication function	Data exchange with external master unit via UART interface
Reset function	Supports internal automatic reset function for abnormalities and also supports hardware reset via external pins.
Pressure measurement (optional)	Supports pressure measurement and output for working gas.

5 Hardware interface

5.1 Basic serial port configuration

Baud rate	9600bps
Start bit	1bit

Stop bit	1bit
Data bit	8bit
Check digit	1bit even parity

5.2 Block diagram
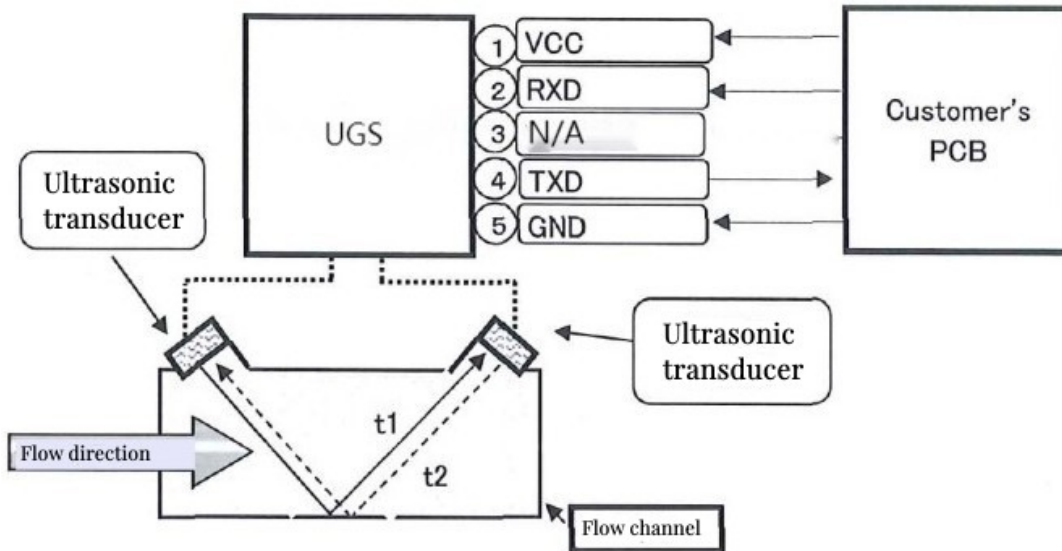
5.3 Functions of UGS PIN

PIN number	Terminal name	Function	I/O	Remark
1	VCC	Power supply	-	
2	RXD	Serial data input	IN	
3	N/A	Wireless beam export	-	Reserved reset pin
4	TXD	Serial data output	OUT	
5	GND	Grounding	-	

Note: PIN 3 is a reserved pin and will not be lead out for the time being

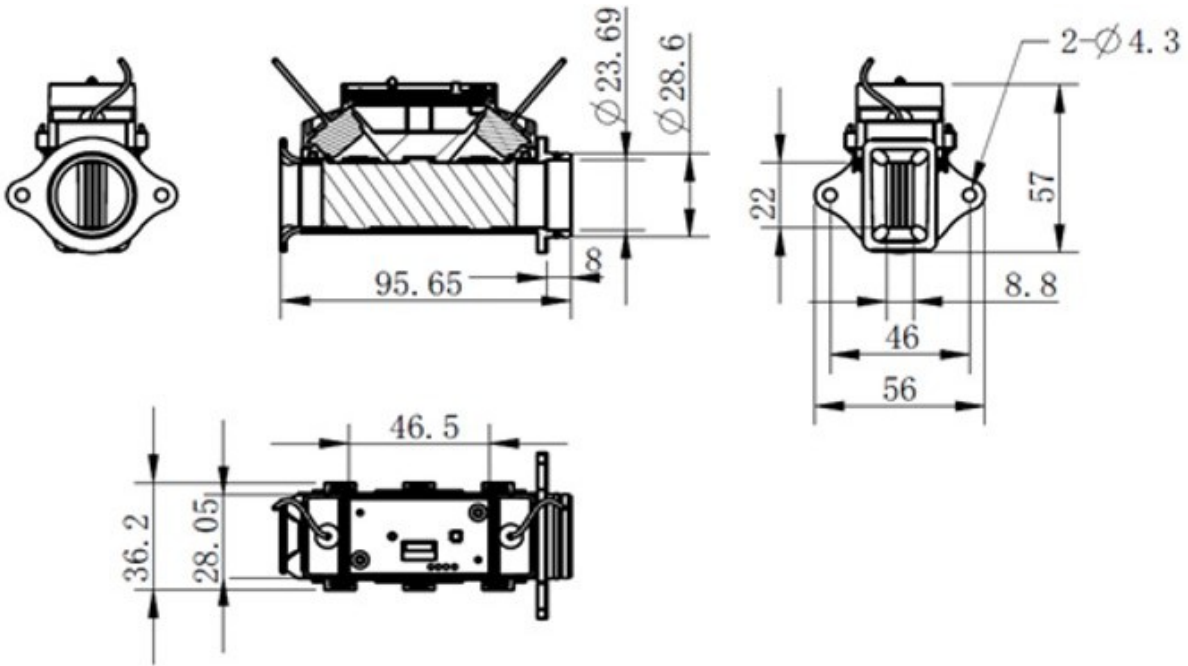## 5.4 Direction of flow channel connection
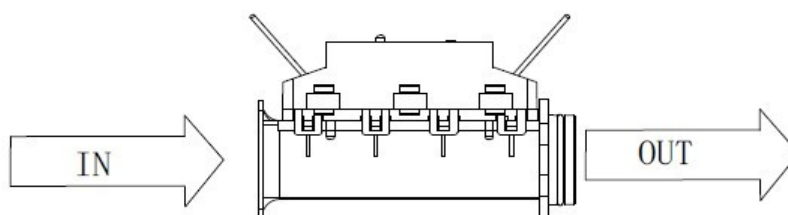
6 Dimensions

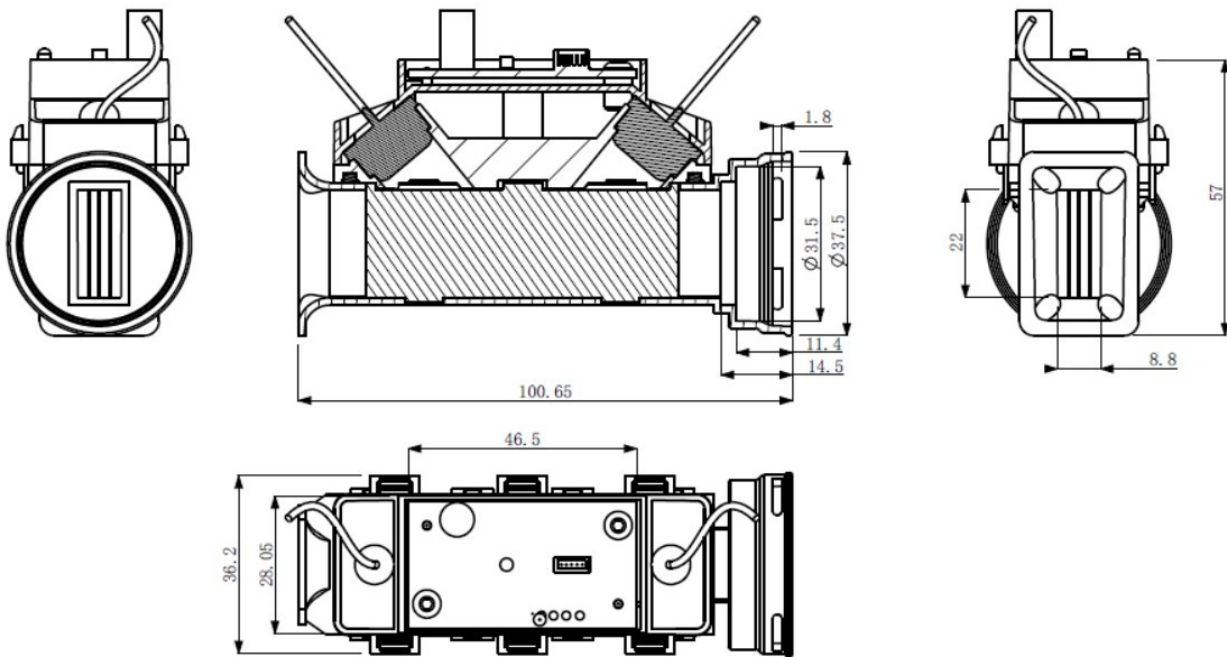## 6.1 Scheme 1 (independently developed)

6.1.1 Outline drawing

6.1.2 Dimensions

Item	Unit: mm
(1) Length	95.65
(2) Width	56
(3) Height	57
(4) Cross-sectional area	8.8 x 22=193.6mm^2
(5) Connection method	Round hole screws
(6) Connection dimensions	φ28.5x8
(7) Deflector dimensions	63.8x22x0.3

6.2 Scheme 2 (Panasonic pin-to-pin)

6.2.1 Outline drawing

6.2.2 Dimensions

Item	Unit：mm
(1) Length	100.65
(2) Width	36.2
(3) Height	57
(4) Cross-sectional area	8.8 x 22=193.6mm^2
(5) Connection method	Circlip connection
(6) Connection dimensions	φ31.5×11.4
(7) Deflector dimensions	63.8x22x0.3