

STN2 Series Thermal Mass Flow Meter

User's Manual

Vo 2. 2005.8

Sunnylee



Customer's Notice

SunnyLee company will not be responsible for any harm to health that caused by standard mass flow meter in harmful measurement medium. When choosing model, you must check whether the flow meter is suitable to your measure field or not.

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Chapter 1: brief introduction



Welcome to future gas mass flow measurement world, sunnylee company (this company is special to gas flow meter). This manual is a guide of using instruments.

Characteristic of STN2 series instruments as follows:

Setting different gas parameters

Display zero to clear

Output analog measurement modification

Multipoint non-linear curve modification

rate of Measurement capacity: 1000:1

Big-diameter and small flux measurement

Less than 8 points flux measurement

Adopt special technique “double-balance strument” sealed sensor , not be sensitive to vibration

Straight pipe section 1D-2D

Measurement value of flux has nothing to do with temperature and stress

Adopt special smart I hardware and smart II software , adapt to high temperature measurement (510℃)

Adopt expert arithmetic, to realize high precision

Using manual

The manual is composed of seven chapters

Chapter 1: brief introduction and operating principle

Chapter 2: the instruction of installation 、 fitting and connection

Chapter 3: the instruction of instrument operation

Chapter 4: communication operation (RS232/RS485)

Chapter 5: setting ex-factory and accessories

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Appendixes

Appendix A: the table of gas

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Safety information

“notice” and “warning” in this manual are used to remind you of important information



Warning: this sign with important information that protect worker's safety and equipment's danger, need to pay more attention to it



Notice! This sign with important information that protect equipment and running property

Receiving goods



when receiving instruments from sunnylee company, please check packing box to confirm whether in good case or not, if packing box is broken, you should inform transportation department and submit a report to factory or their agents. Take apart packing strip to check whether products and accessories are complete. Please notice not to throw away any packing material. Please don't return any product to factory before you contact to our customer service. explanation of terms used in the manual.

Noun definition used in the manual as follows:

Measurement capacity: instrument can measure maximum flux in precision range. generally speaking, instrument can measure higher than its flux range, but its precision will not be in its technical parameter range.

Measurement capacity rate: during precision range, it's the rate that instrument can measure maximum flux and minimum flux.

One-piece form: it's a form that shell of transmitter and sensor are together

In parts form: it's a form that shell of transmitter is apart from sensor

Flow sensor theory

STN2 series gas mass flow meter is based on king law(thermal diffusion theory) : the quantity of liquid go through heat resource is direct proportion with the heat quantity of dissipation. This instrument has two sensors. The one is used as a heat resource and sensor, another one is used to measure the medium temperature, when flowing, liquids go through sensor has a rate of heat quantity of dissipation , so we can calculate the flux by electronic module. Because it measures the mass flux that has nothing to do with medium temperature and pressure.

Chapter2: installation

Before installing instrument, you should be assure of location suitable (reference data tag) . this point is very important, because every instrument is collocated for special application range, please check gas instrallation location、 installation direction、 maximum flux range、 maximum pressure and working temperature.. pipe pressure should not go beyond rating pressure and temperature of instrument. If your field goes beyond any above parameter. Please contact with FEXR sales before your installation. It's ok to consult FEXR technical supports.

Check proceeding before installation

1. you should switch on power to check in order to find whether it's ok or not
simple methods
according to correct connection, flux signal output should connect current block, aim at probe continually flash several times.output has some changes. If any problem, please consult agent or sunnylee technical support department.
2. to check whether installation accessories is complete or not, such as tighten tie-in、 tighten flange、 continually flowing ball-valve equipment、 welding pipe matched (connect with pipeline)
3. don't install instrument in the neighborhood equipment that's temperature changeable. Actually overhumidity and dispersing a mass of heat ensure to have enough room to use cable connection.



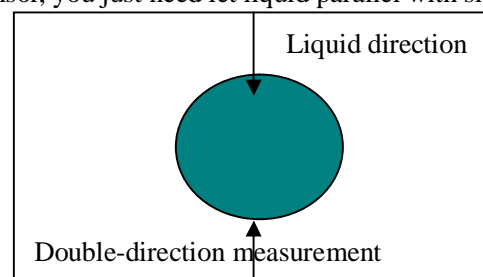
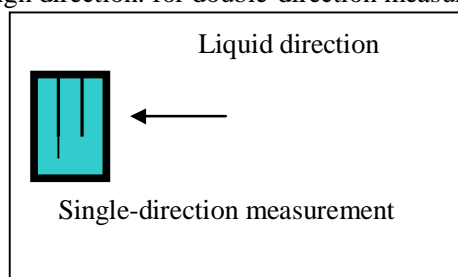
4. if the instrument is against-exploding products. You should install according to following requirements:
- (1) the cover of front and back must tighten. Electric connection must seal by accessories
 - (2) instrument installation should avoid environmental temperature beyond range seted by technical parameter. The highest surface temperature can't beyond gas temperature permitted
 - (3) against-exploding model should pay some attention to agaisst-exploding surface and screw thread, don't allow having damnify
 - (4) Products is eligible by exploding check that can't allow to change parts
 - (5) location setting against-exploding flowmeter must accord with GN3836.15-2000 < exploding gas environment use electric equipment the fifteenth part: dangerous location electric installation except coal and mine> standard.
 - (6) The shell of against-exploding products must rely to ground
 - (7) Before installing, instrument should be checked, if it can't satisfy requirement, don't allow to use



!notice: turn off power in installation

Sensor installation direction

STN2 series gas mass flow meter have two kinds: one is double-direction measurement, another one is single-direction measurement. Notice in installation, any direction sign in the bottom of instrument shell is single-direction measurement sensor. In installation ,you should let liquid in sign direction. for double-direction measurement sensor, you just need let liquid parallel with sign.



Plug-in installation

STN2 series gas mass flowmeter have two installation that is plug-in and flange

Plug-in installation: just as its name is direct plug in pipeline (figure 3) plug-in installation have one-piece and in parts.

location confirm

In priciple: when installing instrument , you should be away from elbow、 change-diameter、 electromagnetic valve and so on, to ensure stable flow field. Instrument should locate in “front 10 back 5”, that is to say upper straight pipe is 10 times diameter, lower pipe is 5 times diameter of pipe. You can install horizontally or vertically.

Factory recommendation:

Upper-pipe has control valve: upper straight pipe is 45 times D(diameter)



Upper-pipe has syphon: upper straight pipe is 15 times D

Upper-pipe has gradual-contract pipe: upper straight pipe is 15 times D

Upper-pipe has gradual-enlarge pipe :upper straight pipe is 10 times D

Upper instrument has throttle component: upper straight pipe is 5 times D

Actually, according to real situation you can plug-in proper location to get stable flux. in real installation process, because of different pipeline, you can consult FEXR technical supports according to specific situation. In convenient location you should add rectifier, so straight pipe can be reduced to 1D.

Welding foundation:

To drill a $\Phi 22$ round hole in pipe, weld foundation on it, to ensure welding has no weakening location and welding line smoothing.

Installation instrument:

Plug-in depth seeing item of installation depth

One-piece installation has tighten installation and flange installation.

In installation, you should make tighten lock into probe, after confirm plug-in depth, tighten by spanner, flange installation fixed by 4 bolts is ok. Notice to fill up sealed mat. For high-temperature model, notice to use resistant high temperature mat.

Installation in parts: transmitter installation is installed by accessories, sensor installation direction just like “ one-piece installation”. suggest user adopt continuous ball valve, take apart conveniently, especially in harmful medium field.

Installation depth:

In real application process mostly two kinds pipeline: roundness and squareness. Two kinds description as follows: about others pipeline shape, please consult sunnylee company technical support, here is nothing to say.

Factory recommendation: (average flux location)

Round pipeline:

Less than DN300 of diameter, plug-in depth is $1/2D+15\text{mm}$

Diameter between DN300-1000, plug-in depth is $1/4D+15\text{mm}$

Diameter more than DN1000, plug-in depth is $1/8D+15\text{mm}$

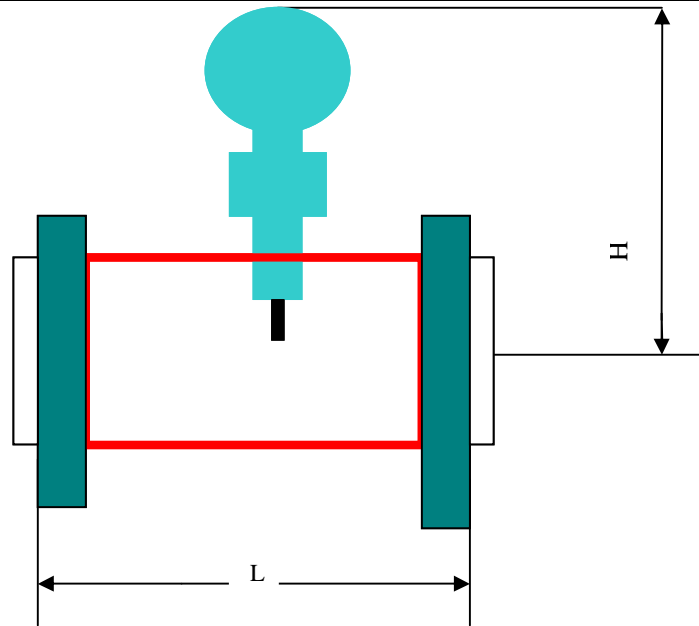
Square pipeline

Generally, make a testing through plug-in instrument, because flowing from one pipewall to another one, at least when flowing section is symmetrical, we can confirm average flux point by a half pipeline.

Flange installation (figure 4)

Flange module with a section of pipeline

DN15、DN25、DN40、DN50、DN80、DN100、DN150、DN200、DN250、DN300, specific shape and size seeing table 1



You can install horizontally or vertically

When installation firstly to weld front and back straight pipe with special flange together. Secondly, connect front and back straight pipe. Sealing mat and instrument to be complete one, then install this groupware in the pipeline. when installing, please notice sign direction on the instrument should be accord with liquid direction.

Flange model has single-direction measurement and double-direction measurement, for double-direction measurement instrument, it's no necessary to consider the instrument direction.

Installation in parts just like plug-in one.

Table 1:

Diameter	L (mm)	H (mm)
DN15	305	255
DN25	381	260
DN40	305	270
DN50	305	275
DN80	457	290
DN100	457	300
DN150	610	325
DN200	615	350
DN250	620	375
DN300	630	400

Instrument electric connection

Screw open back-end lid (as fig. 5)

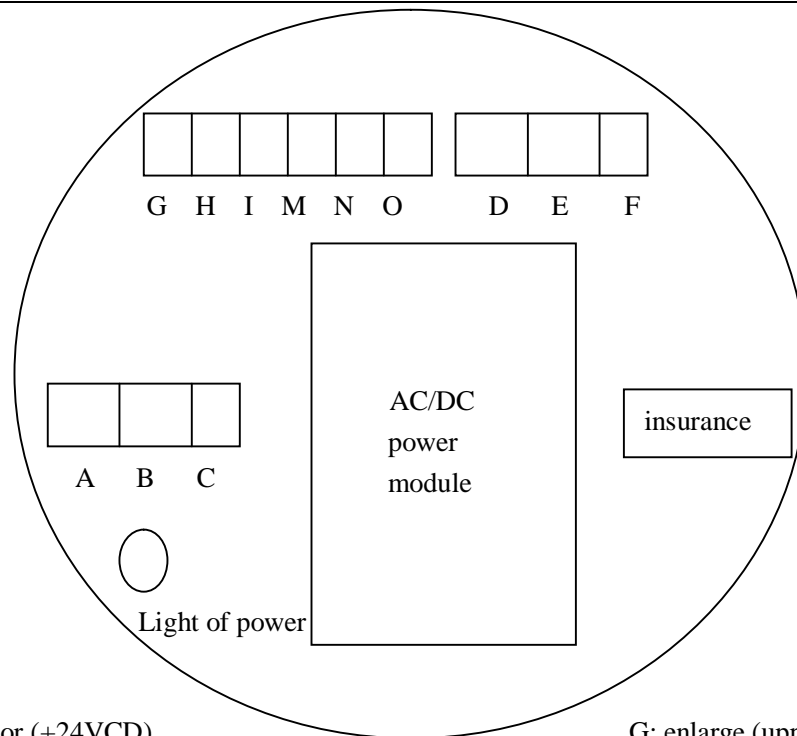


fig. 5

A: AC220 or (+24VDC)

B: AC220 or (-24VDC)

C: Ground

D: RXD (A+)

E: Digital

F: TXD (B-)

G: enlarge (upperlimit of flux)

H: impulse – (public)

I: impulse + (lowerlimit of flux)

M: analog output of flux signal

N: Signal

O: analog output of temperature signal

Moreover: please indicate choice of output function, when ordering products

Chapter 3: instrument operation description

Function brief introduction:

This instrument is used to measure gas mass flux. It has functions to display instantaneous and accumulative flux. Moreover, it has some human function such as: gas property coefficient、non-linear、modification、output signal revision、oprating simply and conveniently、secret key function. It's not set parameter until you input correct password.

It's very important to run safely for instrument ,when you press nothing ,instrument will return to main measurement module one minute later, to ensure normal measurement.

Setting key function

You can set full measurement scale、set instantaneous、flux radix point、non-linear value

Gas coefficient、display zero to clear、simulation output revision、 recover ex-factory coefficient by keyboard.

>Instrument measurement scale: 4 available digit, maximum 9999

> Display of DecimalPoint: The largest three digits:9.999.;one digit:999.9;two digits:99.99; three digits:9.999.When changing the decimal point of instantaneous flow,the pile-up flow will change the same number of digits.Thus,the decimal point should be set before normal function of the meter.If you want to set the decimal point again,you should stop the meter and record the pile-up



reading.

>Signal of Non-linear Value: 4 significant digits. There are 12 sections. Each section has two values, including the actual measuring value and the standard value.

>Gas Coefficient: The largest value: 1.999. The difference in nature of each gas results in the difference in specific heat capacity, which is listed when the product leaves the factory. Clients can inquire SUNNYLEE company for technical support.

>Setting Zero : Since the sensibility of the meter is very high, so it will not display zero. In order to set zero, you should input the non-zero number displayed into the meter. (the largest value 0-9999)

>Adjustment of Flow Input : In each period, you need to adjust the scale and zero point which are corresponding to point 4mA and 20mA so that you can simply input the current reading from the meter connected in the circuit in series.

4mA Input Format (Fixed): X.XXXX

20mA Input Format (Fixed): X.XXX

>Resumption of Original Parameters : When you set something wrong to the meter, You can use this function.

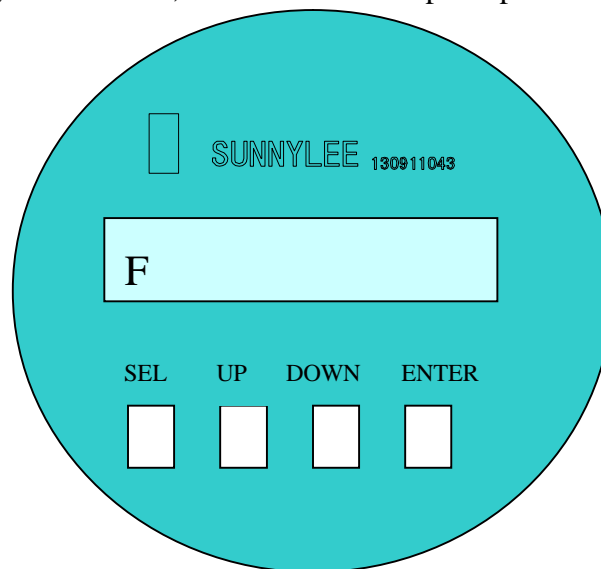
OFF: Cancel the Function

ON : Open the Function

>Linear modification is "ON", when it leaves factory. Suggest user not to change it, unless user indicates it personally, it should be set to "OFF".

>Calculated value to clear: this function is "OFF", when it leaves factory. When clearing zero, choosing "ON" is ok.

Notice: When using this function, the meter clears the pile-up value.



Setting Steps

Position of Keys and Definitions

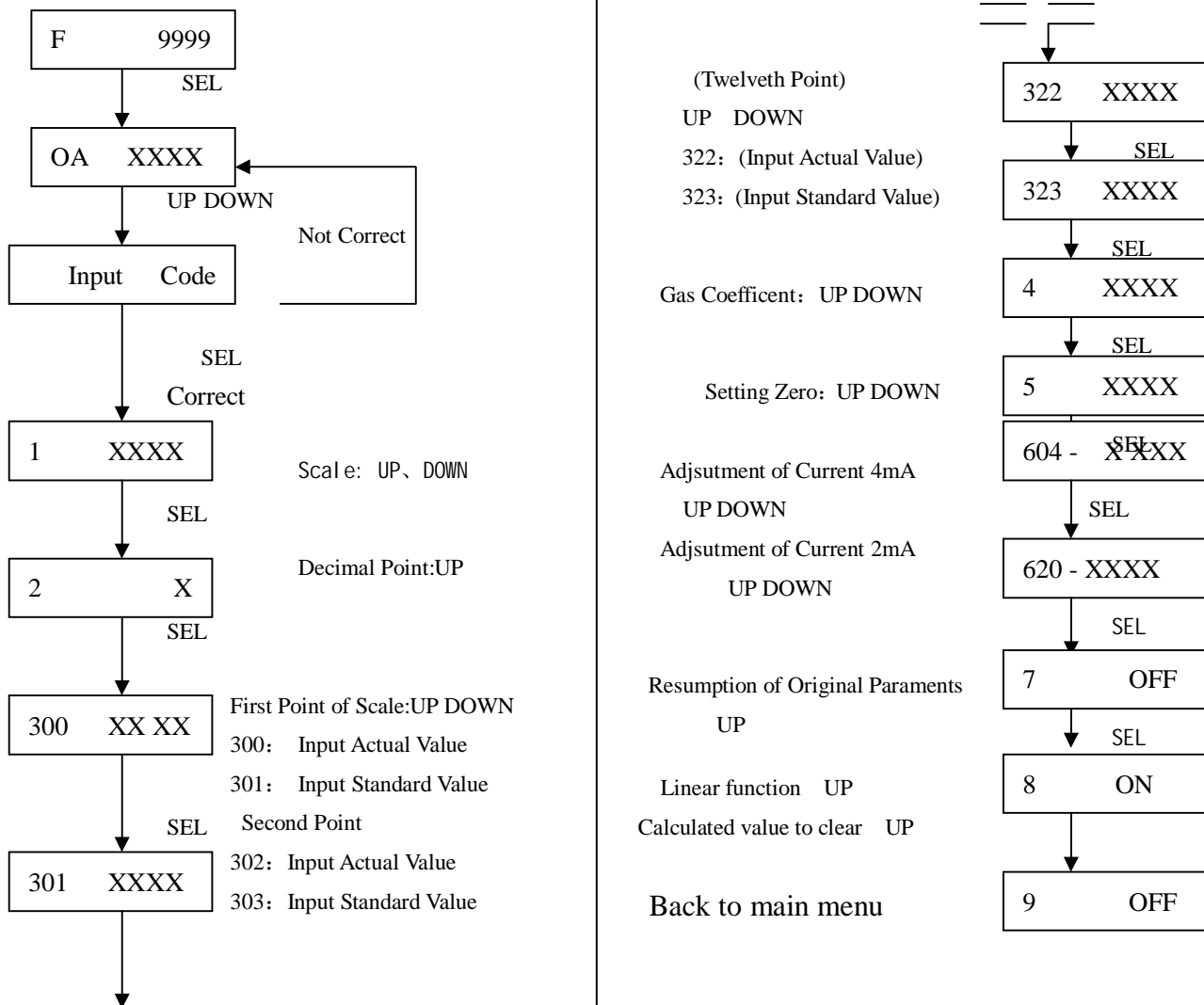
SEL: The Key for Setting and Entering the Menu.

UP: The key for adding one, which can be the browse key under the measuring mode.

DOWN: The Key for Left-moving

ENTER: The Key for Holding (For Expansion)

Setting Steps with the Meter Keyboard (Table 2)



Setting of Parameters

Meter Scale :

Referring to Table 2

Format

1	XXXX
---	------

Under the measuring mode, press the key SEL to enter the sub-menu of code, and then input the password 1111. The cursor flashes in the units place. Pressing the key UP for adding 1 to the digital quantity (0-9 circulation). Then, press the DOWN key for left-moving tens place

Display of Decimal Point

Format

2	X
---	---

After setting the scale, you can press the SEL key for setting decimal point. The decimal place only



has the units place 0-3 circulation. The setting method is the same as “Meter scale”.

Linear revision of signal 12 sections

Format

300	XXXX
-----	------

After setting the display of decimal point, you should press the SEL key for Setting the Linear revision of signal 12 sections.

Meaning of Points: Each point has two values. One is the actual measuring value and the other is the calculated standard value.

Order: Point 1-12, the value should be in ascending order.

Format: 300 XXXX: The actual measuring value of first point
301 XXXX: The calculated standard value of first point
302 XXXX: The actual measuring value of second point
303 XXXX: The calculated standard value of second point
322 XXXX: The actual measuring value of twelfth point
323 XXXX: The calculated standard value of twelfth point

Referring to the “Meter scale” for the method of running keyboard.

Gas Coefficient:

Format:

4	XXXX
---	------

After setting the linear correction value, you should press the SEL key for setting the gas coefficient. The method is the same as “Meter scale”.

Setting Zero:

Format:

5	XXXX
---	------

After setting the gas coefficient, you should press the SEL key for setting zero. The method is the same as “Meter scale”.

Adjustment of Flow 4mA:

Format:

604	—
-----	---

Notice: Before entering this function, a current meter should be connected with the output of the meter in series.

After setting zero, you should press the SEL key for setting the adjustment of 4mA output of the analogue value. Record the reading from the current meter and input them into the meter, then finished. The method is the same as “Meter scale”.

Adjustment of Flow 20mA

Format:

620	—	XXXX
-----	---	------

After setting the adjustment of flow 4mA output of the analogue value, you should press the SEL key for setting the analogue 20mA.

The method is the same as “The adjustment of flow 4mA”.



Resumption of Original Parameters

Format:

7	OFF
---	-----

After setting the adjustment of flow 20mA,you should press the SEL、 ENTER key for setting the resumption of original parameters.

OFF: Parameters remain the same

ON: Parameters are the original ones

In the sub-menue,press the UP key to choose the function and then
Press the SEL key to confirm.

Section 4: RS232/485 Operation(Smart200 software)

Introduction

As an assistant software of the meter, this software wants to achieve two goals.One is to provide communication agreements to clients for the convenience to enter the system of clients and test their softwares.The other is to be a fast and effective testing tool when clients check their meter.

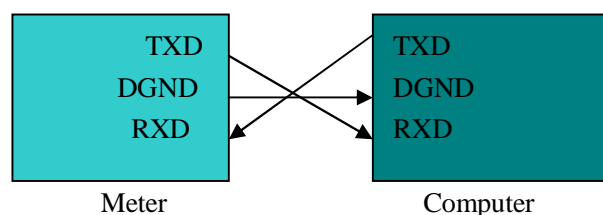
Features of Software Smart 200

- › Practical 、 convenience and easy to use
- › Green software、 operation system of WINDOWS2000 and 500k harddisk space

Installation of Software Smart 2000

Put it in your designated area and click“SETUP.exe”,then the software will be installed automatically.

Connection of the Meter and Computer



Open the back cover of the meter and reveals the terminal strip the 0.15mm2 line which shields with three cores belts,then connect according to the above graph. The computer uses 9 cores communications plug: 2---RXD, 3 - TXD, 5--- digital place.

Operation of Software Smart 200:

Functions of Software Smart 200

Setting of Meter Scale

Setting of Gas Coefficient

Setting of Decimal Point

Setting of Display of Setting Zero

Adjustment of Flux and Analogue Value 4mA



Adjustment of Flux and Analogue Value 20mA

Setting of Correction Value of 12 Section Nonlinear Signal

Instantaneous Flow and Regular Temperature Monitoring

Clicks on "Smart200" in the computer procedure instantly to be able to appear the following picture



Chapter 5: Original Settings and Attachments

Original Settings

Gas coefficient :1.000 (No Indication by Clients)

Decimal Point:0

Resumption of Original Parameters:OFF

Attachments

A Guide Book

A Pass Certificate

A Mass Flow Meter of Gas

Locking Connector(optional)

Ball Valve Device of Non-stop Flow(optional)

A Demarcation Sheet(optional)

A Demarcation Software (optional)

Chapter 6: Technical Support and Service

Problem Analysis and Handling:

Phenomenons	Reasons	Solutions
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Display value is too large.	Too much water in the medium; Dirty probe head; The temperature level of the probe is not enough; Wrong insertion.	Increase the number of filters; Clean the probe head; Use a probe of higher temperature level; Use a software of calculating higher temperature; Install following the instructions.
Indication variation of flow output is too large.	The straight part of the tube is not long enough; Dirty probe head;	Increase the number of rectifiers; Clean the probe head;
No output	Weakelectricity source; Wrong connection;	Choose a suitable electrical source; Right connection.
Display value of full scale	High temperature; In water;	Use a probe of higher temperature level; Use a software of calculating higher temperature; Right installation

Maintenance:

This product as a result of own characteristic, the cost of maintenance is minimum. When there is a large error of output signal, you should clean the probe head regularly. To clean the probe head, you cannot knock it with hard objects, instead you should use water, alcohol and cotton and dry it before normal use. Clients are suggested using the install method of ball valve non-stop flow so that it is easy to disassembly and install. Suggested client do not repair the meter, otherwise this can create a bigger error. Sometimes this can do a bigger harm to the meter. The meter should be examined once a year. Client can demarcate the meter themselves for the meter mode of having display. For those which don't have display, clients must purchase the hand-operated machine for SUNNYLEE company to demarcate. Also, service of regular examination is provided by the company.

Transportation and Preservation:

Transportation: During transportation, this product must not be exposed to rain and heavy objects must be put on it. Load or unload this product carefully.

Preservation: This product must be put under the conditions of temperature 40°C-85°C and humidity 85%RH%. Damages can be made to the meter beyond these conditions.

Chapter 7: model instruction

	Model	Model	Descriptions
STN2	STN2L	STN2J	2-Insertion Model, 2L-Flange Model, 2J-Nip Model
Model	Model	Model	Electricity Source
A	A	A	24VDC
B	B	B	220VAC
C	C	C	110VAC



Model	Model	Model	Flow Direction
1	1	1	One Direction
2	2	2	Double Directions
Model	Model	Model	Diameter of Probe Rod
A	A	A	16mm
B	B	B	19mm
Model	Model	Model	Probe Head
B	B	B	Stainless Steel
C	C	C	HAS Alloy C
W	W	W	Others (Contact with the factory or office when
Model	Model	Model	Process Connection
A	-	-	3/4"NPT
B	-	-	1" Flange
C	-	-	1 1/4"NPT
D	-	-	1 1/2"NPT
E	-	-	2" Flange
W	-	-	Others (Contact with the factory or office when
Model	Model	Model	Size of Tube
-	A	A	1/4"
-	B	B	1/2"
-	C	C	1"
-	D	D	1 1/2"
-	E	E	2"
-	F	F	6"
-	G	G	8"
-	W	W	Others (Contact with the factory or office when
Model	Model	Model	Flange Standard
0	-	-	NO
1	-	-	150Ib Carbon Steel
2	-	-	150Ib Stainless Steel
3	-	-	300Ib Carbon steel
4	-	-	300Ib Stainless Steel
W	-	-	Others (Contact with the factory or office when
Model	Model	Model	Tube /Flange



-	A	A	Carbon Steel
-	B	B	Stainless Steel
Model	Model	Model	Temperature, Pressure
1	1	1	-40℃--100℃
2	2	2	-20℃--200℃
H	H	H	0℃--450℃
P	P	P	>1.6MPa
Model	Model	Model	Depth of Insertion
1	-	-	1--6"
2	-	-	1--12"
3	-	-	1--21"
W	-	-	Definition of the User
Model	Model	Model	Type of Transmission
A	A	-	All in One
B	B	-	Fission (Only Suitable for Occasions of
Model	Model	Model	Other Options
S1	S1	S1	Sealed Device of On-line Putting In/Out (Low
M1	M1	M1	Display of Meter Head
E1	E1	E1	The Factory Mutually Examines (FM) Non-
E2	E2	E2	Identification of Product Safety and Explosion
N1	N1	N1	Bearing Transient Voltage to Protect Circuit
T1	T1	T1	Communication with RS232
T2	T2	T2	Communication with RS485
J1	J1	J1	Output of Analogue Value of Temperature
J2	J2	J2	Alarm Output of Relay (Flow)
-	F1	-	

Appendix A: Gas Table

Table of Transition of Mass Flow to Coefficient of Gas

Gas	Molecular Formula	Density(Gram/Litre 0℃)	(Transition Coefficient)
Air	Air	1. 293	1. 000
Ar	Ar	1. 784	1. 415
AsH ₃	AsH ₃	3. 478	0. 673
BBr ₃	BBr ₃	11. 180	0. 673
BCL ₃	BCL ₃	5. 227	0. 378
CH ₄	CH ₄	0. 715	0. 719



C ₂ H ₆	C ₂ H ₆	1. 342	0. 481
CO	CO	1. 250	1. 000
CO ₂	CO ₂	1. 964	0. 737
CL ₂	CL ₂	3. 163	0. 858
O ₂	O ₂	1. 427	0. 992
CH ₃	CH ₃	0. 760	0. 719
NO	NO	1. 389	0. 976
NO ₂	NO ₂	2. 052	0. 741
N ₂	N ₂	1. 250	1. 000
H ₂ S	H ₂ S	1. 520	0. 844
Ne	Ne	0. 900	1. 415
Kr	Kr	3. 739	1. 415
He	He	0. 179	1. 415
H ₂	H ₂	0. 090	1. 010
SiH ₄	SiH ₄	1. 433	0. 599
SO ₂	SO ₂	2. 858	0. 687
HBr	HBr	3. 610	1. 000
SiF ₄	SiF ₄	4. 643	0. 348
C ₂ H ₆	C ₂ H ₆	1. 967	0. 348
C ₄ H ₁₀	C ₄ H ₁₀	2. 593	0. 255
CH ₃ OH	CH ₃ OH	1. 430	0. 584
C ₂ H ₆ O	C ₂ H ₆ O	2. 055	0. 392
C ₅ H ₁₂	C ₅ H ₁₂	3. 219	0. 217
C ₂ H ₂	C ₂ H ₂	1. 162	0. 581
C ₃ H ₄	C ₃ H ₄	1. 787	0. 421
C ₂ H ₄	C ₂ H ₄	1. 251	0. 598
C ₃ H ₆	C ₃ H ₆	1. 877	0. 398
C ₄ H ₈	C ₄ H ₈	2. 503	0. 294
C ₄ H ₆	C ₄ H ₆	2. 413	0. 322
CF ₄	CF ₄	3. 967	0. 428

Appendix B: Technical Parameters

Measuring Range: 0 --120m/s (20℃, 101.33KPa)

Accuracy: ±1% Reading ±0.5 Full Scale

Repeatability: Full Scale

Range of Environmental Temperature: 40℃--85℃(No Display); -30℃--70℃(Display); Humidity < 90%RH.

Range of Medium Temperature: -40℃-100℃; 0℃-200℃; 0℃-450℃; 0-510℃

Output of Analogue Value: Flow: 4-20mADC; Temperature: 4-20mADC

Typical Response Time: 1 second

Temperature Coefficient: 0.05%/℃



Output of the Value of Pile-up Pulse

Enter 12 sections of non-linear revision, in sets at 10 sections of non-linear revision.

Communication: Output RS232/RS485/RS422

Relay of Lower and Upper Limit Output 2A/220VAC

4-digit display of instantaneous flow, 6-digit output of pile-up flow

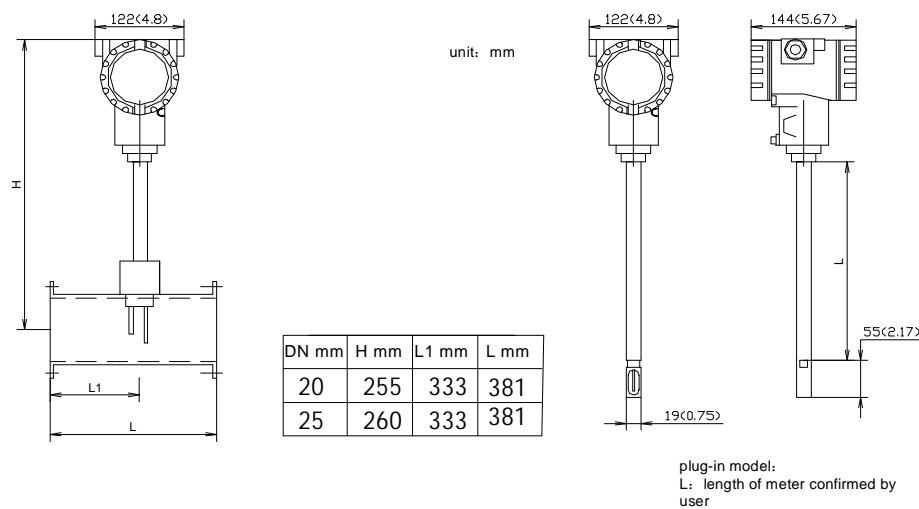
Large Screen with 8-digit LCD Display

Process Pressure: <2MPa

Process Connection: Flange /Locking Device/Ball Valve Connection

Safety and Explosion Suppression

Appearance Size and Installation Size



Appendix C: Applications

Measurement of Suppressed Air in Factories

Measurement of Natural Gas

Measurement of Fuel Gas and Air Blast of Boilers

Measurement of Gas of Sewage Handling

Measurement of Torch Gas

Measurement of Liquid Gas and Methane

Measurement of Hydrogen Gas

Measurement of Gas Adding of Iron and Steel Plant

Measurement of Ammonia Gas in the Fertilizer Factory

Measurement of Coal Gas of Coking Furnace in the Coking Factory

Measurement of Coal Gas of Blast Furnace in the Puddling Factory

Measurement of the First Wind and Second Wind of Blast Furnace in Power Plant

Control of the Ratio of Powder and Gas in the Process of Burning Powdered Coal.

Measurement of Emission of SO₂ and NO_x in the Flue Pipe

Measurement of the Gas Flow in Fuel Battery Factory

Control of Hot Steam Flow's Exhaustion of Vertical Stroke-like Pulverizer in the Cement Industry



Control of Hydrogen、Oxygen and Nitrogen Gas in the Quench Tower

Measurement and Control of Fuel Gas (e.g. Coal Gas of Blast Furnace 、Coal Gas of Coking、Natural Gas) of the Heating Furnace and the Measurement of Gas Flow in the Industrial Pipe.

Measurement of Air Flow in the Burning Process

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