# VORTEX FLOW METER USER MANUAL

# TABLE OF CONTENTS



**WORKING PRINCIPLE**

Non- streamline Vortex- Flow Meter be set in fluid (anti- flow part), then two regular vortex would be come out, from two sides of the vortex- maker in turn, so this kind of vortex be called as Karman Vortex street flow meter.

Vortex is not flowing symmetrically under vortex- maker set. As if set frequency of vortex is f, the speed of test medium is V, inlet face width of vortex- maker is d, past part diameter is D, as the principle of Karman Vortex flow meter as follow:

$$f=St\ V/d$$

**Factor:**

f- The Karman vortex flow meter frequency which one side of vortex- maker

St- Strouhal No (dimensionless No)

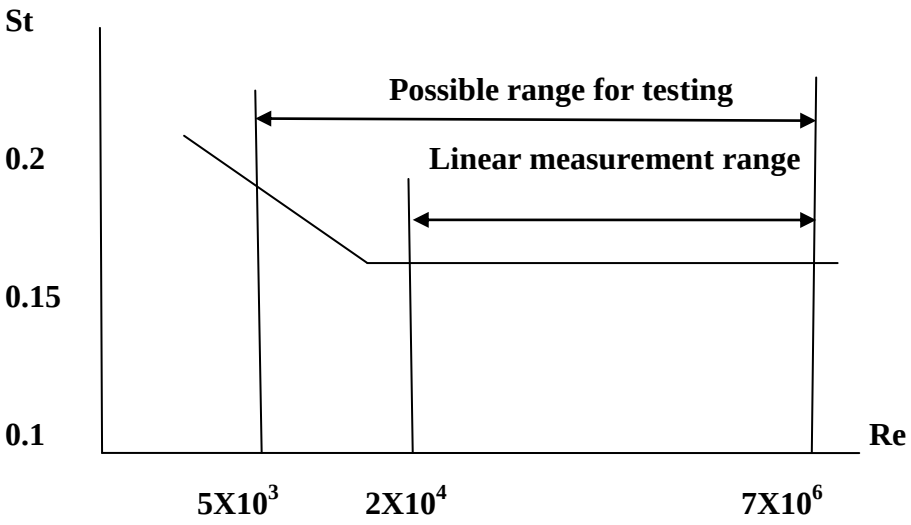
V- Mean flow rate

d- The width of vortex- maker

so check the separate frequency of Karman vortex street to know the instant capacity (flow). Among strouhal No (St) is dimensionless No,

**Chart II:**

Show the relation of, strouhal No (St) & Reynolds No (Re)




Straightness part in curve (St= 0.17), free frequency & flow rate of Vortex is direct ratio, it means flow sensor range, so just check out frequency (f), we can get the flow rate inside pipe, then as the flow rate (V) to take volume flow, the ratio record of impulse & volume called as (K) as follow (2)

$$K= N/Q \ (1/ m^3)$$

Model: K= instrument constant ($1/m^3$)

N= impulse No

Q= Volume flow ($m^3$)

**The key Technical indexes**

| | |
|---|---|
| Inside nominal diameter (mm) | 25, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, (300~1000 plug- in) |
| Nominal Pressure (Mpa) | DN25- DN200 4.0 (> 4.0 order by agreement), DN250- DN300 1.6(>1.6 order by agreement) |
| Medium Temperature (°C) | Piezoelectric type: -40~260, -40~320; capacitance: -40~300, -40~400 agreement) |
| Noumenon | 1Cr18Ni9Ti, (order by agreement if need other material) |
| Vibrating acceleration | Piezoelectric type: 0.2 g, Capacitance: 1.0~ 2.0 g |
| Range | ±1% R, ±1.5 %, ±1FS; plug- in: ±2.5 %R, ±2.5% FS |

| | |
|---|---|
| Range degree | 1: 6~1: 30 |
| Service voltage | Sensor: +12 V DC, +24 V DC, Transmitter: +12 V DC, +24 V DC, battery supply feed: 3.6 V battery |
| Output signal | Square wave pulse (non- battery supply feed): high level ≥5 V, Low Level ≤1 V; current: 4~20 mA |
| Loss coefficient | JB/T9249 Cd≤ 2.4 |
| Anti- explosion sign | Ben- an type: ExdIIia CT2-T5 anti- explosion type: Exd II CT2- T5 |
| Protection Grade | Ordinary typeIP65 dive type IP68 |
| Environment condition | Temp -20°C~ 55°C, relative humidity 5%~90%, atm press 86~106 Kpa |
| Medium | Gas, liquid, vapor |
| Transmission Range | Three- wire system flow sensor: ≤300m, electric sign of two- wire system transmitter (4~20 mA): load resistance ≤ 750Ω |

## MODEL SELECTING & INSTALLING FOR METER

### PARTII: Model Selecting & Installing for meter

It is important for selecting model, the key to use, so client must read this chapter carefully, and if find question, you can contact us

### I. Ensure the diameter of meter

According to the flow range to choose diameter. Different diameters hold different test range. Even if the same diameter, the test range is different if medium is not same. Practical test range must be confirmed by figure

Flow range of air and water under reference condition, as chart II, reference condition as follow:
**1. Air:** normal temp & press, t=20°C, P=0. 1 Mpa (absolute Pressure), ρ= 1.205 kg/$m^3$, v= 15X$10^{-6}$ m2/$S_0$

**2. Liquid:** normal Temperature water, t=20°C, ρ=998.2 kg/ $m^3$, v= 1.006X $m^2/S_0$

Basic step to ensure diameter of meter and flow range:

1. Working parameter clearly
2. Name & component of testing medium
3. Min, Nor and Max capacity under working/ condition
4. Min, Nor & Max press & Temp of medium
5. Meter test the flow capacity of medium under working condition, so as the technological parameter to know the flow capacity of medium under working condition as follows:

6. If know air capacity under standard condition, we can get the capacity which under working condition, as follows
7. $Qv = Q0 \times \frac{0.131025}{0.101325+p} \times \frac{273.15}{293.15+t}$ formula

(b) If know air density under standard condition ρ, as follows:

$$\rho = \rho 0 \times \frac{0.101325+p}{0.101325} \times \frac{293.15}{273.15+t} \quad \text{formula (4)}$$

Mass flow Rate Qm charge to volume flow Qv

$$Qv = Qm \times 103/\rho \quad \text{formula (5)}$$

Among formula (5)

Qv: volume flow of medium under working condition (m3/Hr) (Q= 3600f/ K, K: coefficient of meter)

Qm volume flow under standard condition (Nm3/Hr)

Qm: Mass flow rate (t/h)

P: gauge pressure under normal state (Kg/m3)

P- Density of medium under normal state (Kg/m3), common air medium under normal state, as chart III

T: gauge pressure under working state (Mpa)

T: Temp under working state (°C)

1. To ensure lower limit capacity. For the upper limit capacity of flow meter may be not counted under ordinary condition, so that just count its lower limit for choosing caliber. Shall meet two conditions: Minimum Reynolds number shall be not less than limited ($Re= 2\times10^4$): for vortex street flow meter with stress type set, it takes vortex intensity from lower limit capacity shall be more than limited sensor intensity (vortex intensity and lift force, as scaling relation as $\rho V^2$). Relation as follows: for density to test measurable lower limit flow:

For kinematic viscosity to test linear lower limit flow:

**Medium: Qp:** meet request of vortex intensity, the minimum

| Caliber (mm) | Range (m3/Hr) | Output freq Range (Hz) | Measurement Range (m3/Hr) | Output freq range (Hz) |
|---|---|---|---|---|
| 25 | 1.2~16 | 25~336 | 8.8~55 | 190~1140 |
| 40 | 2~40 | 10~200 | 27~205 | 140~1040 |
| 50 | 3~60 | 8~160 | 35~380 | 94~1020 |
| 80 | 6.5~130 | 4.1~82 | 86~1100 | 55~690 |
| 100 | 15~220 | 4.7~69 | 133~1700 | 42~536 |
| 150 | 30~450 | 2.8~43 | 347~4000 | 33~380 |
| 200 | 45~800 | 2~31 | 560~8000 | 22~315 |
| 250 | 65~1250 | 1.5~25 | 890~11000 | 18~221 |
| 300 | 95~2000 | 1.2~24 | 1360~18000 | 16~213 |
| (300) | 100~1500 | 5.5~87 | 1560~15600 | 85~880 |
| (400) | 180~3000 | 5.6~87 | 2750~27000 | 85~880 |
| (500) | 300~4500 | 5.6~88 | 4300~43000 | 85~880 |
| (600) | 450~6500 | 5.7~89 | 6100~61000 | 85~880 |
| (800) | 750~10000 | 5.7~88 | 11000~110000 | 85~880 |
| (1000) | 1200~17000 | 5.8~88 | 17000~170000 | 85~880 |
| >(1000) | agreement | | agreement | |

**Tips: Above table the caliber (300) ~ (1000) is plug- in**

Table (III) the density of common gas under state (0°C, absolute pressure P=0, 1 Mpa)

| Name | Density (Kg/m3) | Name | Density (Kg/m3) |
|---|---|---|---|
| Air (dry) | 1.2928 | Acetylene | 1.1717 |
| Nitrogen | 1.2506 | Ethylene | 1.2604 |
| Oxygen | 1.4289 | Propylene | 1.9140 |
| Argon | 1.7840 | Methane | 0.7167 |
| Ne | 0.9000 | Ethane | 1.3567 |
| Ammonia | 0.7710 | Propane | 2.0050 |
| Hydrogen | 0.08988 | Butane | 2.7030 |
| Carbon Monoxide | 1.997704 | Natural Gas | 0.8280 |
| Carbon dioxide | 1.3401 | Coal Gas | 0.8020 |

## DESIGN & INSTALLATION FOR METER AND ENSURING CALIBER

### Part II: Design & Installation

It is important to install meter, if not installed well, then would affect precision, use- life and damage.

**I Environmental request for installing:**

1. To avoid strong current, high frequency and powerful switch set, power supply of meter shall be avoided to nearby these equipments.
2. To avoid high- Temp & Radiation source. If have to install it, need heat insulation & ventilated measure
3. To avoid high- Temp & etchant gas, if have to install it, need ventilated measure.
4. Vortex flow meter shall be avoided to install on shaking part of pipeline. If have to install on it, shall add clamp device and vibration pad which located an 3D to enhance shake proof, meter has better to installed indoors, pay attention to water proof when installing meter outdoors, special notice the joint, make cable conductor to U shape to avoid water get into the amplifier body around installing place shall save enough space, so that install connection line and maintenance routine.

**II Request for installing of pipeline meter:**

1. Vortex flow meter need a request for about installing point Up- downstream pipe, if not flow field of medium will be affected in pipeline, refer to measurement accuracy of meter Up- downstream pipe of meter as chart (III)
2. Tips: control valve shall not install on Upstream of meter, it better to the downstream 10D.
3. Up- down internal diameter of pipe shall be same. If not, than internal diameter of pipe dp and Vortex flow meter inner diameter Db, shall be as follow

$0.98Db \leq Db \leq 1.05Db$

Up- down internal diameter of pipe shall be concentric with inner diameter of flow meter, the non- axiality shall be less than 0.05Db

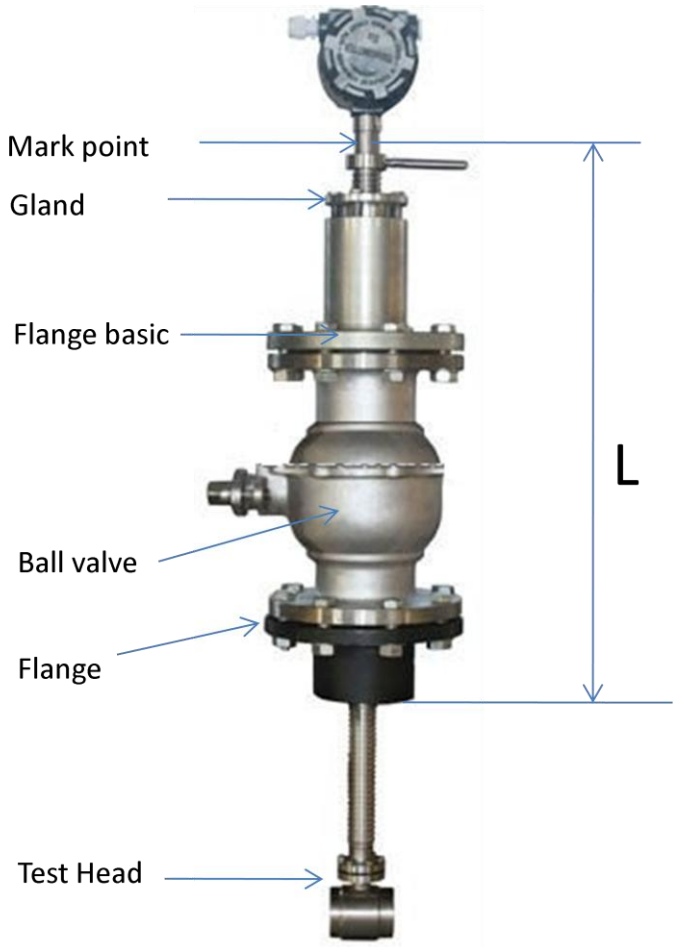
4. Sealing gasket which between meter with flange, cannot joint inside pipe when installing and its inner diameter shall more than meter about 1~2 mm
5. Design for temp & Press point. When test pipeline need install temp & pressure transmitter, pressure tap may be downstream of 3-5D, thermometer hole may be downstream of 6-8D, see chart (VII), D is nominal caliber, Unit: mm
6. Meter can be installed by horizontal, vertical and bias ways on pipeline
7. When test air, gas can flow anywhere when under uptake pipe to install. If where some air inside pipe, to prevent liquid into the test pipe. So the air may from below to top, as list (IV)

8. When test for liquid, to ensure pipeline filled full, so install meter under vertical or bias working condition, shall ensure liquid flow from below to top. If there are some air inside of pipeline. Meter may be installed under pipeline to prevent air into it.
9. When test high & Low temp medium. Any pay attention to heat preventation. Inside changer (inside body of gauge outfit) must be not more than 70°C: if low temp inside will produce water into meter and reducing insulation.

**III overall dimension installing of meter:**

| **Caliber (mm)** | **A** | **B** | **C** | **$C_H$** |
|---|---|---|---|---|
| 15~25 | 70 | 55 | 390 | 455 |
| 40 | 85 | 80 | 385 | 440 |
| 50 | 85 | 90 | 390 | 450 |
| 65 | 85 | 105 | 400 | 470 |
| 80 | 90 | 120 | 420 | 480 |
| 100 | 85 | 140 | 440 | 500 |
| 125 | 95 | 168 | 465 | 530 |
| 150 | 100 | 194 | 490 | 560 |
| 200 | 102 | 248 | 545 | 610 |
| 250 | 115 | 300 | 600 | 660 |
| 300 | 130 | 350 | 650 | 710 |

Ball valve & plug- in Vortex flow meter for installing of location dimensions



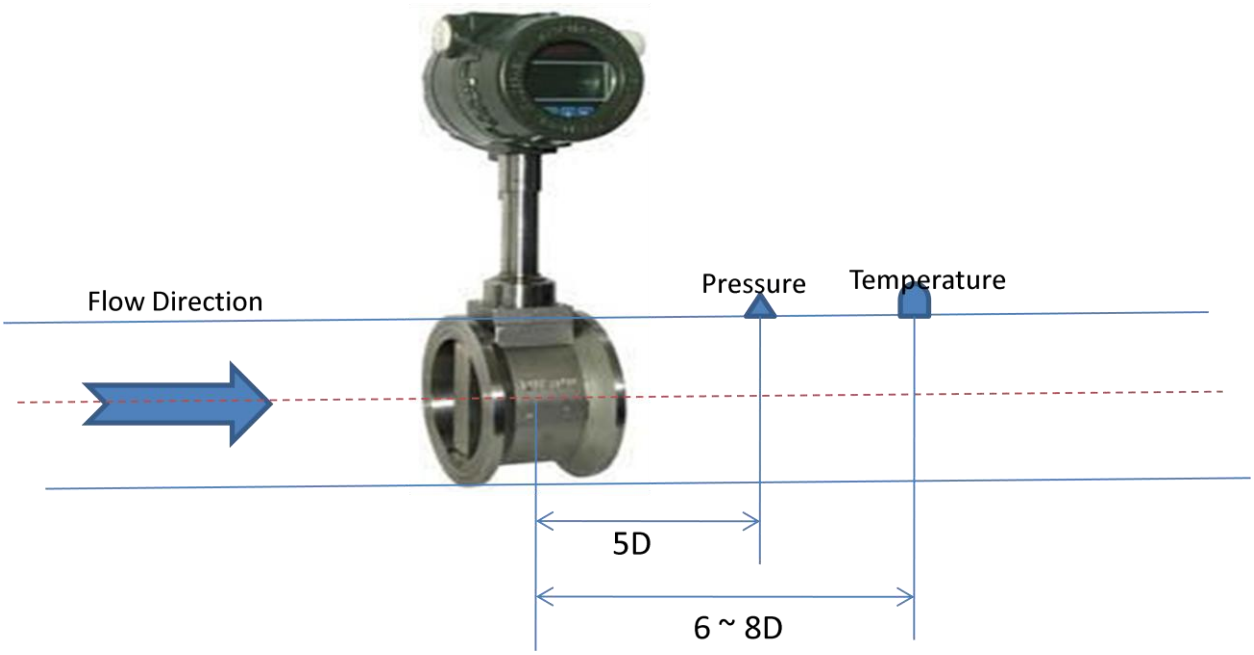

| Caliber (mm) | DN250 | DV300 | DN400 | DN500 | DN600 | DN800~2000 |
|---|---|---|---|---|---|---|
| 1 | 60.5 | 58 | 65.5 | 60.5 | 55.5 | 45.5 |

**(IV) The steps of installing plug-in vortex flow meter**

1. Use gas welding to get a near ø100mm circular hole, and clear it so that make measuring head would be work fine
2. The flange which from manufacturer would be burned on round hole of pipeline
3. Take ball valve and sensor install on the flange
4. Balance screw, so that insertion depth is pass muster (ensure central axis dead in line between test head with pipeline), fluid flow direction must be stay the same with arrows.
5. Balance gland screw. (Notice: lead screw swirl and seal degree is detected to gland screw elasticity)

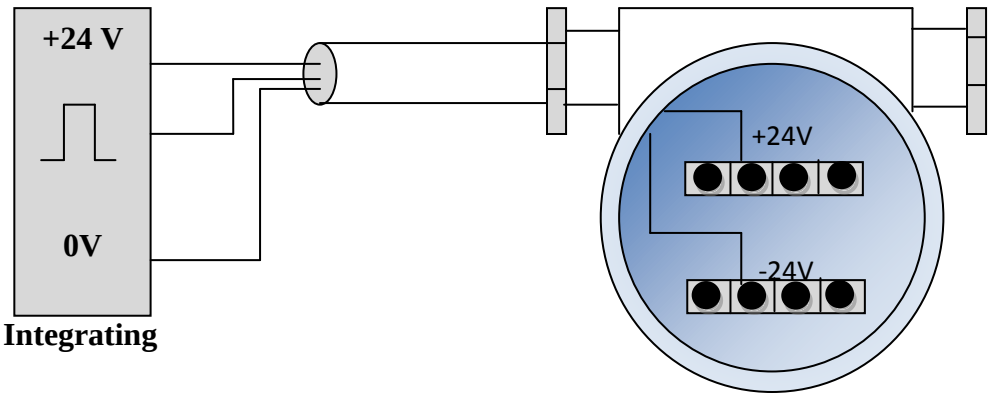
Check every steps, opening value slowly to ensure leakage (take care of body), if fluid leakage, do step 5, 6 once more

**(V) Pt100 Installing sketch map of PT100 and pressure transmitter**

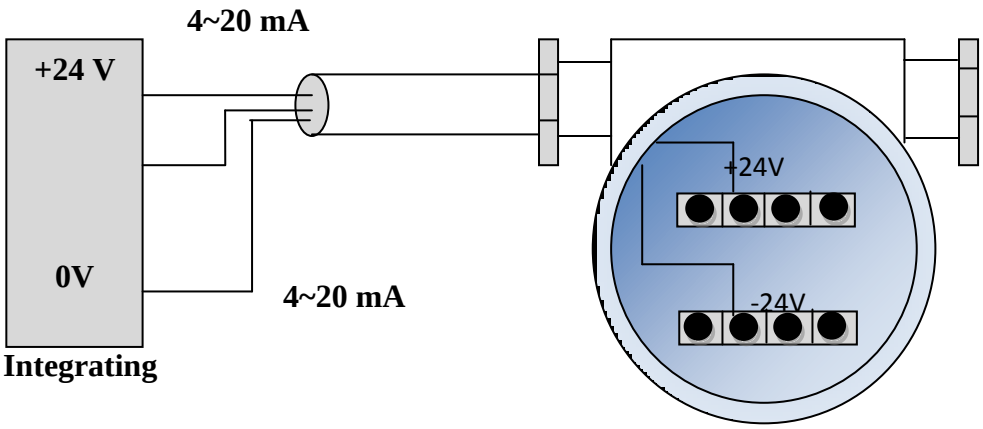



**PART III: Pipeline Design**

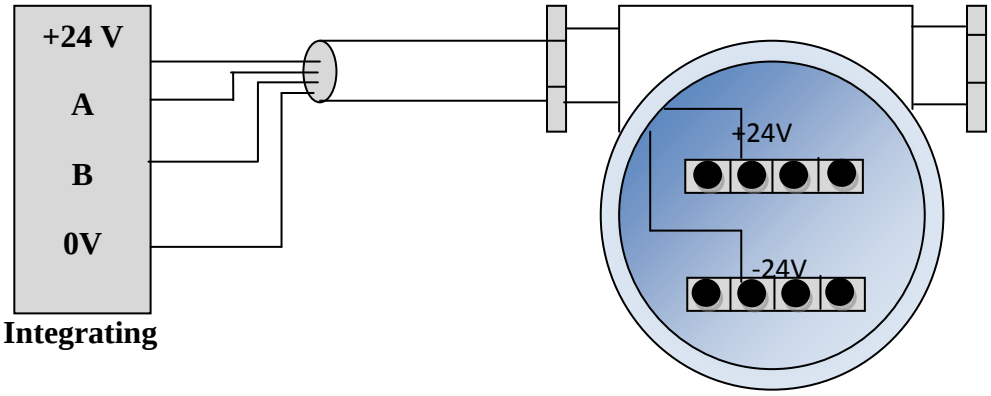
1. Pipeline design for three- wire system vortex flow meter of output frequency signal meter. It use power supply of 24 V DC or 12 V DC, by means of three- core shield cable be joined with display devices or computer, shield shall be joined with ground connection screw of amplifier. The choice of shield cable shall be suitable for condition, besides shield cable shall be separated with, other high power line, not parallel line. Sensor connection end



2. Current signal two- wire system meter designing with output standard (4~20 mA). It use DC24 V power Supply, by means of two- core shielded cable be joined with display devices or computer, the choice of shield cable shall be suitable for condition, besides shield cable shall be separated with, other high power line, not parallel line, sensor connection end.

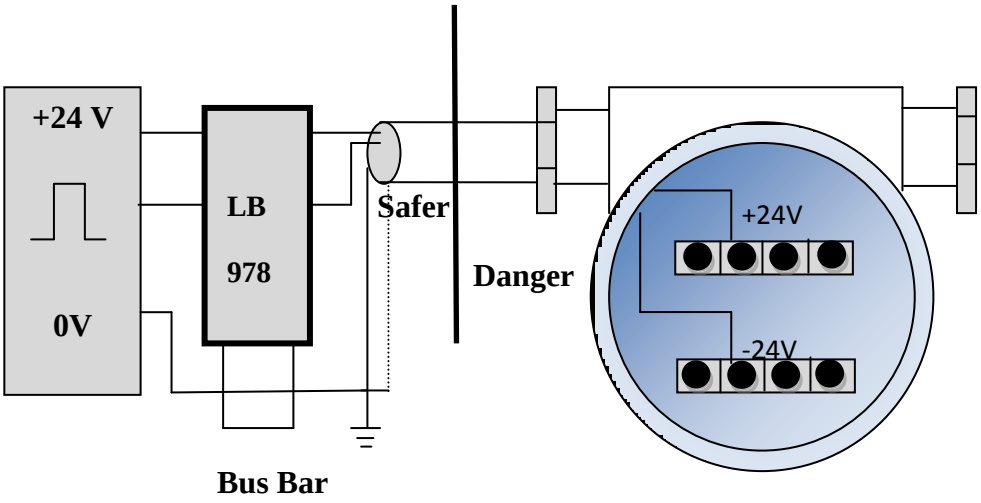


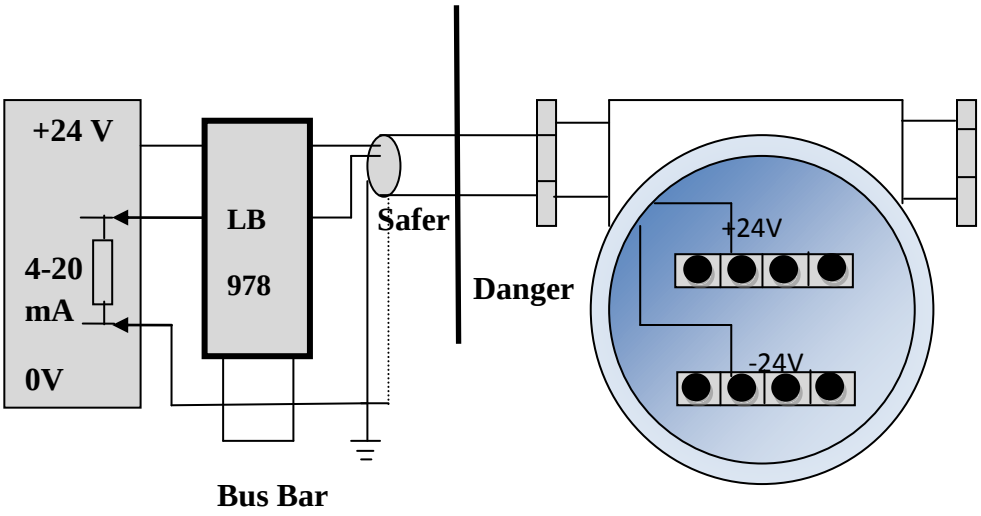

3. Pipeline design of vortex street meter with RS485 communication interface function. It use 24 V DC power supply, and use four- wire system way to transfer with other equipments, meter connection end.



**Pipe designing for antiriot type Vortex street meter**

Vortex street flow meter which with three- wire system pulse output shall be joined, Vortex flow meter which with two- wire system (4~20 mA) current output shall be joined, so could made a intrinsic system, anti- explosion sign: Ex ia II CT2-T5 and these series for relevance equipments, would be as follow chart



1. Explosion proof type sensor & Transmitter would be installed on danger area, guard grating, indicating instrument, power supply and computer, etc shall be installed on safe area.
2. Sensor & Transmitter shall use earth connection; anti- explosion ground wire shall be not used with strong current protective grounding together.

## V. PARAMETER SET OPERATING INSTRUCTIONS FOR ORDINARY LIQUID CRYSTAL DISPLAY (V01P)

### 1. Account for faceplate button

| | |
|---|---|
| SET | Enter Parameter setting state/ page turning/ write in |
| ◀ | Figure Left shift/ Decimal point setting/ Clear |
| ▲ | Figure 0-9/ bit zone changing- over/ Instantaneous & Accumulative flow changing- over |
| ▶ | Get Back |

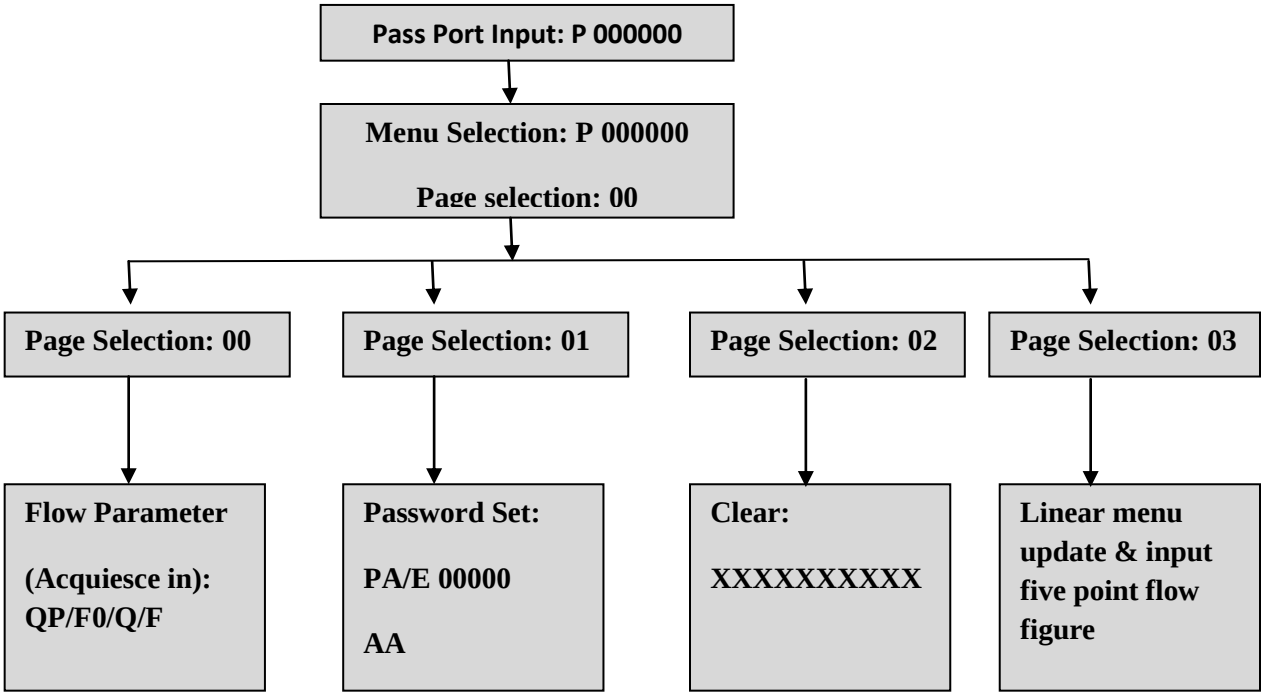
### 2. Character show of display window

Liquid- Crystal display sign means

| Sign | Explain | sign | explain | Remark |
|---|---|---|---|---|
| Qp | Decimal Point Set | F | Full flow Q corresponding frequency (Hz) | |
| Q | Full flow (M3/Hr) or (Km3/H) | F0 | Small- signal cut off frequency value | |
| P AA | Password set | P EE | Linear correction term | |

## 3. Operating Instructions

Parameter set by menu type, block diagram as follow




3.1 The set have be ready before leaving factory as customer's request. If client need to change flow set, as follow, such as, ø600 plug- in flow meter, original capacity: 50000 m3/Hr, frequency is 694.4 . full flow capacity, now to change: 70000 m3/hr, frequency 972.2 Hz, after get into each flow parameter, its right sign would be flickering, everything is ready, need put set to ensure and saving.

1.

| | |
|---|---|
| **Q** | **8006** |
| **F** | **111.2** |

or

| | |
|---|---|
| **Q** | **8006** |
| **XXXXXXXXXX** | |

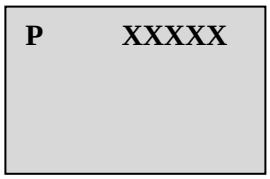
Working Condition

2.

| | |
|---|---|
| **P** | **000000** |

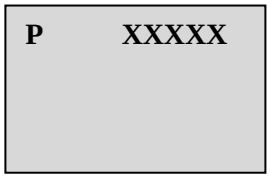
Put set , show P, number is zero, if no-operation over 8 seconds, Would back to work state

3.



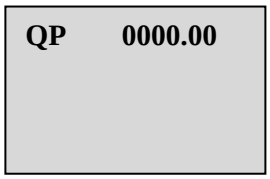

Input passport: put ↑ key and left shift ← key, input password XXXXX.↑ Key can move number 0-9, once put Figure will towards the right, could do it repeatedly put ← key to clear,← put → key to back work state.

4.



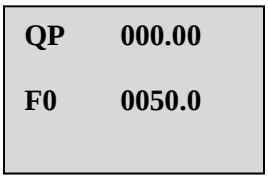

Menu selection: put SET key to sure, show as right chart, terminal row "00" flicker. Adjust value to choose kinds of parameter set.

5.



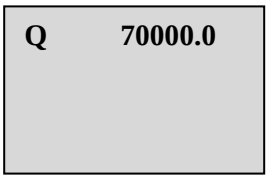

Decimal Point Set: Put SET key to ensure, get into acquiesce in flow parameter set, display screens show Qp, Put↑ key to set bit zone. Put ← key to set decimal point, put → key to back menu.

6.



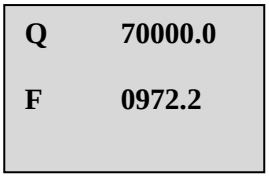

Small- Signal Cut Off: Put SET key to ensure, get into acquires in flow parameter set, display screen show F0, Put ↑ and ← to set, signal cut frequency, put → key to back.

7.




Parameter set of full flow: Put SET key to ensure last step record, display screens show Q, Put ⬆ and ⬅, to set full flow value 70000 (Km3/H), put ➡ key to back.

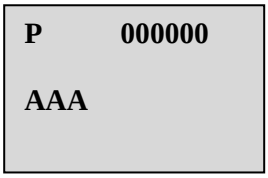
8.




Frequency Parameter of full flow to set: Put SET key to ensure last step record, show F, Put ⬆ and shift key ⬅, set corresponding full flow frequency as 972.2 Hz, put SET key to ensure last step record and back to first menu, put ➡ key could to back menu.

### 3.2 Password Set

9.

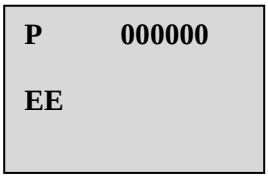



Menu selection, Step (4), adjusted as “01”, and put set key, enters into password set.

Password set: Put ⬆ and shift key ⬅, set password, put SET to ensure, “AA” flickering, means password of screen show has been ready, put ➡ key could to back menu

### 3.3 Linear Revise Set

10.




Menu selection: Step (4), adjusted as “03”, enter into linear revise menu

Linear Revise: if “AA” flickering, means meter working under linear revise state, if “P” flickering, means not working under revises state, enter authentication code to menu of revise ➡

parameter set. For being safety, current password is closed up for customer. Put key to back menu.

3.4 Small flow cut off

When pipeline is vibrating under working condition, non- practical flow, but hold interference signal input, then could use small flow cut off to clear, signal frequency range which be cut off would less than lower limit of meter, specific condition as working to set.

## VI ORDINARY LIQUID- CRYSTAL DISPLAY SET (V02P)

1. **Keyboard Use** **Chart 1**

| Function / Name | **Working condition** | **Parameter set state** | **Remark** |
|---|---|---|---|
| | Enter into set | Ensure \ turn page | |
| | ---------- | Figure left shift \ clear | |
| ▲ | Display frames set | Figure 0-9 \ decimal point set | |
| ▶ | ---------- | **Back to last step** | |

2. **Character Declaring of display screens**
   **Under working condition see chart** **Chart 2**

| **Sign** | **Definition** | **Sign** | **Definition** | **Remark** |
|---|---|---|---|---|
| Q | Flow under working condition (m3/Hr) | F | Instant working frequency (Hz) | See Chart 3 |
| QT | Compensated flow | d | Compensated value set | |

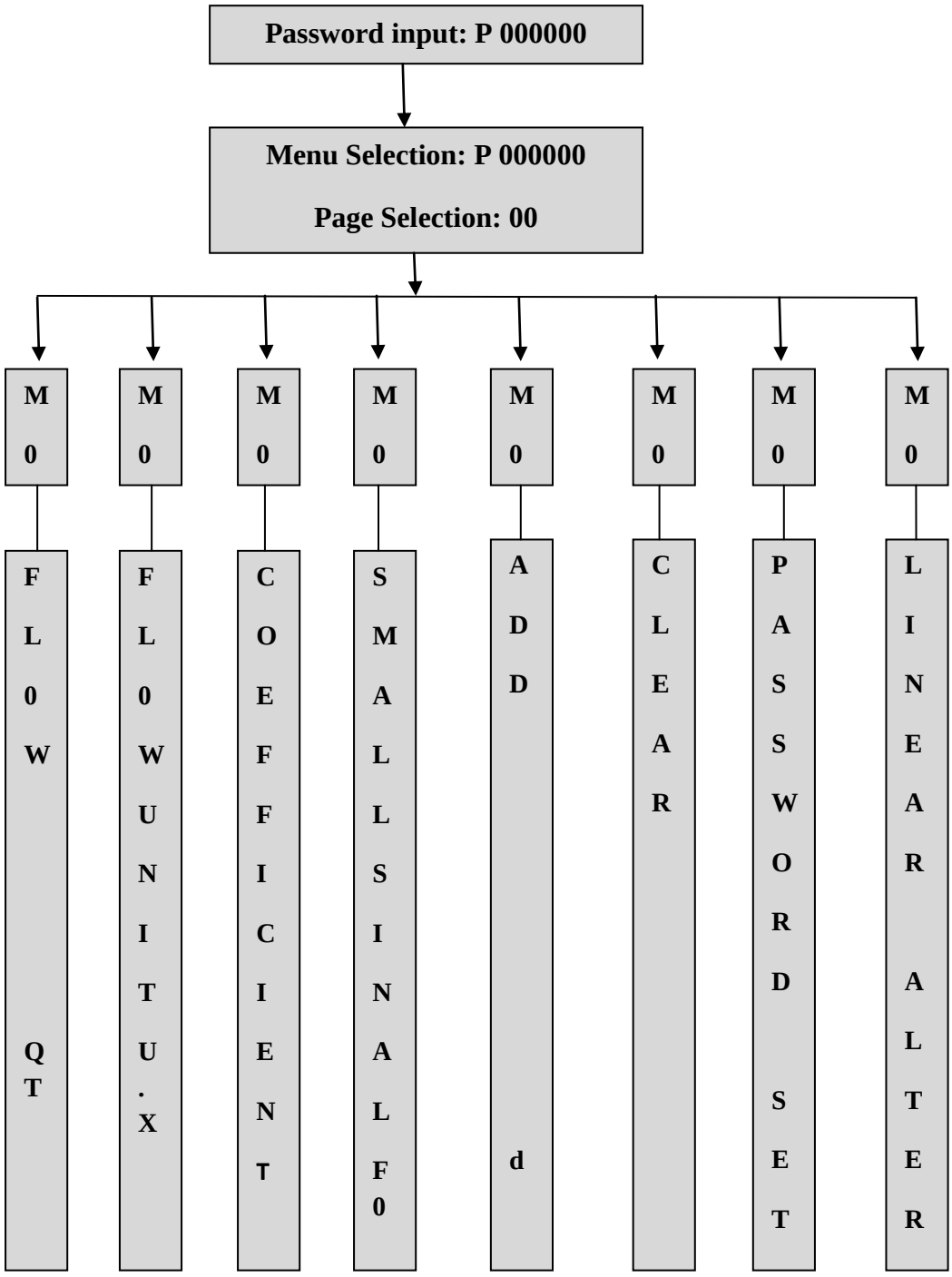
**Under Parameter set condition see chart 3.**

| Sign | Definition | Sign | Definition | Remark |
|---|---|---|---|---|
| QT | 20 mA input corresponding flow value | Co | Coefficient (pulse/m3) | d- (International unit) or gas compensated coefficient |
| U. x | Compensating flow unit:<br>U.0- input unit 1;<br>U. 1- input unit 1/1000 | d | Set Compensation (default as 1) | |
| F0 | Small- signal cut off frequency (Hz) | | | |

**Tips: X means "0" or "1**

## 3. Operating Instructions

### 3.1 Set parameter as follow

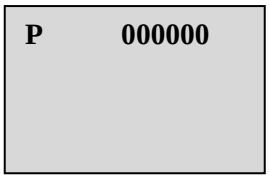


### 3.2 Parameter Set (Read it carefully before use)

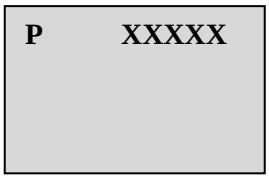
1. When you set parameter if prompt light flickering, it means that working is not ready, you can put set to ensure or, put ➡ to back, if not flickering, it means Ok, parameter has been set and sure, than could put set to turn page or put ➡ to back.
2. When parameter set, need put password and ensure it to get in, to avoid error to get in parameter set, for ensuring normal working, when you set password, put ⬆ to change number, not cycling, just single- pass; after enter into parameter menu, for each parameter could change by put ⬆ to adjust.
3. For could set decimal point option, first to set decimal point and quite sure, then set parameter to ensure

### 3.3 Parameter

Every parameter have been set fine before leaving factory, if client need set parameter, refer to steps, as follow: d: would back to menu state

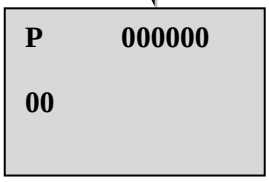



Under working condition, put SET, show P, digits clear, 8 seconds without operating, would back to menu state




Put Password: Put ⬆ and left shift ⬅, put password XXXX (Acquiesced password is (000123)

⬆ To adjust 0-9, per put ⬅ once to right one bit.



Menu selection: Put Set to ensure, show as right chart, foot line "00" flickering to set menu as kinds of parameter. So put 00 turn to 04, then put SET into set d.

| | |
|---|---|
| **P** | **XXXX.X** |
| **d** | **1.00000** |

Constant compensated value set: d flickering, first step: to adjust decimal point, can put ⬅ to clear or put⬆ to adjust decimal point, if OK to put SET to sure ( d still flickering); second step: to adjust value, could put ⬆ to adjust figure, put ⬅ once, the figure would shift right once, if Ok, Put SET to ensure, d stop flickering, set this parameter well, can put SET to next step or put➡ to back. On the side, after compensated unit set U.X to pass ⬆ to adjust.

3.4 **Linear revise:** this start can adjust 5 point revise for meter coefficient, acquiesced state is prohibited. For working safety, this option is not open for client, need special password to get in.

**Computational formula:**

**Vapor test computational formula**

**(1)** Volume flow under working condition computational formula: $Q=\frac{3600*f}{K}$ **(m^3/h)**

**(2)** Density d, unit kg/m^3

**(3)** Mass flow computational formula, unit kg/h: **QT =Q*d (kg/h)**

**(4)** Mass flow computational formula, unit t/h: **QT= Q*d/1000(t/h)**

# PARAMETER SET AND PIPELINE DESIGN

## OPERATING INSTRUCTIONS FOR PARAMETER SET OF INTEGRATION LIQUID –CRYSTAL DISPLAY (V03Z)

### 1. Key board use

| Function / Name | Working condition | Parameter set state | Test state |
|---|---|---|---|
| | Parameter set | Ensure \ turn page | **Begin to test** |
| | ---------- | Figure left shift \ clear | ---------- |
| ▲ | Display frame shift | Figure 0-9 \ decimal point set | **Checkpoint shift** |
| ▶ | ---------- | **Back to last step** | **Out from check state** |

### 2. DISPLAY OPERATION

Character under working condition

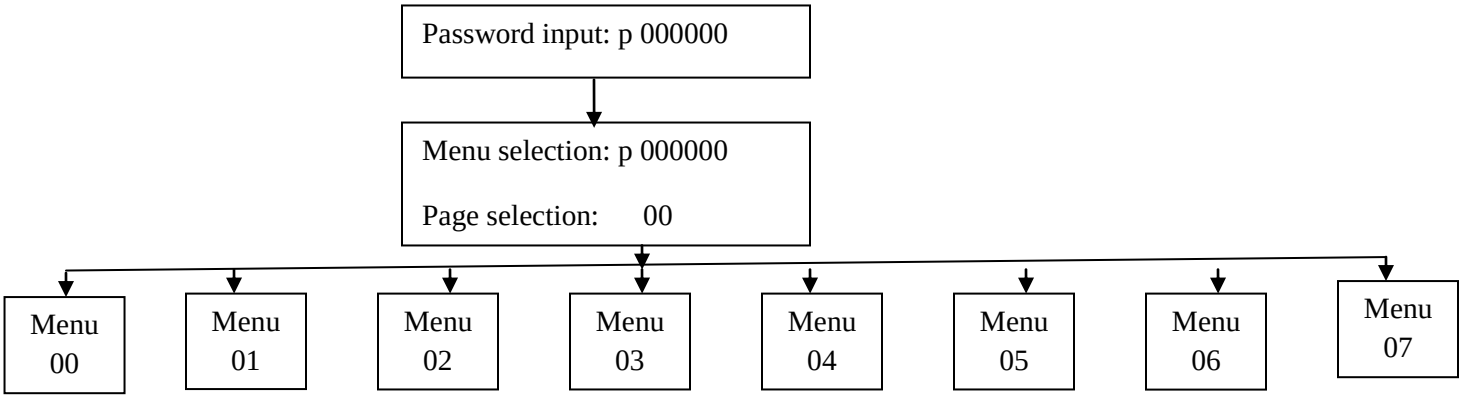
| SIGN | DESCRIPTION | SIGN | DESCRIPTION | REMARK |
|---|---|---|---|---|
| **Q** | Volume flow (m3/hr) | **F** | Frequency (Hz) | |
| **QT** | Instant Mass Flow (kg/h or t/h) | **T** | Working Temp ( °C ) | |
| **Q'** | Instant standard flow (Nm3/h or KNm3/h) | **P** | Working Pressure (Mpa) | |

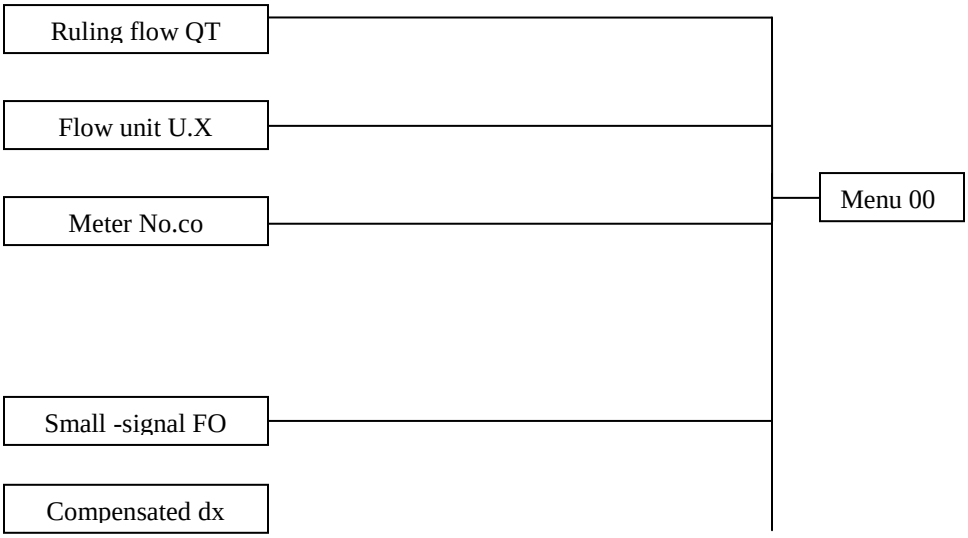
**Parameter setting & symbol**

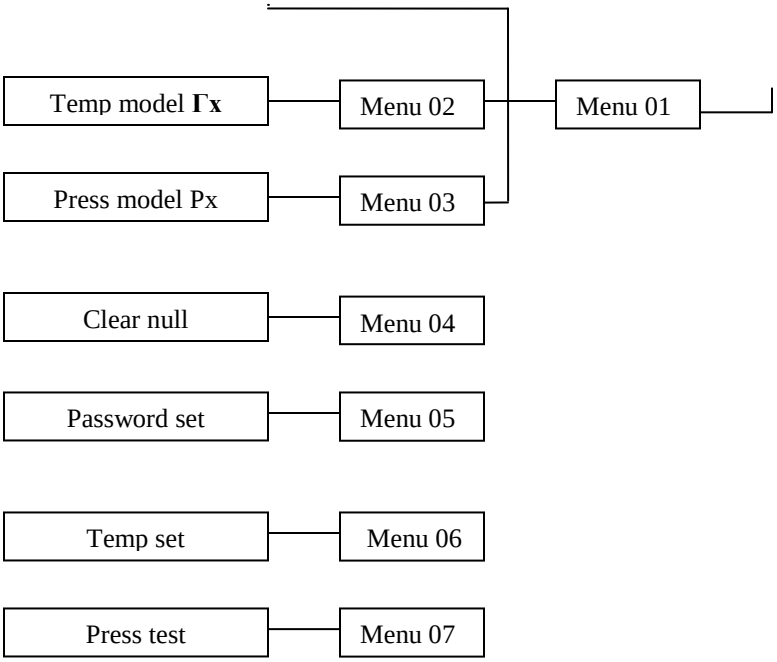
| SIGN | DESCRIPTION | SIGN | DESCRIPTION | REMARK |
|---|---|---|---|---|
| **QT** | Mark flow (t/h or kg/h) | **dx** | Compensated model (QT is prompt) (d0 – Saturation, d1-Overheating) | |
| **Q'** | Mark flow (Nm3/h or kg/h) | **D** | Gas compressibility coefficient (Zn/Z) | Default 1 |
| **U.x** | Flux unit (U.O – kg/h or Nm3/h: U.1- t/h or KNm3/h) | **Γx** | Temp model ( T prompt) (**Γ**0-Trends: **Γ**1-Constant value) | T flicker, set model **Γ**1 flicker, set constant value |
| **Co** | Meter coefficient (Pulse/m3) | **Px** | Pressure Model (P prompt) (P0-Trends: set press range) (P1-Constant value: set Press constant value) | P flicker, set model Px flicker, set range or constant value |
| **Fo** | Frequency Signal cut off rate (Hz) | | | |

## 3. OPERATING INSTRUTIONS

**3.1** This kind of series use self guide and menu to test, the self-guide is when client into menu 00, microcomputer would notice you to set parameter and could use menu to set parameter. Vapor menu as follow


Password input: p 000000
Menu selection: p 000000
Page selection: 00
Menu 00
Menu 01
Menu 02
Menu 03
Menu 04
Menu 05
Menu 06
Menu 07


Ruling flow QT
Flow unit U.X
Meter No.co
Small -signal FO
Compensated dx
Menu 00




Tips :

1.compensated model dx, aerometry menu sign d, means: gas comparison parameter, acquiesced value as 1

2.if vapor test,

Menu 00 would self- guide other parameter as compensated model

**3.2 parameter set:**

When set them ,prompt flickering means not quite sure, could put SET to ensure or put→to back; if not flickering means this parameter is ok, than SET to turn page or put→to back., when get into parameter set ,need to input password (6 digit) and ensure to get in to, to avoid get in to parameter menu ,to ensure working well, when set password ,use to adjust ↑not be circulated ,only adjust one by one, only put right password in to the system of set parameter menu, could to step less control data.

Parameter have been set well before leaving factory, if client want to adjust parameter, could be as follow, F.X, to adjust mark flow QT:

| |
|---|
| **p 000000** |

Under working condition, put **SET**, show P, digits cleared, 8seconds

Without operation, will come to menu.

| |
|---|
| **p 000000** |

**Put password: put** ↑ and left shift ← , put password xxxxx (acquiesced Is 000123), ↑ key to adjust 0-9, put ←once to right shift, could put ← Few time to clear, put →to back working state.

| |
|---|
| **p 000000**<br>**00** |

**Menu selection:** put SET to ensure, show as right chart, foot line "00"

To adjust kinds of value for parameter set menu. Put SET get into menu 00 term

| |
|---|
| **QT xxxx.xx**<br>**U.0** |

**Mark flow set:** QT Flickering, first step: to adjust decimal point, put ← To clear or put ↑ to adjust decimal point, adjust well, put SET to Ensure (QT still flickering);

Second: to adjust value, could put ↑ to adjust every figure. put ← once to right shift, adjust well, put SET to ensure, QT stop flickering ,parameter set well ,and could do next set or get to back.

Besides, unit set U.X and compensated model set to put ↑ to adjust dx.

3.4 check tips: the parameter of temp& press has been set well. Checkout passage way has crypto guard, if want to change them, please contact with us

**Computational formula:**

**Vapor test computational formula**

**(1)** Volume flow under working condition computational formula: $Q=\frac{3600*f}{K}$ **(m^3/h)**

**(2)** Density d, unit kg/m^3

**(3)** Mass flow computational formula, unit kg/h: **QT =Q*d (kg/h)**

**(4)** Mass flow computational formula, unit t/h: **QT= Q*d/1000(t/h)**

**Table of comparisons for saturation water- vapor density & Platinum resistor- temperature**

**Indexing No: Pt100 R0= 100.00 Ω Absolute pressure**

| Temp °C | Pressure (bar) | Density (Kg/m3) | Platinum Resistor (Ω) | Temp °C | Pressure (bar) | Density (Kg/m3) | Platinum Resistor (Ω) |
|---|---|---|---|---|---|---|---|
| **100** | 1.1033 | 0.5997 | 138.50 | **151** | 4.889 | 2.613 | 157.69 |
| **101** | 1.0500 | 0.6108 | 138.88 | **152** | 5.021 | 2.679 | 158.06 |
| **102** | 1.0878 | 0.6388 | 139.26 | **153** | 5.155 | 2.747 | 158.43 |
| **103** | 1.1267 | 0.6601 | 139.64 | **154** | 5.293 | 2.816 | 158.81 |
| **104** | 1.1668 | 0.6321 | 140.02 | **155** | 5.433 | 2.886 | 159.18 |
| **105** | 1.2080 | 0.7046 | 140.39 | **156** | 5.577 | 2.958 | 159.55 |
| **106** | 1.2504 | 0.7277 | 140.77 | **157** | 5.732 | 3.032 | 159.93 |
| **107** | 1.2941 | 0.7515 | 141.15 | **158** | 5.872 | 3.106 | 160.30 |
| **108** | 1.3390 | 0.7758 | 141.53 | **159** | 6.025 | 3.182 | 160.67 |
| **109** | 1.3852 | 0.8008 | 141.91 | **160** | 6.181 | 3.260 | 161.04 |
| **110** | 1.4327 | 0.8265 | 142.29 | **161** | 6.339 | 3.339 | 161.42 |
| **111** | 1.4815 | 0.8528 | 142.66 | **162** | 6.502 | 3.420 | 161.79 |
| **112** | 1.5316 | 0.8798 | 143.04 | **163** | 6.667 | 3.502 | 162.16 |
| **113** | 1.5832 | 0.9075 | 143.42 | **164** | 6.836 | 3.586 | 162.53 |
| **114** | 1.6362 | 0.9359 | 143.80 | **165** | 7.008 | 3.671 | 162.90 |
| **115** | 1.6906 | 0.9650 | 144.17 | **166** | 7.183 | 3.758 | 163.27 |
| **116** | 1.7465 | 0.9948 | 144.55 | **167** | 7.362 | 3.847 | 163.65 |
| **117** | 1.8039 | 1.025 | 144.93 | **168** | 7.545 | 3.937 | 164.02 |
| **118** | 1.8628 | 1.057 | 145.31 | **169** | 7.731 | 4.029 | 164.39 |
| **119** | 1.9233 | 1.089 | 145.68 | **170** | 7.920 | 4.123 | 164.76 |
| **120** | 1.9854 | 1.122 | 146.06 | **171** | 8.114 | 4.218 | 165.13 |
| **121** | 2.0492 | 1.155 | 146.44 | **172** | 8.311 | 4.316 | 165.50 |
| **122** | 2.1145 | 1.190 | 146.81 | **173** | 8.511 | 4.415 | 165.87 |
| **123** | 2.1816 | 1.225 | 147.19 | **174** | 8.716 | 4.515 | 166.24 |
| **124** | 2.2504 | 1.261 | 147.57 | **175** | 8.924 | 4.618 | 166.61 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **125** | 2.3210 | 1.298 | 147.94 | **176** | 9.137 | 4.723 | 166.98 |
| **126** | 2.3933 | 1.336 | 148.32 | **177** | 9.353 | 4.829 | 167.35 |
| **127** | 2.4675 | 1.375 | 148.70 | **178** | 9.574 | 4.937 | 167.72 |
| **128** | 2.5435 | 1.415 | 149.07 | **179** | 9.798 | 5.048 | 168.06 |
| **129** | 2.6215 | 1.455 | 149.45 | **180** | 10.027 | 5.160 | 168.46 |
| **130** | 2.7013 | 1.497 | 149.82 | **181** | 10.259 | 5.274 | 168.83 |
| **131** | 2.7831 | 1.539 | 150.20 | **182** | 10.496 | 5.391 | 169.20 |
| **132** | 2.8670 | 1.583 | 150.57 | **183** | 10.738 | 5.509 | 169.57 |
| **133** | 2.9528 | 1.627 | 150.95 | **184** | 10.983 | 5.629 | 169.94 |
| **134** | 3.0410 | 1.672 | 151.33 | **185** | 11.233 | 5.752 | 170.31 |
| **135** | 3.1310 | 1.719 | 151.70 | **186** | 11.488 | 5.877 | 170.68 |
| **136** | 3.2230 | 1.766 | 152.08 | **187** | 11.747 | 6.003 | 171.05 |
| **137** | 3.3170 | 1.815 | 152.45 | **188** | 12.010 | 6.132 | 171.42 |
| **138** | 3.414 | 1.864 | 152.83 | **189** | 12.278 | 6.264 | 171.79 |
| **139** | 3.513 | 1.915 | 153.20 | **190** | 12.551 | 6.397 | 172.16 |
| **140** | 3.614 | 1.967 | 153.58 | **191** | 12.829 | 6.533 | 172.53 |
| **141** | 3.717 | 2.019 | 153.95 | **192** | 13.111 | 6.671 | 172.90 |
| **142** | 3.823 | 2.073 | 154.32 | **193** | 13.398 | 6.812 | 173.26 |
| **143** | 3.931 | 2.129 | 154.70 | **194** | 13.690 | 6.955 | 173.63 |
| **144** | 4.042 | 2.185 | 155.07 | **195** | 13.987 | 7.100 | 174.00 |
| **145** | 4.155 | 2.242 | 155.45 | **196** | 14.298 | 7.248 | 174.37 |
| **146** | 4.271 | 2.301 | 155.82 | **197** | 14.596 | 7.398 | 174.74 |
| **147** | 4.398 | 2.361 | 156.19 | **198** | 14.909 | 7.551 | 175.10 |
| **148** | 4.510 | 2.422 | 156.57 | **199** | 15.226 | 7.706 | 175.47 |
| **149** | 4.634 | 2.484 | 156.94 | **200** | 15.549 | 7.864 | 175.84 |
| **150** | 4.760 | 2.584 | 157.31 | **201** | 15.877 | 8.025 | 176.21 |

| **Temp °C** | **Pressure (bar)** | **Density (Kg/m3)** | **Platinum Resistor (Ω)** | **Temp °C** | **Pressure (bar)** | **Density (Kg/m3)** | **Platinum Resistor (Ω)** |
|---|---|---|---|---|---|---|---|
| **202** | 16.210 | 8.188 | 176.57 | **253** | 41.831 | 21.05 | 195.16 |
| **203** | 16.549 | 8.354 | 176.94 | **254** | 42.534 | 21.42 | 195.52 |
| **204** | 16.893 | 8.522 | 177.31 | **255** | 43.246 | 21.79 | 195.88 |
| **205** | 17.243 | 8.694 | 177.68 | **256** | 43.967 | 22.17 | 196.24 |
| **206** | 17.598 | 8.868 | 178.04 | **257** | 44.697 | 22.55 | 196.60 |
| **207** | 17.959 | 9.045 | 178.41 | **258** | 45.437 | 22.94 | 196.96 |
| **208** | 18.326 | 9.225 | 178.78 | **259** | 46.185 | 23.33 | 197.69 |
| **209** | 18.699 | 9.408 | 179.41 | **260** | 46.943 | 23.73 | 197.69 |
| **210** | 19.077 | 9.593 | 178.78 | **261** | 47.711 | 24.14 | 198.05 |
| **211** | 19.462 | 9.782 | 179.14 | **262** | 48.488 | 24.55 | 198.41 |
| **212** | 19.852 | 9.974 | 179.88 | **263** | 49.275 | 24.97 | 198.77 |
| **213** | 20.249 | 10.17 | 180.61 | **264** | 50.071 | 25.40 | 199.13 |
| **214** | 20.651 | 10.37 | 180.97 | **265** | 50.877 | 25.83 | 199.49 |
| **215** | 21.060 | 10.57 | 181.34 | **266** | 51.693 | 26.27 | 199.85 |
| **216** | 21.475 | 10.77 | 181.71 | **267** | 52.519 | 26.72 | 200.21 |
| **217** | 21.869 | 10.98 | 182.07 | **268** | 53.356 | 27.17 | 200.57 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **218** | 22.324 | 11.19 | 182.44 | **269** | 54.202 | 27.63 | 200.93 |
| **219** | 22.324 | 11.41 | 182.80 | **270** | 55.058 | 28.10 | 201.29 |
| **220** | 22.758 | 11.62 | 183.71 | **271** | 55.925 | 28.57 | 201.65 |
| **221** | 23.198 | 11.84 | 182.07 | **272** | 56.802 | 29.06 | 202.01 |
| **222** | 23.645 | 12.07 | 182.44 | **273** | 57.689 | 29.55 | 202.36 |
| **223** | 24.099 | 12.30 | 182.80 | **274** | 58.587 | 30.04 | 202.72 |
| **224** | 24.560 | 12.53 | 183.17 | **275** | 59.496 | 30.55 | 203.08 |
| **225** | 25.027 | 12.76 | 183.53 | **276** | 60.415 | 31.06 | 203.44 |
| **226** | 25.501 | 13.00 | 183.90 | **277** | 61.346 | 31.58 | 203.80 |
| **227** | 25.982 | 13.24 | 184.26 | **278** | 62.287 | 32.11 | 204.16 |
| **228** | 26.470 | 13.49 | 184.63 | **279** | 63.239 | 32.65 | 204.52 |
| **229** | 26.965 | 13.74 | 184.99 | **280** | 64.202 | 33.19 | 204.88 |
| **230** | 27.467 | 14.00 | 185.36 | **281** | 65.176 | 33.75 | 205.23 |
| **231** | 27.976 | 14.25 | 185.72 | **282** | 66.162 | 34.31 | 205.59 |
| **232** | 28.493 | 14.52 | 186.09 | **283** | 67.158 | 34.88 | 205.95 |
| **233** | 29.016 | 14.78 | 186.45 | **284** | 68.167 | 35.47 | 206.31 |
| **234** | 29.547 | 15.05 | 186.82 | **285** | 69.186 | 36.06 | 206.67 |
| **235** | 30.086 | 15.33 | 186.18 | **286** | 70.218 | 36.66 | 207.02 |
| **236** | 30.632 | 15.61 | 187.54 | **287** | 71.261 | 37.27 | 207.38 |
| **237** | 31.186 | 15.89 | 187.91 | **288** | 72.315 | 37.89 | 207.74 |
| **238** | 31.747 | 16.18 | 188.63 | **289** | 73.382 | 38.52 | 208.10 |
| **239** | 32.317 | 16.47 | 189.00 | **290** | 74.46 | 39.16 | 208.45 |
| **240** | 32.893 | 16.76 | 189.36 | **291** | 75.55 | 39.81 | 208.81 |
| **241** | 33.478 | 17.06 | 189.72 | **292** | 76.65 | 40.48 | 209.17 |
| **242** | 34.071 | 17.37 | 190.09 | **293** | 77.77 | 41.15 | 209.52 |
| **243** | 34.672 | 17.68 | 190.45 | **294** | 78.90 | 41.83 | 209.88 |
| **244** | 35.281 | 17.99 | 190.81 | **295** | 80.04 | 42.53 | 210.24 |
| **245** | 35.898 | 18.31 | 191.18 | **296** | 81.19 | 43.24 | 210.59 |
| **246** | 36.523 | 18.64 | 191.54 | **297** | 82.36 | 43.96 | 210.95 |
| **247** | 37.157 | 18.97 | 191.90 | **298** | 83.53 | 44.69 | 211.31 |
| **248** | 37.799 | 19.30 | 192.26 | **299** | 84.72 | 45.43 | 211.66 |
| **249** | 38.449 | 19.64 | 192.63 | **300** | 85.93 | 46.19 | 212.02 |
| **250** | 39.108 | 19.99 | 192.99 | **301** | 87.12 | 46.96 | 212.37 |
| **251** | 39.776 | 20.36 | 193.35 | **302** | 88.37 | 47.75 | 212.73 |
| **252** | 40.452 | 20.69 | 193.71 | **303** | 89.62 | 48.54 | 213.09 |

| **Temp °C** | **Pressure (bar)** | **Density (Kg/m3)** | **Platinum Resistor (Ω)** |
|---|---|---|---|
| **304** | 90.87 | 49.36 | 213.44 |
| **305** | 90.14 | 50.18 | 213.80 |
| **306** | 93.43 | 51.02 | 214.15 |
| **307** | 94.73 | 51.88 | 214.51 |
| **308** | 96.04 | 52.75 | 214.86 |
| **309** | 97.36 | 53.64 | 215.22 |
| **310** | 98.70 | 54.54 | 215.57 |

| | | | |
|---|---|---|---|
| **311** | 100.01 | 55.47 | 215.93 |
| **312** | 100.14 | 56.40 | 216.28 |
| **313** | 100.28 | 57.36 | 216.64 |
| **314** | 100.42 | 58.33 | 216.99 |
| **315** | 100.56 | 59.33 | 217.35 |
| **316** | 100.70 | 60.31 | 217.70 |
| **317** | 100.85 | 61.37 | 218.05 |
| **318** | 100.99 | 62.43 | 218.41 |
| **319** | 101.14 | 63.50 | 218.76 |
| **320** | 101.29 | 64.60 | 219.12 |
| **325** | 102.06 | 70.45 | 220.88 |
| **330** | 102.86 | 76.99 | 222.65 |
| **335** | 103.71 | 84.36 | 224.41 |
| **340** | 104.61 | 92.76 | 226.17 |
| **345** | 105.55 | 102.4 | 227.92 |
| **350** | 106.57 | 113.6 | 229.67 |
| **355** | 107.58 | 127.2 | 231.42 |

**Overheating Vapor density chart (Kg/m3)**

| **Absolute pressure p/Mpa** | **Temp t(°C)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **140** | **150** | **160** | **170** | **180** | **190** | **200** | **210** | **220** | **230** | **240** |
| 0.20 | 1.070 | 1.042 | 1.016 | 0.992 | 0.969 | 0.947 | 0.926 | 0.906 | 0.887 | 0.868 | 0.851 |
| 0.30 | 1.622 | 1.578 | 1.537 | 1.499 | 1.463 | 1.428 | 1.396 | 1.365 | 1.336 | 1.308 | 1.281 |
| 0.40 | - | 2.127 | 2.067 | 2.014 | 1.964 | 1.916 | 1.872 | 1.829 | 1.789 | 1.751 | 1.715 |
| 0.50 | - | - | 2.608 | 2.538 | 2.472 | 2.411 | 2.353 | 2.299 | 2.247 | 2.198 | 2.512 |
| 0.55 | - | - | 2.882 | 2.803 | 2.729 | 2.661 | 2.596 | 2.535 | 2.478 | 2.424 | 2.372 |
| 0.60 | - | - | 3.159 | 3.071 | 2.989 | 2.912 | 2.841 | 2.773 | 2.710 | 2.650 | 2.593 |
| 0.65 | - | - | - | 3.341 | 3.250 | 3.165 | 3.087 | 3.013 | 2.943 | 2.877 | 2.815 |
| 0.70 | - | - | - | 3.614 | 3.514 | 3.421 | 3.334 | 3.253 | 3.117 | 3.105 | 3.037 |
| 0.75 | - | - | - | 3.889 | 3.779 | 3.678 | 3.584 | 3.495 | 3.413 | 3.335 | 3.261 |
| 0.80 | - | - | - | - | 4.048 | 3.937 | 3.835 | 3.739 | 3.649 | 3.565 | 3.486 |
| 0.85 | - | - | - | - | 4.318 | 4.198 | 4.087 | 3.984 | 3.887 | 3.797 | 3.711 |
| 0.90 | - | - | - | - | 4.591 | 4.461 | 4.342 | 4.231 | 4.127 | 4.030 | 3.938 |
| 1.00 | - | - | - | - | 5.145 | 4.995 | 4.856 | 4.729 | 4.610 | 4.499 | 4.395 |
| 1.10 | - | - | - | - | - | 5.537 | 5.379 | 5.233 | 5.098 | 4.973 | 4.855 |
| 1.20 | - | - | - | - | - | 6.089 | 5.909 | 5.744 | 5.593 | 5.452 | 5.321 |
| 1.30 | - | - | - | - | - | - | 6.448 | 6.263 | 6.093 | 5.936 | 5.790 |
| 1.40 | - | - | - | - | - | - | 6.996 | 6.789 | 6.600 | 6.426 | 6.265 |
| 1.50 | - | - | - | - | - | - | 7.554 | 7.324 | 7.114 | 6.922 | 6.744 |
| 1.60 | - | - | - | - | - | - | - | 7.867 | 7.635 | 7.424 | 7.229 |
| 1.70 | - | - | - | - | - | - | - | 8.418 | 8.163 | 7.931 | 7.719 |
| 1.80 | - | - | - | - | - | - | - | 8.978 | 8.699 | 8.446 | 8.214 |
| 1.90 | - | - | - | - | - | - | - | 9.548 | 9.243 | 8.967 | 8.715 |
| 2.00 | - | - | - | - | - | - | - | - | 9.795 | 9.785 | 9.222 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.10 | - | - | - | - | - | - | - | - | 10.36 | 10.03 | 9.735 |
| 2.20 | - | - | - | - | - | - | - | - | 10.93 | 10.57 | 10.25 |
| 2.30 | - | - | - | - | - | - | - | - | 11.51 | 11.12 | 10.78 |
| 2.40 | - | - | - | - | - | - | - | - | - | 11.68 | 11.31 |
| 2.50 | - | - | - | - | - | - | - | - | - | 12.25 | 11.85 |
| 2.60 | - | - | - | - | - | - | - | - | - | 12.83 | 12.40 |
| 2.70 | - | - | - | - | - | - | - | - | - | 13.41 | 12.96 |
| 2.80 | - | - | - | - | - | - | - | - | - | - | 13.52 |
| 2.90 | - | - | - | - | - | - | - | - | - | - | 14.09 |
| 3.00 | - | - | - | - | - | - | - | - | - | - | 14.67 |
| 3.10 | - | - | - | - | - | - | - | - | - | - | 15.26 |
| 3.20 | - | - | - | - | - | - | - | - | - | - | 15.86 |
| 3.30 | - | - | - | - | - | - | - | - | - | - | 16.47 |
| 3.40 | - | - | - | - | - | - | - | - | - | - | - |
| 3.50 | - | - | - | - | - | - | - | - | - | - | - |
| 4.00 | - | - | - | - | - | - | - | - | - | - | - |

| **Absolute pressure p/Mpa** | **Temp t(°C)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **250** | **260** | **270** | **280** | **290** | **300** | **310** | **320** | **330** | **340** | **350** |
| 0.20 | 0.834 | 0.818 | 0.803 | 0.788 | 0.774 | 0.760 | 0.747 | 0.721 | 0.721 | 0.709 | 0.698 |
| 0.30 | 1.256 | 1.230 | 1.208 | 1.185 | 1.163 | 1.142 | 1.122 | 1.084 | 1.084 | 1.066 | 1.049 |
| 0.40 | 1.680 | 1.647 | 1.615 | 1.585 | 1.555 | 1.527 | 1.500 | 1.449 | 1.449 | 1.424 | 1.401 |
| 0.50 | 2.108 | 2.066 | 2.025 | 1.986 | 1.949 | 1.914 | 1.879 | 1.814 | 1.814 | 1.784 | 1.754 |
| 0.55 | 2.323 | 2.276 | 2.231 | 2.188 | 2.147 | 2.108 | 2.070 | 1.998 | 1.998 | 1.964 | 1.931 |
| 0.60 | 2.539 | 2.487 | 2.438 | 2.391 | 2.345 | 2.302 | 2.260 | 2.182 | 2.182 | 2.145 | 2.109 |
| 0.65 | 2.755 | 2.699 | 2.696 | 2.594 | 2.544 | 2.497 | 2.452 | 2.366 | 2.366 | 2.326 | 2.287 |
| 0.70 | 2.973 | 2.912 | 2.853 | 2.797 | 2.744 | 2.693 | 2.643 | 2.551 | 2.551 | 2.507 | 2.465 |
| 0.75 | 3.191 | 3.125 | 3.062 | 3.001 | 2.994 | 2.889 | 2.836 | 2.736 | 2.736 | 2.689 | 2.643 |
| 0.80 | 3.411 | 3.339 | 3.271 | 3.206 | 3.144 | 3.085 | 3.028 | 2.921 | 2.921 | 2.871 | 2.822 |
| 0.85 | 3.631 | 3.554 | 3.481 | 3.412 | 3.345 | 3.282 | 3.221 | 3.107 | 3.107 | 3.053 | 3.001 |
| 0.90 | 3.852 | 3.770 | 3.692 | 3.618 | 3.547 | 3.480 | 3.415 | 3.293 | 3.293 | 3.236 | 3.181 |
| 1.00 | 4.296 | 4.204 | 4.116 | 4.032 | 3.952 | 3.876 | 3.804 | 3.667 | 3.667 | 3.603 | 3.541 |
| 1.10 | 4.745 | 4.641 | 4.542 | 4.449 | 4.360 | 4.275 | 4.194 | 4.042 | 4.042 | 3.971 | 3.902 |
| 1.20 | 5.198 | 5.082 | 4.972 | 4.869 | 4.770 | 4.676 | 4.587 | 4.419 | 4.419 | 4.340 | 4.265 |
| 1.30 | 5.654 | 5.526 | 5.405 | 5.291 | 5.182 | 5.079 | 4.981 | 4.798 | 4.798 | 4.711 | 4.629 |
| 1.40 | 6.114 | 5.974 | 5.841 | 5.716 | 5.598 | 5.485 | 5.378 | 5.178 | 5.178 | 5.084 | 4.994 |
| 1.50 | 6.579 | 6.425 | 6.280 | 6.144 | 6.015 | 5.893 | 5.776 | 5.560 | 5.560 | 5.458 | 5.361 |
| 1.60 | 7.049 | 6.880 | 6.723 | 6.575 | 6.435 | 6.303 | 6.177 | 5.943 | 5.943 | 5.834 | 5.729 |
| 1.70 | 7.522 | 7.340 | 7.169 | 7.009 | 6.858 | 6.715 | 6.580 | 6.329 | 6.329 | 6.211 | 6.099 |
| 1.80 | 8.001 | 7.803 | 8.072 | 7.446 | 7.284 | 7.131 | 6.985 | 6.716 | 6.716 | 6.590 | 6.470 |
| 1.90 | 8.484 | 8.271 | 8.529 | 7.886 | 7.712 | 7.584 | 7.393 | 7.105 | 7.105 | 6.971 | 6.843 |
| 2.00 | 8.973 | 8.743 | 8.990 | 8.330 | 8.144 | 7.968 | 7.802 | 7.496 | 7.496 | 7.353 | 7.217 |
| 2.10 | 9.466 | 9.219 | 9.455 | 8.777 | 8.578 | 8.391 | 8.214 | 7.888 | 7.888 | 7.737 | 7.593 |
| 2.20 | 9.965 | 9.700 | 9.924 | 9.228 | 9.015 | 9.965 | 8.628 | 8.283 | 8.283 | 8.123 | 7.970 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.30 | 10.47 | 10.19 | 10.40 | 9.682 | 9.456 | 9.244 | 9.045 | 8.679 | 8.679 | 8.510 | 8.349 |
| 2.40 | 10.98 | 10.68 | 10.87 | 10.14 | 9.899 | 9.675 | 9.464 | 9.078 | 9.078 | 8.899 | 8.730 |
| 2.50 | 11.50 | 11.17 | 11.36 | 10.60 | 10.35 | 10.11 | 9.886 | 9.478 | 9.478 | 9.290 | 9.112 |
| 2.60 | 12.02 | 11.67 | 11.84 | 11.07 | 10.80 | 10.55 | 10.31 | 9.880 | 9.880 | 9.683 | 9.495 |
| 2.70 | 12.55 | 12.18 | 12.33 | 11.53 | 11.25 | 1.98 | 10.74 | 10.28 | 10.28 | 10.08 | 9.880 |
| 2.80 | 13.08 | 12.69 | 12.83 | 12.01 | 11.71 | 11.43 | 11.17 | 10.69 | 10.69 | 10.47 | 10.27 |
| 2.90 | 13.62 | 13.21 | 13.33 | 12.48 | 12.17 | 11.87 | 11.60 | 11.10 | 11.10 | 10.87 | 10.66 |
| 3.00 | 14.17 | 13.73 | 13.84 | 12.97 | 12.63 | 12.32 | 12.03 | 11.51 | 11.51 | 11.27 | 11.05 |
| 3.10 | 14.73 | 14.26 | 14.35 | 13.45 | 13.10 | 12.77 | 12.47 | 11.92 | 11.92 | 11.67 | 11.44 |
| 3.20 | 15.30 | 14.80 | 14.86 | 13.94 | 13.57 | 13.23 | 12.91 | 12.34 | 12.34 | 12.08 | 11.83 |
| 3.30 | 15.87 | 15.34 | 15.39 | 14.44 | 14.05 | 13.69 | 13.36 | 12.76 | 12.76 | 12.48 | 12.23 |
| 3.40 | 16.45 | 15.89 | 15.91 | 14.94 | 14.53 | 14.15 | 13.80 | 13.18 | 13.18 | 12.89 | 1263 |
| 3.50 | 17.04 | 16.44 | 18.65 | 15.44 | 15.01 | 14.61 | 14.25 | 15.60 | 13.60 | 13.30 | 13.02 |
| 4.00 | - | 19.34 | 18.62 | 18.04 | 17.49 | 17.00 | 16.55 | 15.74 | 15.74 | 15.39 | 15.05 |

*Head Office*

**RLT INSTRUMENTATION PVT.LTD**

**#2, Rangarajapuram 1st Street, Kodambakam, Chennai – 600024.**

**Ph: 044-24806500 (10 Lines); Fax: 044-24806555**

**E-mail: chennai@rltech.in ; Website: www.rltech.in**