

Manufacturing Certificate  
CMC Shanghai No.02220105

# Instruction Manual

**TYPE FI/TBS  
FI/TBT  
FI/TBL  
FI**

**Flow Convertor**



 **SHANGHAI NO.9 AUTOMATION INSTRUMENTATION CO., LTD.**

A/SS VERSION; 2013.03  
ZNZQ-B064-C-Y

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**READ THIS MANUAL CAREFULLY BEFORE INSTALLATION AND USE**

# 1. General Description

This manual is for the installation, application and maintenance of Type FI Series Flow Converter designed and made by SAIC No.9 .

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The Flow Converter Type FI Series is designed for use with flow meter or flow sensor, such as turbine meter.

There is a pick-up in the bottom of the converter. As the equally-spaced ferromagnetic rotor blade pass through the magnetic field created by the pickup coil, a sinusoidal voltage is generated. The peak-to-peak voltage of this signal is directly proportional to the rotor speed and each positive peak-to-peak voltage pulse represents an increment of volume throughput.

The Flow Converter Type FI Series converts the sinusoidal voltage to square wave pulse ,than calculates and displays the instant flow rate and flow totalize, outputs pulse signal, changes to standard DC electrical current (4~20mA).

The Flow Converter performance is stable and trustiness, higher precision, fast response, easy and convenient for use, operation and service.

The type FI is with no display, and the others have a liquid crystal display, it shows that:

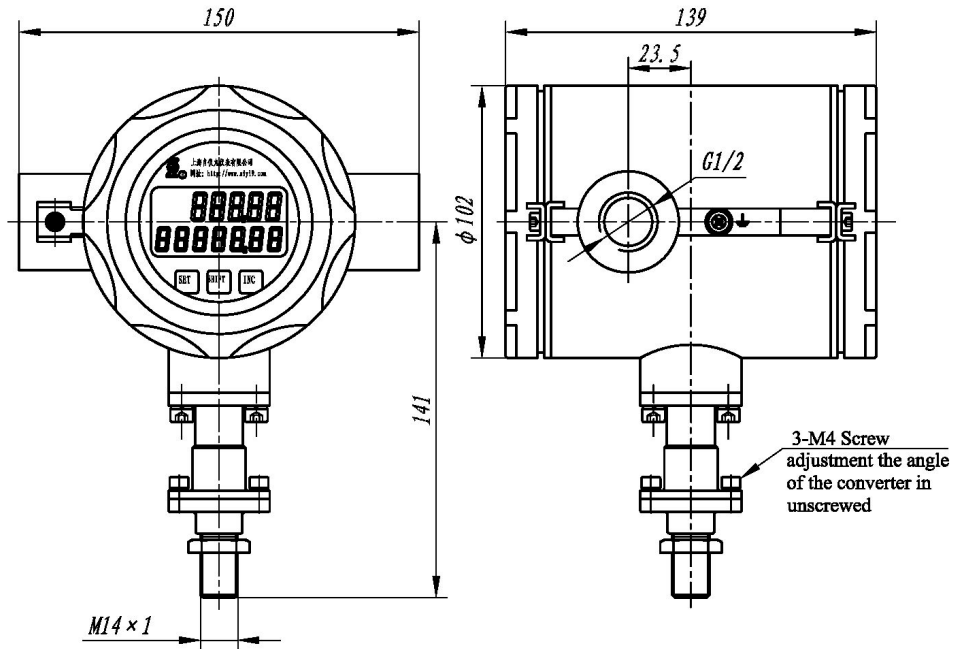
- FI/TBS Flow Converter: on-site instant flow (5-digits); totalized (7-digit)
- FI/TBT Flow Converter: on-site totalized flow (12-digits)
- FI/TBL Flow Converter: on-site instant flow (5-digits); flow in percentage (4-digits)

All above can be equipped with optional standard DC electrical current (4~20mA) output, when a standard current output is requested, please specify the maximum flow.

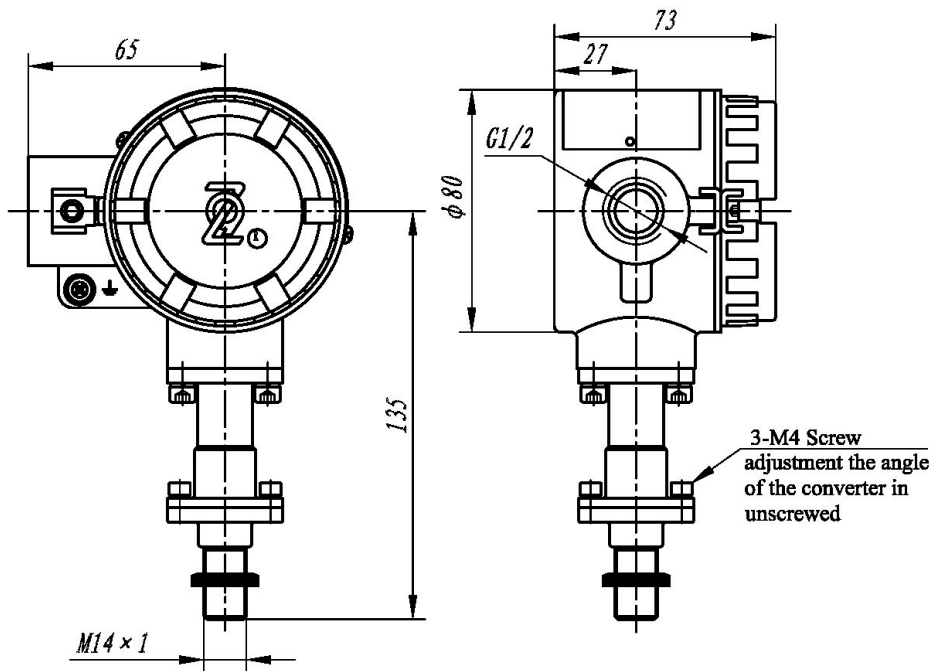
## 2. Technical Specifications

- 1) Frequency range: 2Hz~5000Hz
- 2) Totalized Flow Display: Decimal 7 digits
- 3) Instant Flow Display: Decimal 5 digits
- 4) Totalized Flow indicating error:  $\pm 1$  display unit
- 5) Instant Flow indicating error:  $\pm 0.01\%$  (REL)
- 6) Pulse output
  - Waveform: square wave
  - High level: (Supply Voltage  $V_{po}-2$ ) V
  - Low level:  $\leq 1$  V
  - (load resistance 10 k  $\Omega$ )
  - Power supply: DC 10 V~30 V
- 7) Current Output:( should be indicated with the max flow-rate in order)
  - 4~20mA
  - Tolerance: 0.1%(F.S.)
  - Temperature drift:  $\pm 50$ ppm/ $^{\circ}$ C
  - Response time:  $\leq 1$ s
  - Power supply: DC  $(10+R/40)$ V~30 V
  - (R: the resistance of load and cable)
- 8) Meter Coefficient Range: 0.10000~99999
- 9) Protected Duration if Power Failure : not less than 5 years
- 10) Working environmental
  - Ambient temperature:  $-20^{\circ}$ C to  $60^{\circ}$ C
  - Humidity: 0~85% non-condensing
- 11) Overall dimensions: see Figure 1
- 12) Weight: approximately 2.5 kg(FI/TBS) 1.2kg(FI)
- 13) Electrical approvals: d II CT1~T6, according to the standard GB3836.2-2010 《Explosive atmospheres – Part 2: Equipment protection by flameproof enclosures “d”》 ,degree of protection provided by enclosure:IP65

### 3. Dimensions & Installation Reference



Type FI/TBS,FI/TBT,FI/TBL Converter(with liquid crystal display)



Type FI Converter(no display)

Figure 1 Dimensions of outline and Installation

## 4. Installation & Wiring

### (1) Installation of convertor

In general, the convertor is installed on the flow meter.

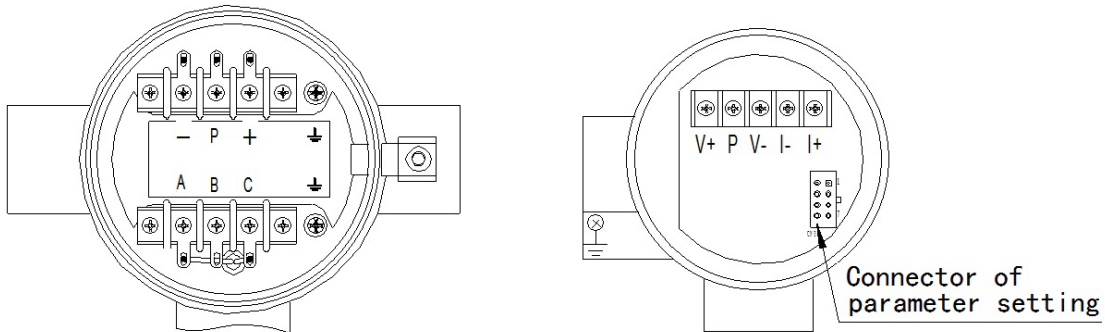
Mount the Flow Converter on the Flow Meter housing by M14×1 Screw. Put the Converter on the connection pad of the housing, rotate it into the pad manually, then fasten the lock nut finally.

### (2) Explosion-proof sealing connection

Fix the explosion-proof connector, and wiring as per Chapter 5 of this manual

### (3) Wiring

#### a) Wiring terminal



#### Type FI/TBS,FI/TBT,FI/TBL

Terminal definition:

- A: 4~20mA current loop (+)
- C: 4~20mA current loop (-)
- +: DC Power Supply (+)
- P: Pulse output
- : DC Power Supply (-)

#### Type FI

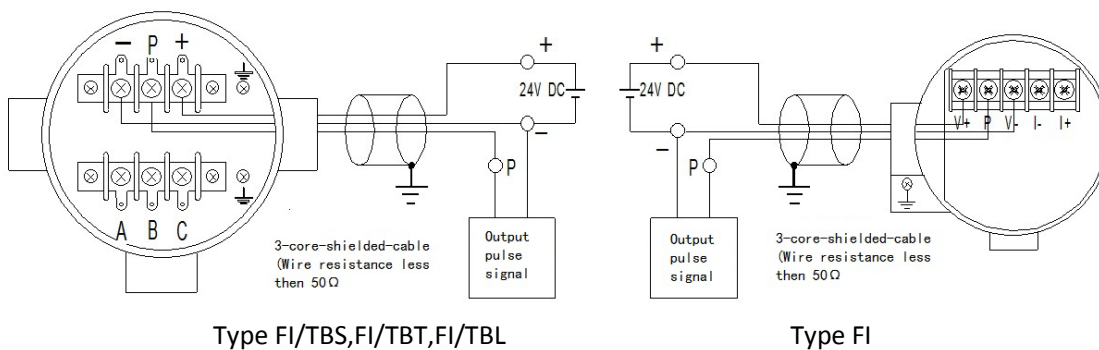
Terminal definition:

- I+: 4~20mA current loop (+)
- I-: 4~20mA current loop (-)
- V+: DC Power Supply (+)
- P: Pulse output
- V-: DC Power Supply (-)

Figure 2 Wiring terminal

*NOTE: The connector of parameter setting of Type FI is used for setting and modification of the converter's parameter, with specific liquid crystal display, setting method is as same as Type FI/TBS*

#### b) The Flow Converter wiring of pulse output



Type FI/TBS,FI/TBT,FI/TBL

Type FI

Figure 3 Wiring

c) The Flow Converter wiring of current output

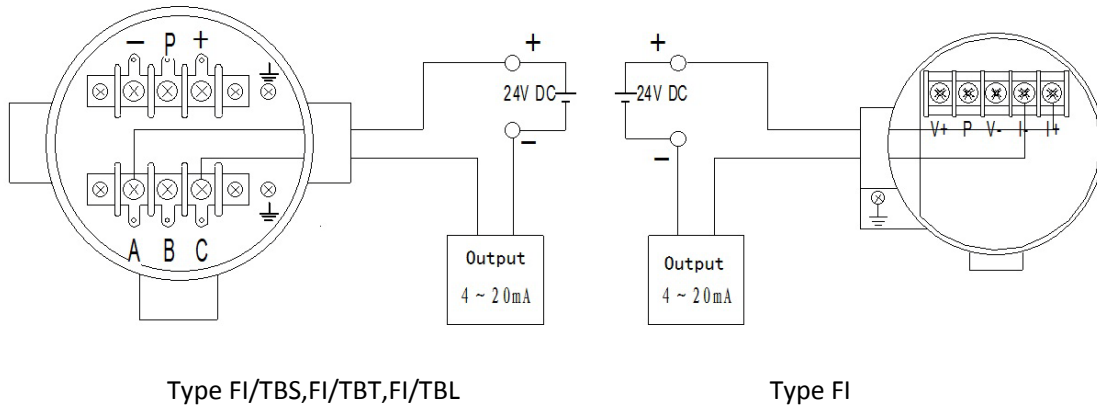


Figure 4 Wiring

## 5. Key Points to the Installation of Explosion-Proof products

Products marked with “Ex d II CT1~T6” can be used in the environment stipulated in the following standards:

GB3836.1-2010 《Explosive atmospheres – Part 1: Equipment – General requirement》 and GB3836.2-2010 《Explosive atmospheres – Part 2: Equipment protection by flameproof enclosures “d”》

for Explosion Class not higher than Explosion Class II, Grade C, Natural Temperature T1~T6 Group, Zone I or Zone II hazardous areas;

To secure SAFETY, user must be very careful in installation with bolts, cables and pipes and should pay high attention to safety regulations during maintenance;

1) Installation of Explosion-Proof Seal Connector: (see Fig.5)

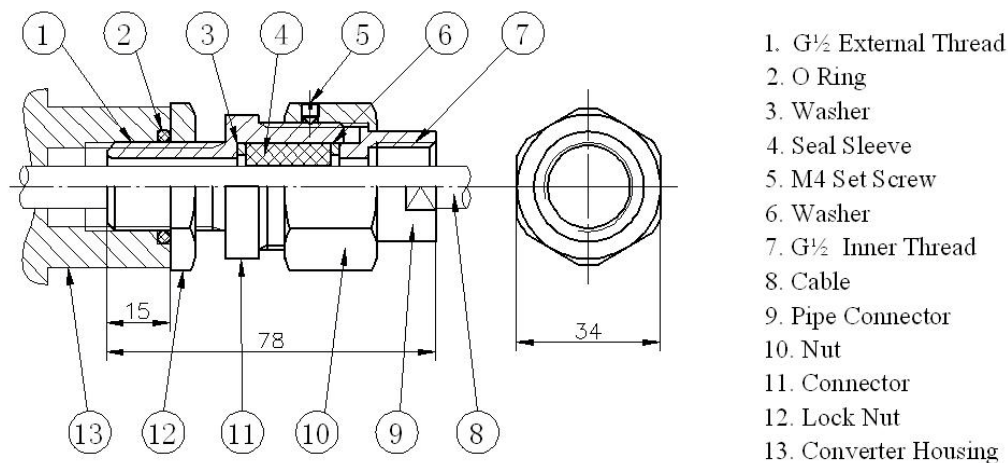


Fig. 5 Explosion-Proof Seal Connector

(1)Ground terminal is available; well- “grounded” is necessary in use

(2)During operation or maintenance on site, strictly observe the WARNING

“Open the cover only when power is off”

- (3) The out-diameter of leading cable is approximately  $\phi 9-10$ (mm); 3-core-shielded-cable is recommended;
- (4) Maintenance must be carried out in the safe area, where no combustible gas exists.

2) Ambient Conditions for Installation:

- (1) Ambient atmosphere pressure 80kPa ~ 110kPa; temperature  $-20^{\circ}\text{C} \sim +60^{\circ}\text{C}$ , maximum relative air humidity 90%
- (2) If there are combustible gases or vapors of flammable liquids working around, their explosion class must not be higher than Class II /Grade B; Natural Temperature within T4 Group; and Installation of the product is within Zone I or Zone II hazardous area.
- (3) Listed below is a Table that stipulates the temperature limitations; within the Temperature Grade, the maximum out-exposed-surface temperature between explosion-proof product and equipment as well as the medium temperature are not allowed to exceed the limitations;

Temperature Group Grade	T1	T2	T3	T4	T5	T6
Maximum Medium Temperature ( $^{\circ}\text{C}$ )	450	300	200	135	100	85

3) Usage:

- (1) If housing corrosion happens, replace it promptly;
- (2) Both internal and external ground terminals must be “grounded” properly; During maintenance, taking off the Terminal Box cover must be under power -off condition;
- (3) The seal ring within the cable-leading connector and the O ring within the cover must be replaced in time, as soon as they are ageing;
- (4) The connecting between wires and wiring-strips must be in firm and reliable way, meanwhile using insulation sleeve is also necessary, which shall be bent into right angle, to ensue the electrical gap bigger than 4mm
- (5) Leading cable should be suitable to the corrosive and high temperature enduring conditions on site;
- (6) During Terminal Box mounting, please to be sure, do not damage the thread and explosion-proof linkage surface;
- (7) On-site installation, application and maintenance of the product shall also abide by stipulations related to « GB50058-92 Design Requisition for the Electrical Equipment on Explosion & Fire Hazardous Site » and «GB3836 .15-2000».



## 6. Display meaning

There are 3 keys on the Converter panel, they are SET, SHIFT and INC respectively .

- Setting key SET: switch working, flow totalized setting and Flow coefficient setting
- Shifting key SHIFT: adjusting Total Flow Resolution in the total mode; shift the cursor 1-digit to the right in Flow Coefficient mode.
- Increasing 1 unit key INC: clean the total Flow Display in total mode; in Coefficient mode increasing 1 unit at the cursor position

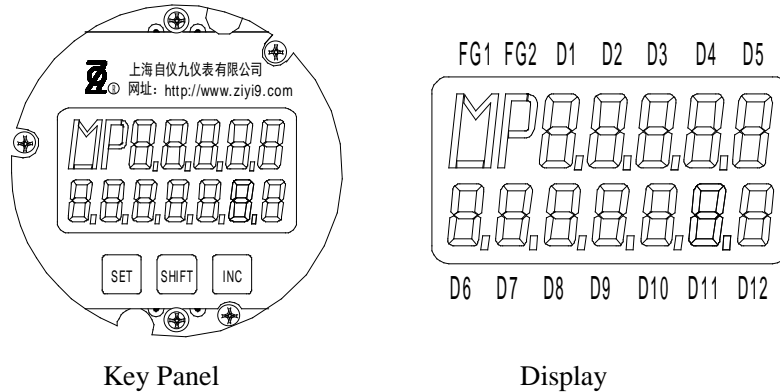


Fig. 6 Panel and Display

Display shows 14 characters in total:

FG1 and FG2 are prompt characters:

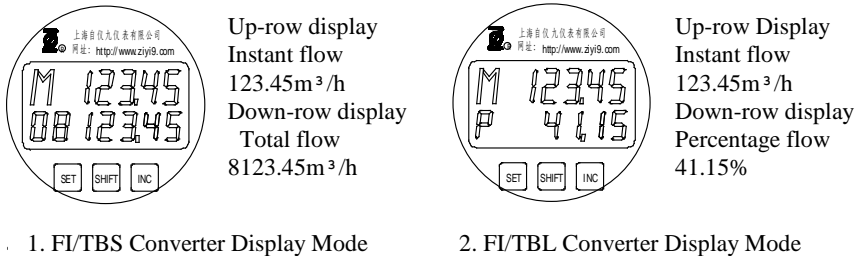
FG1 shows either M or L (M=Cubic Meter L=Liter)

FG2 shows P

D1-D5: up-row figure;

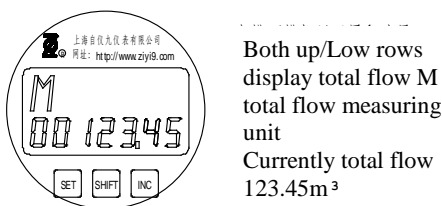
D6-D12 down-row figure

Display mode example as below:



1. FI/TBS Converter Display Mode

2. FI/TBL Converter Display Mode



3. FI/TBT Converter Display Mode

Note:

Up-row left prompt character display either M or L  
 If M: instant flow in  $m^3/h$ ; total flow in  $m^3$   
 If L: instant flow in L/h; total flow in L

Fig. 7 Display Mode

## 7. Settings on the Flow Converter

### (1)Operational Interface:

Varying by Type, Flow Converter operational interface can display as follows:

- a) Instant and Total Flow at the same time
- b) Instant and Percentage Flow
- c) Total Flow

Please refer to chapter 6 Converter Display Mode and examples

### (2)Settings:

#### Please read instructions below carefully before setting:

- a)The average meter coefficient is shown on the Quality Certificate attached to the Meter ; the Certificate should be well kept for reference; each time, after inspection or calibration, if the coefficient changes, the meter coefficient for the converter should be re-adjusted promptly.
- b) The biggest decimal point position for the total flow depends on the meter coefficient, in that case, the user can only move the decimal point to the backward position. During instant flow display, the scanning interval to the instant flow is 1 second , so reading is updated each second . Its decimal point position is locating automatically with full scale readings.

Meter coefficient range	The biggest decimal point position & Unit
0.10000-0.99999	XXXXXX.XX
1.0000-9.9999	XXXX.XXX
10.000-99.999	XXX.XXXX
100-999.99	XXXXX.XX
1000-9999.9	XXXX.XXX
10000-99999	XXX.XXXX

Full Scale Readings	Instant Flow decimal point
<8	X. XXXX
8-80	XX. XXX
80-800	XXX. XX
800-8000	XXXX. X
>80000	XXXXX

#### General instructions:

Following parameters can be set for Type FI/TBS, FI/TBL, FI/TBT, varying from Type:

- a) Clearing Total Flow (Except Type FI-TBL)
- b) Total Flow Resolution adjusting (Except Type FI-TBL)
- c) Flow coefficient (applicable to all types)

#### Total Flow Display clearing operation:

In working mode, push SET key to enter Total Flow mode, its operational interface like:

```

M t o t a l
76543.21
    
```

Under Total Flow setting mode, push INC key (increasing 1 key), Total Flow shows all zero, if push SET key, Clearing is completed ; if Clearing is not required, push INC again, the total flow display resumes, then, push SET key to return to the operational interface without clearing

#### Total Flow Resolution adjustment (actually shows Decimal Point position adjustment)

In working mode, push SET key to enter Total Flow mode, its operational interface like

Clearing.

The display accuracy of total flow is regarded as the digits kept after the decimal point of total flow displayed.

Higher display accuracy exhibits more precisely the Total Flow, but readings' overflow happens more often in that case, and the reverse is also true.

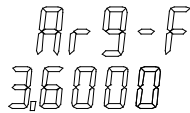
In Total Flow setting mode, push SHIFT key (Decimal Point Position Change Key), the Decimal Point

Position of the Total Flow displayed will change accordingly.

Beings Satisfied with the adjusting, then push SET key for operational interface return.

### Flow Coefficient Setting:

In operational mode, consecutively push SET key twice (for TBS; TBT, FI-TBS, FI-TBT); push SET key one time (for TBL, FI-TBL) to enter Flow coefficient, here shows the Operational Interface



The image shows a digital display with two lines. The top line displays 'A, 9 - F' and the bottom line displays '36000'. The digits '9' and '0' in the bottom line are flashing.

Decimal Point display is flashing at the time: push INC (increasing 1 key) to move the Decimal Point to the appropriate digit, push SHIFT key to enter the highest digit setting

The highest digit flashes this time: push INC key to enter the highest effective digit of the Flow Coefficient, push SHIFT for moving to 2<sup>nd</sup> digit.

Then the 2<sup>nd</sup> digit flashing, push INC key to enter 2<sup>nd</sup> digit of the Flow coefficient, push SHIFT for moving to the 3<sup>rd</sup>

Then the 3<sup>rd</sup> digit flashing, push INC key to enter 3<sup>rd</sup> digit of the Flow coefficient, push SHIFT for moving to the 4<sup>th</sup>

Then the 4<sup>th</sup> digit flashing, push INC key to enter 4<sup>th</sup> digit of the Flow coefficient, push SHIFT for moving to the lowest digit

Then the lowest digit flashing, push INC to enter the lowest effective digit of the Flow coefficient, push SET key to save the settings, meanwhile return to operational mode,

Or push SHIFT key to enter Decimal Point position setting (initial Decimal Points is flashing) and re-enter modification

## 8. Application Example

A Flow Meter with Meter Coefficient  $K=36.3065(P/L)$ ; full- scale- flow  $Q=40(m^3/h)$  (already being set at ex-works as per Order); display unit: Instant Flow  $XX.XXX (m^3/h)$ , Total Flow  $XXXXX.XX (m^3)$

Setting as follows:

- (1) When power is on, the meter opening picture appears, then it enters into the Operational Mode in about 3 seconds. If it is TBS, the display mode shall be “up-row for Instant Flow, down-row for Total Flow”
- (2) In Operational Mode, consecutively to push SET key twice to enter Flow Coefficient Setting, the interface is as shown:

A<sub>r</sub>9-F  
36000

- (3) Enter Flow Coefficient, K=36.3065, its 5-digit effective figure=36.307 after round, Push INC once, to set the Decimal Point like XX.XXX, the Meter shows as 36.000, push SHIFT for the highest digit; no change is needed at this digit, push SHIFT key directly for the 2nd digit, no change is needed for the 2nd; Push SHIFT for 3rd digit: push INC key 3 times, the 3rd digit shows 3; push SHIFT key for 4th digit ; no change is needed for 4th; push SHIFT for the 5th digit, push INC for 7 times, the 5th digit is set as 7, the interface appears at the time is shown like this:

A<sub>r</sub>9-F  
36,307

- (4) Push SET key, to confirm the Meter returns to Operational interface.

## 9. Transportation & Storage

- 1) During transportation or moving of the Flow Meter (dispatching it to the job-site or returning it for repair), please to keep the Ex-works packing condition that is initially provided by this company.
- 2) The Flow Meter shall be stored within the room where temperature ranges from 5-40C° and relative humidity does not exceed over 85%, with good ventilation and without corrosive gases.
- 3) Strictly prohibit from directly taking the Flow Convertor on the Flow Meter for the whole set moving

## 10. Notice for Ordering

Cable for the Flow Convertor Output is not included in the delivery. It is customer's own option. This company offers RVVP metal-shielded-cable with Polyethylene insulation, in 3 specifications as 3X23/0.15, 3X28/0.15; 3X32/0.15

If require, please specify the specification and length during order placing.

## 11. Accessories

- |                         |   |
|-------------------------|---|
| 1) Instruction Manual   | 1 |
| 2) Quality Certificate  | 1 |
| 3) Seal Ring            | 2 |
| 4) Wiring Strip         | 3 |
| 5) Wrench for Inner Hex | 1 |

The end.