

Electropneumatic Positioner  
ET-SP2智能电气阀门定位器



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## READ ME FIRST

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The Manual describes the steps for mounting, connection, and adjustment. It also contains detailed information about function and operation of our products.


The device must only be installed and operated by professional person.

The device must be connected to safety extra-low voltage which determined by power unit alone. High force generated by pneumatic actuators is dangerous for people.

Installation and operation must be carried out according to the strict safety regulations.

### Meaning of Terms

	<b>WARNING</b>
<b>Indicate a potential hazardous situation which, if not avoided, could result in death or serious injury.</b>	

	<b>CAUTION</b>
<b>Indicate a potential hazardous situation which, if not avoided, could result in property damage or serious injury.</b>	

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### Chapter 1 Principle

The ET-SP2 positioner is used for pneumatic linear or part-turn actuators. The positioner moves the actuator to a valve position corresponding to the setpoint from 4-20mA signal or computer binary signal.

Using piezo technology, the positioner can replace directly the traditional positioner with spray nozzle. Position Feedback module, Limit Switch module, HART module and other bus modules can be supplied as option.

Using Fuzzy PID control software, the positioner can auto select fine valve-parameters by itself, running fast, steadily and accurately. With a 32-Character LCD and four input keys, the valve can be operated easily at the scene, do not need other equipment.

The positioner can detect and sign any abnormal change on the actuator and valve. This information is important for diagnosis of the actuator or valve.

# Principle

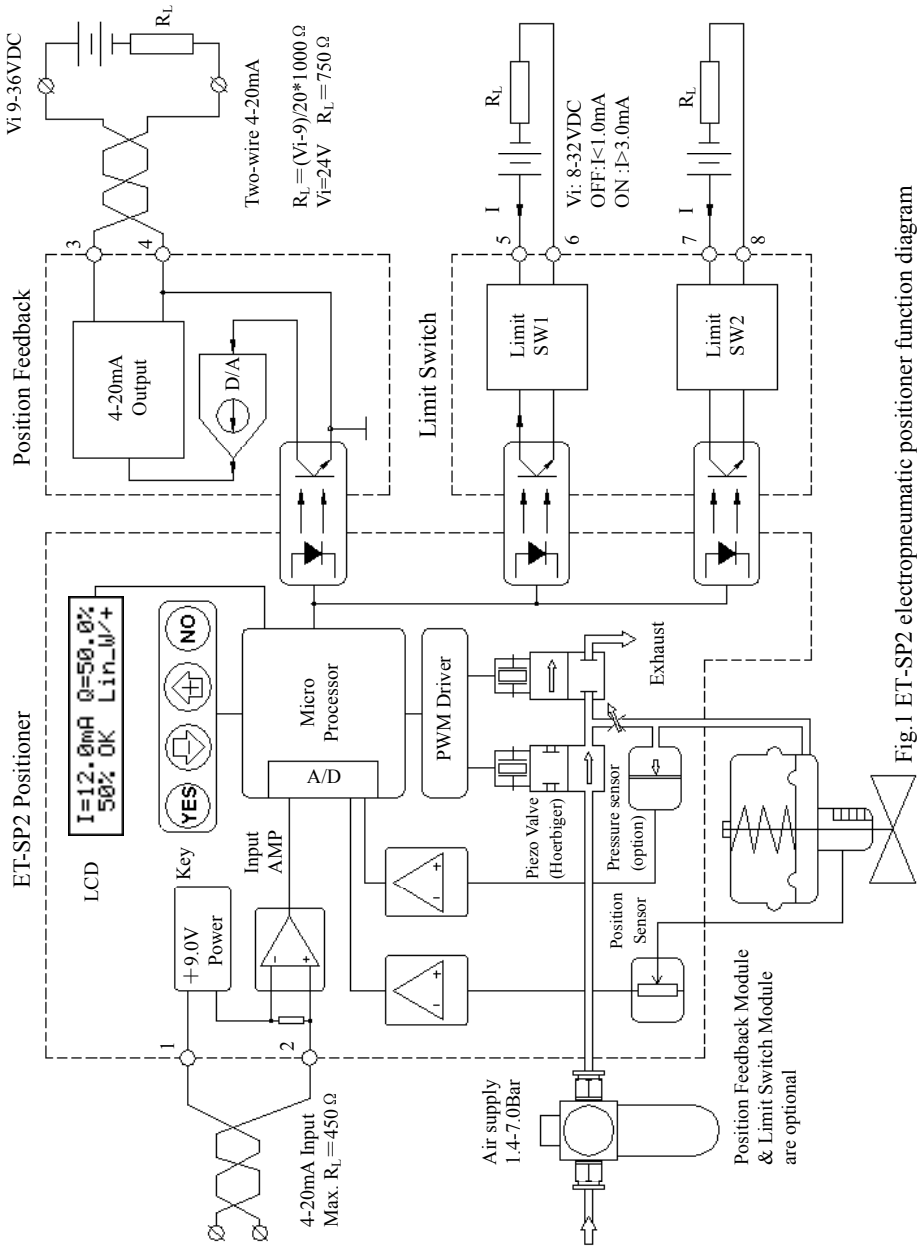


Fig.1 ET-SP2 electro-pneumatic positioner function diagram

## Chapter 2 Technical Data

### 2.1 Travel range

Linear actuators: 10 - 150mm

Rotary actuators: 30 - 105°

### 2.2 Input

Power Supply: Two-wire system, 4-20mA

Required load voltage: 9.0V (= 450 Ω)

Min. working current: 3.6mA

Ex Protection Certificate: ExiaIICT6/CNEx05.0840

Entity Parameters:  $U_i=28\text{VDC}$   $I_i=93\text{mA}$   $P_i=0.65\text{W}$   $C_i=0.04\mu\text{F}$   $L_i=0\mu\text{H}$

### 2.3 4-20mA Feedback Module

Power Supply: Two-wire system, 4-20mA, 9-36VDC

Load Resistance:  $(V_i-13)/20*1000\ \Omega$ , when  $V_i=24\text{V}$ , Max.  $R_L=550\ \Omega$

Isolation Voltage to Positioner: 1000V

Resolution: < 0.05%;

Transmission Error: <0.2%

Ex Protection Certificate: ExiaIICT6/CNEx05.0840

Entity Parameters:  $U_i=28\text{VDC}$   $I_i=93\text{mA}$   $P_i=0.65\text{W}$   $C_i=0.04\mu\text{F}$   $L_i=0\text{Mh}$



#### CAUTION

**The feedback output signal is less than 0.4mA, when the device has no power supply.**

**The feedback output signal will be uncertain, when the device is damaged.**

### 2.4 Limit Switch Module

Power Supply: Two-wire system, 8-32VDC, two channels

Isolation Voltage to Positioner: 1000V

Limit Switch Output: Acc. to DIN 19 234,  $R_L=1000\ \Omega$

OFF:  $I < 1.0\text{mA}$ , ON:  $I > 3.0\text{mA}$

Output Mode: eight output modes can be selected

Response Value: 0-100%

Precision: 1%

## Technical Data

Output Hysteresis: 1%  
Ex Protection Certificate: ExiaIICT6/CNEx05.0840  
Entity Parameters:  $U_i=15.5VDC$   $I_i=20mA$   $P_i=64mW$   $C_i=0.6\mu F$   $L_i=12\mu H$



**CAUTION**

**The Limit switch output signal is off, when the device has no power supply or the device is damaged.**

### 2.5 BUS Module

Other BUS Module such as HART, FF and M-BUS are optional on request.

### 2.6 Pneumatic data

Pressure: 1.4-7.0Bar, pressure must be larger than max. Actuator pressure  
Air Quality: Free from moisture, oil and dust  
dew point: min. 10°C below ambient temperature  
Normal Flow: 130 L/min at 6.0bar  
Air Consumption(steady state): 0.07Nm<sup>3</sup>/h  
Switching Time: <20mS

### 2.7 Other technical data

Overload Current: 60mA  
Linearity: 1.0%  
Sensibility: 0.08mA or  $\leq \pm 0.5\%$   
A/D Resolution: 12Bit, <0.02%  
A/D Scanning time: 5mS  
PWM(D/A) Resolution: 16Bit  
Pneumatic Connection: 1/4 NPT  
Electric Connection: M20\*1.5 or 1/2 NPT or others  
Casing & Internal Material: molded aluminium & surface oxidized  
Dimensions: 220mm\*83mm\*90mm  
Weight: 1800g  
Ambient Temperature Range: -30/+60°C  
Protection: IP 65



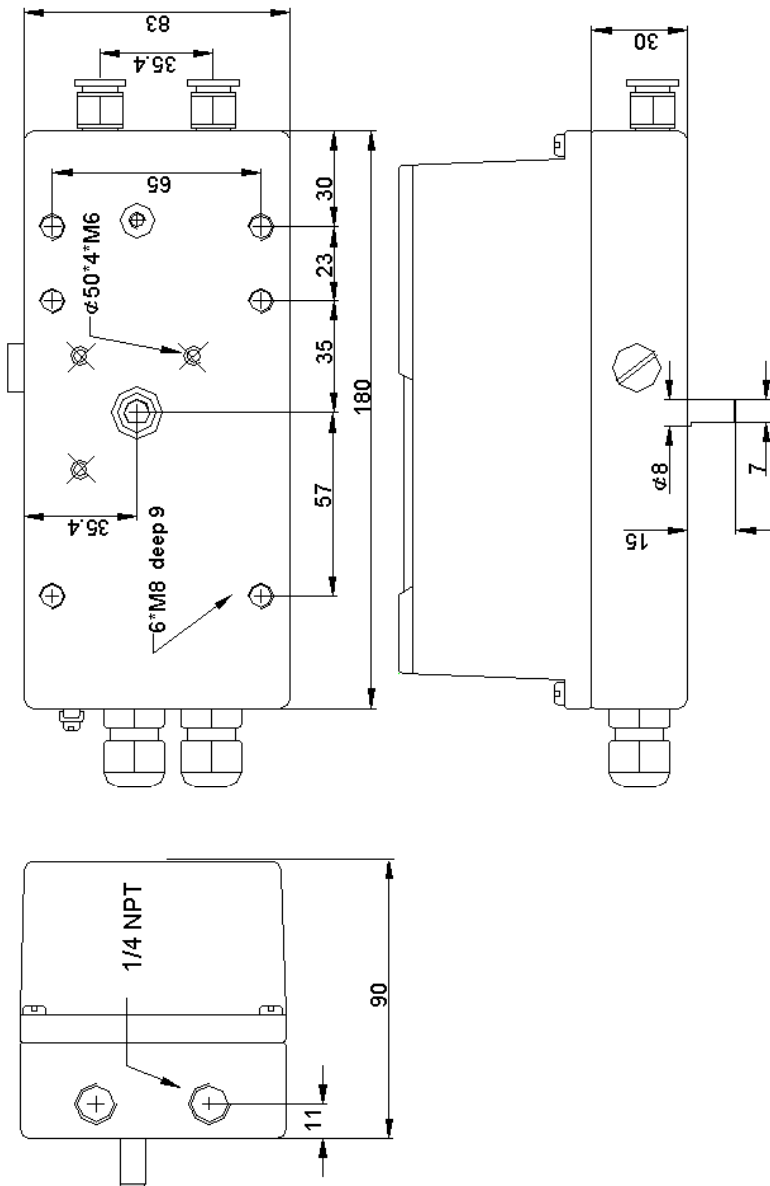
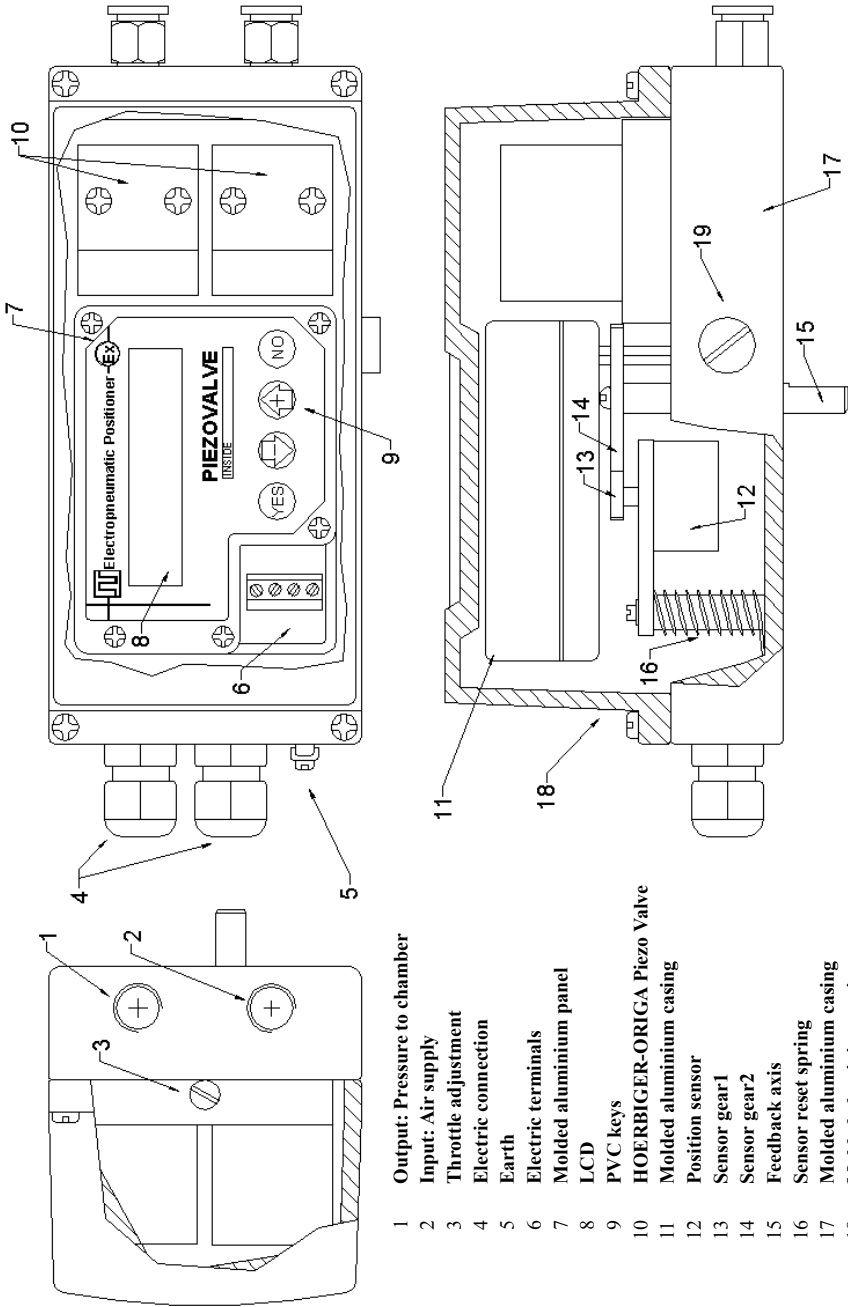


Fig.3 Dimensions of ET-SP2 Electropneumatic Positioner

# Structure



- 1 Output: Pressure to chamber
- 2 Input: Air supply
- 3 Throttle adjustment
- 4 Electric connection
- 5 Earth
- 6 Electric terminals
- 7 Molded aluminium panel
- 8 LCD
- 9 PVC keys
- 10 HOERBIGER-ORIGA Piezo Valve
- 11 Molded aluminium casing
- 12 Position sensor
- 13 Sensor gear1
- 14 Sensor gear2
- 15 Feedback axis
- 16 Sensor reset spring
- 17 Molded aluminium casing
- 18 Molded aluminium casing
- 19 Sound absorber

Fig.2 View of ET-SP2 Electropneumatic Positioner

## Mounting & Connection

### Chapter 4 Mounting & Connection

#### 4.1 Mounting ET-SP2 On Linear Actuator

For linear actuators, a feedback lever is used to convert travel range to angle range.

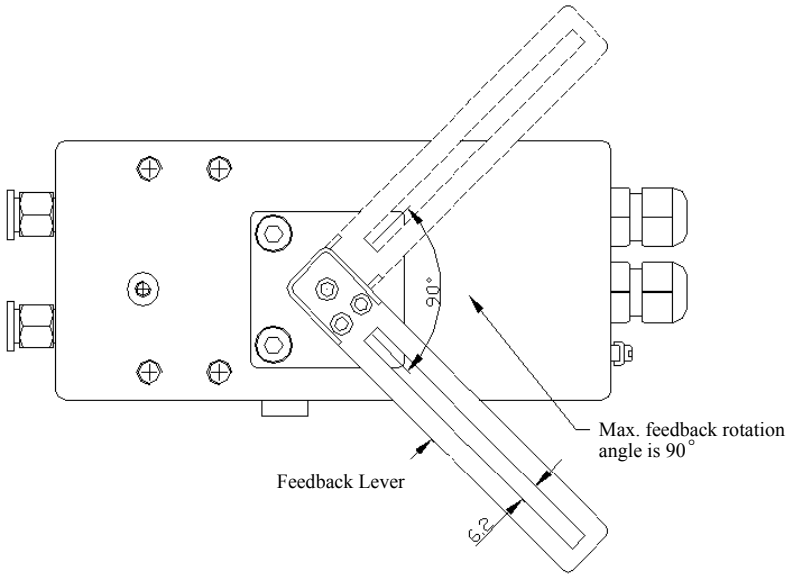


Fig.4 Installation of Feedback Lever

# Mounting & Connection

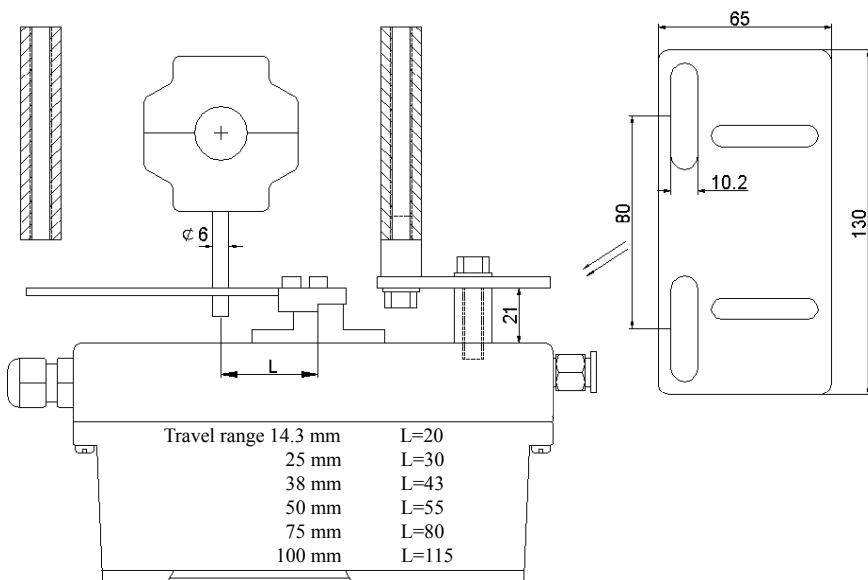


Fig.5 Mounting ET-SP2 On Linear Actuator

# Mounting & Connection

## 4.2 ARCA 812 Single-action Actuator

The ET-SP2 positioner is fitted for ARCA 812 Single-action Actuator without any accessories.

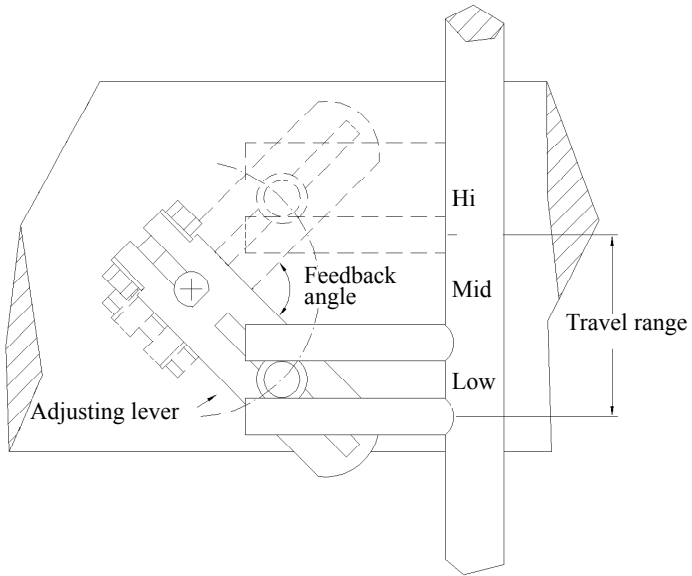


Fig.6 Mounting ET-SP2 On ARCA 812 Actuator

## Mounting & Connection

### 4.3 Mounting ET-SP2 On Part-turn Actuator

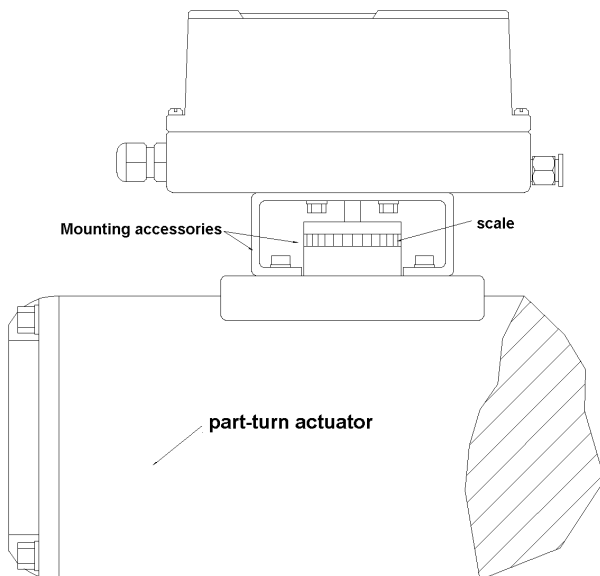


Fig.7 Mounting ET-SP2 On Part-turn Actuator

### 4.5 Electric Connection

- ①/②: 4-20mA Input +/-
- ③/④: 4-20mA Output +/- (Position Feedback)
- ⑤/⑥: Limit SW1 Output +/-
- ⑦/⑧: Limit SW2 Output +/-

## Functions & Menu Operation

### Chapter 5 Functions & Menu Operation

The four keys in Panel:

- YES Confirm selected value
- NO Cancel
- ▼ next option or reduce the input value
- ▲ pervious option or increase the input value

#### 5.1 Functions

The ET-SP2 positioner has the following functions:

**Select Linear or Part-turn actuators**

**Select NC(normally closed)/NO(normally open) actuators**

**Auto Calibrate**

**Manual Calibrate**

**Range split**

**Select Flow Curve**

**Define Customer Curve**

**Select Chamber Size**

**Define Dead Zone at low and high points**

**Select Sensibility**

**Configure Limit switch**

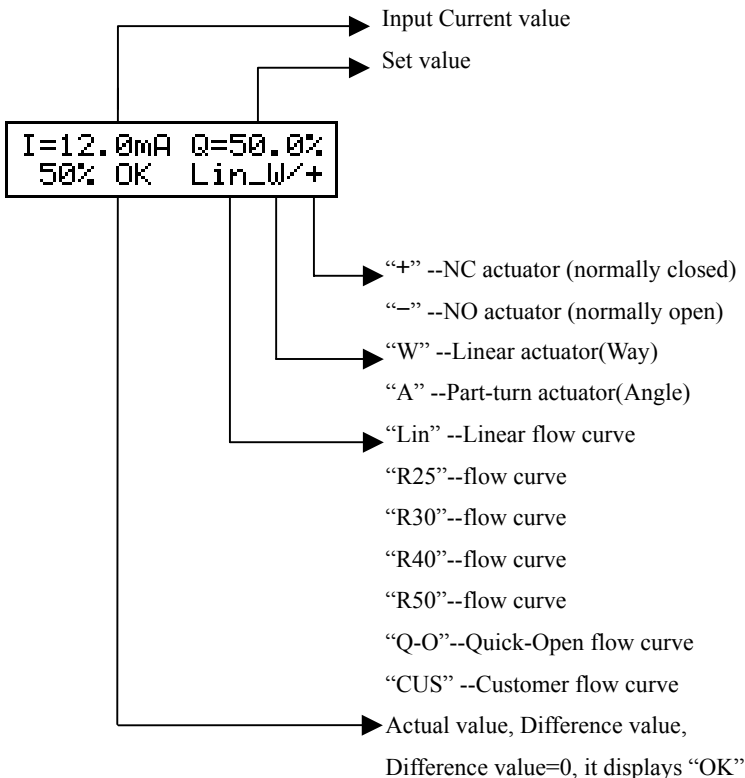
**Load factory set**

### How to open menu?

**When the input current over 4mA, Press “▼” or “▲” for one second, then LCD will display “Menu Open?”, press “YES” to open menu. If there is no operation in 20 seconds, the program will exit and return to the auto mode.**

# Functions & Menu Operate

## 5.2 Auto Mode Display



Note: Difference value means the difference between set value and actual value. For example, “41%<<9” means actual value is 9% lower than set value, “58%>>8” means actual value is 8% higher than set value. When the difference value is more than 10%, it only displays “>>>” or “<<<”; while value=0, it displays “OK”!



# Functions & Menu Operation

## 5.3 Menu Operate

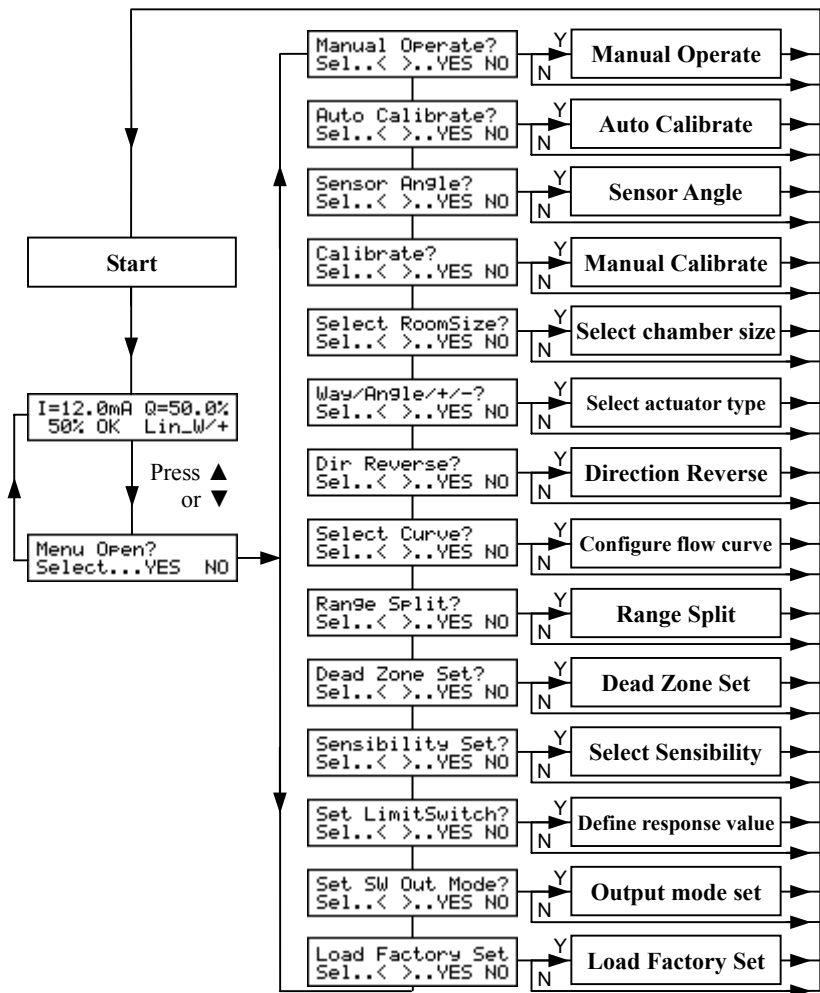


Fig.8 Program flow diagram

## Functions & Menu Operation

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### Manual Operate

LCD displays like the right figure, 42.0% is the setpoint, press “▼” or “▲” to change the value, the positioner will drive the actuator to the setpoint, press “NO” to exit.



Manual Set=42.0%  
40%<<2 No..Exit

### Auto Calibrate

See Chapter 7 "Auto Calibrate".

### Sensor Angle

See Chapter 6.4 “Sensor Angle”.

### Manual Calibrate

See Chapter 6.5 “Manual Calibrate”.

### Select Chamber Size

Select RoomSize: "Small/Medium/Large/Largest", it means the speed of air inlet or outlet, normally select “Medium”, when the valve moves too fast or too slow, press “▼” or “▲” to change the option, then press “YES” to save.

### Way/Angle/+/-

See Chapter 6.3 “Way/Angle/+/-” .

### Dir Reverse

See Chapter 6.2 “Dir Reverse”.

# Functions & Menu Operate

## Select Curve

LCD displays like the right figure, press “▼”

or “▲” to select the following options:



“Linear” -- Linear flow curve

“R25”-- flow curve

“R30”-- flow curve

“R40”-- flow curve

“R50”-- flow curve

“Q-open”-- Quick-open flow curve

“Customer” -- Customer flow curve

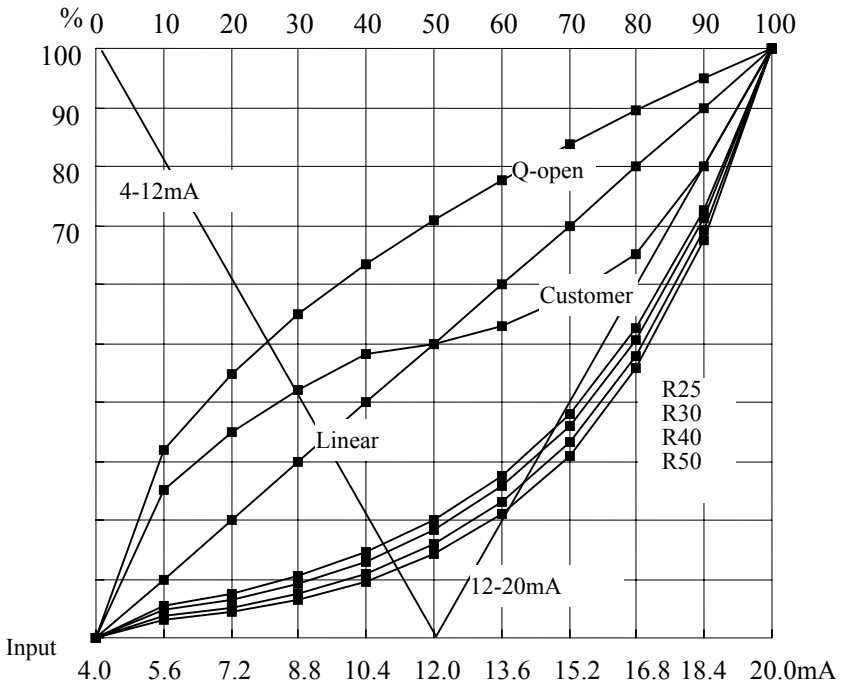


Fig.9 build-in flow curves and range split curves

## Functions & Menu Operate

%	Linear	R25	R30	R40	R50	O Open	Customer
<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	random
10.0	10.0	5.5	4.7	3.6	3.0	31.8	random
20.0	20.0	7.6	6.6	5.2	4.4	44.9	random
<b>25.0</b>	<b>25.0</b>	<b>9.5</b>	<b>8.0</b>	<b>6.5</b>	<b>5.0</b>	<b>50.0</b>	random
30.0	30.0	10.5	9.2	7.6	6.5	54.9	random
40.0	40.0	14.5	13.0	10.9	9.6	63.3	random
<b>50.0</b>	<b>50.0</b>	<b>20.0</b>	<b>18.3</b>	<b>15.8</b>	<b>14.1</b>	<b>70.8</b>	random
60.0	60.0	27.6	25.7	22.9	20.9	77.5	random
70.0	70.0	38.1	36.0	33.1	30.9	83.7	random
<b>75.0</b>	<b>75.0</b>	<b>45.5</b>	<b>43.5</b>	<b>40.5</b>	<b>38.5</b>	<b>86.5</b>	random
80.0	80.0	52.5	50.6	47.8	45.7	89.5	random
90.0	90.0	72.5	71.2	69.2	67.6	94.9	random
<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	random

Fig.10 flow curves table

While “Customer” curve selected, you should define 0%-100% 11 points flow value to make the customer curve.

At First, LCD displays like the right figure, press

“▼” or “▲” to change the value on point “0%”,

for example “9%”.

Then press “YES” to next points.

```
i/I___0%= 0%
Sel..< >..YES NO
```

```
i/I___0%= 9%
Sel..< >..YES NO
```

The original “Customer” curve is the same as “Linear” curve .

### Range Split

LCD displays like the right figure, press “▼” or “▲”

to select three modes: Off, 4-12mA, 12-20mA.

Press “YES” to save.

```
Split=Off
Sel..< >..YES NO
```

## Functions & Menu Operate

### Dead Zone Set at low&high position

“Dead Zone Set” has four options: Low/Hi/Low&Hi/Off.

Press “▼” or “▲” to select, press “YES” to save.

Low: Angle/+ or Way/(NC)

Setpoint < 1%, exhaust all pressure air

Setpoint > 2%, work normally

1.0% - 2.0%, keep the original state

Angle/- or Way/- (NO)

Setpoint < 1%, full filled with all pressure air

Setpoint > 2%, work normally

1.0% - 2.0%, keep the original state

Hi: Angle/+ or Way/(NC)

Setpoint > 99%, full filled with all pressure air

Setpoint < 98%, work normally

98% - 99%, keep the original state

Angle/- or Way/- (NO)

Setpoint > 99%, exhaust all pressure air

Setpoint < 98%, work normally

98% - 99%, keep the original state

Low&Hi: Both low and hi.

Off: No dead zone.



**CAUTION**

**For NC actuator, the suggested option is “Low”; for NC actuator, the suggested option is “Low&Hi”.**

**When you select “Low” or “Hi”, for some huge actuator, the exhausting time may be too long.**

**The air supply pressure must be lower than the safety pressure of the actuator.**

## Functions & Menu Operate

### Sensibility Set

LCD displays like the right figure,

press “▼” or “▲” to select the following six options:

0.8%(±0.4%), 1.2%(±0.6%), 1.6%(±0.8%),

2.0%(±1.0%), 2.4%(±1.2%), 2.8%(±1.4%).

```
Sensibility:1.2%  
Sel..< >..YES NO
```

### Set Limit Switch

LCD displays like the right figure. press “▼”

or “▲” to configure the response value of

Limit SW1(T5/T6), press “YES” to configure the response value of Limit SW2(T7/T8).

Press “YES” to save.

```
SW1 (T5/T6)= 10%  
Sel..< >..YES NO
```

### Set SW Out Mode

LCD displays like the right figure.

“NO” : normally open

“NC” : normally closed

“Min” : Limit Switch is on (for “NO”), if position value < SW value;

“Max”: Limit Switch is on (for “NO”), if position value > SW value.

“Min” : Limit Switch is off (for “NC”), if position value < SW value;

“Max”: Limit Switch is off (for “NC”), if position value > SW value.

SW Out Mode has the following 8 modes:

NO: S1=OFF S2=OFF

NO: S1=Min S2=Max

NO: S1=Min S2=Min

NO: S1=Max S2=Max

NC: S1=OFF S2=OFF

NC: S1=Min S2=Max

NC: S1=Min S2=Min

NC: S1=Max S2=Max

press “▼” or “▲” to select, press “YES” to save, press “NO” to exit.

```
NO:S1=Min S2=Max  
Sel..< >..YES NO
```

## Functions & Menu Operate

---

### Load Factory Set

Factory Set: Way/+, Dead Zone(Low), Range Split(off), RoomSize(Medium), Curve (Linear), Sensibility:(2.0%), SW1(10%), SW2(90%), SW Out Mode(NO:S1=Min S2=Max), Dir Reverse(OFF).

## Chapter 6 Adjustment

### 6.1 Position Sensor angle initialing

The full angle range of position sensor is 0-110°. Out of this range, the valve can't travel to full scale. For different actuators, the sensor original angle must be set according to the following regulations (see in figure.11&12).

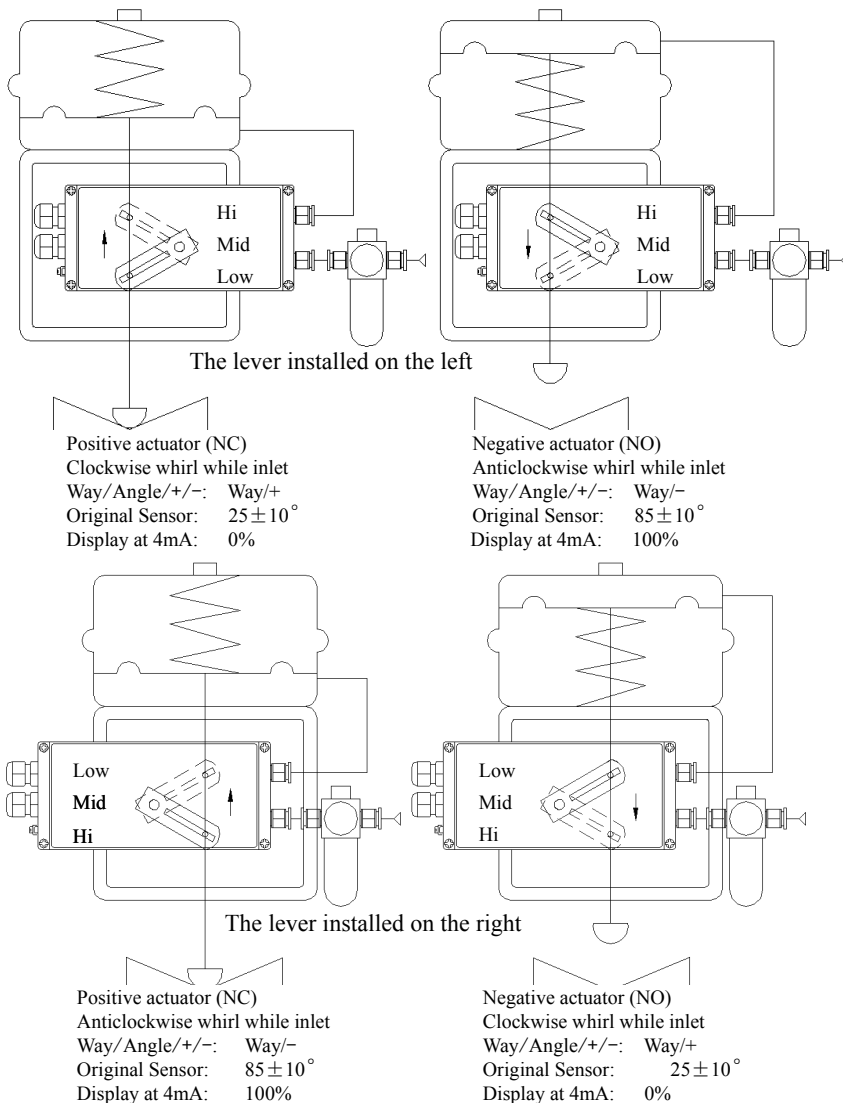


Fig.11 Linear actuator initialing regulations



# Adjustment

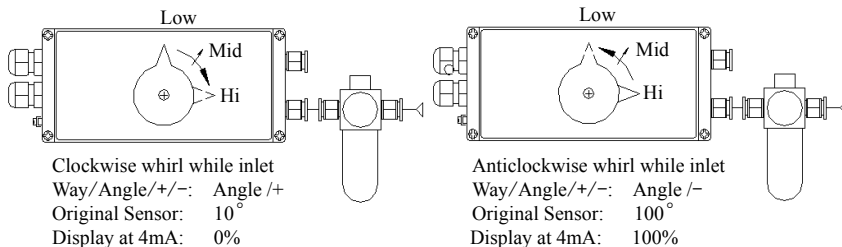


Fig.12 part-turn actuator initialing regulations

Note: Low=point 0%, Mid=point 50%, Hi=point 100%,

The positioner working angle must be within 5-105° .

We should adjust the original angle before calibrating. See Chapter 6.4.

## 6.2 Dir Reverse

Using “Dir Reverse” function, the position display will be changed. See in Fig.13

The function is helpful at observation sometimes.

Origin actuator type	Dir Reverse: OFF		Dir Reverse: ON, display change		
	Display at 4mA	Display at 20mA	Changed type	Display at 4mA	Display at 20mA
Way/+	0%(Low)	100%(Hi)	Way/-	100%(Hi)	0%(Low)
Way/-	100%(Hi)	0%(Low)	Way/+	0%(Low)	100%(Hi)
Angle/+	0%(Low)	100%(Hi)	Angle/-	100%(Hi)	0%(Low)
Angle/-	100%(Hi)	0%(Low)	Angle/+	0%(Low)	100%(Hi)

Fig.13 Display Change (Dir Reverse: ON)

## 6.3 Way/Angle/+/-

LCD displays like the right figure, press “▼” or “▲”

```
Model:Way/+
Sel.< >..YES NO
```

to select the types of actuator: Way/+, Way/-, Angle/+, Angle/-.

Press “YES” to save, press “NO” to exit.

## 6.4 Sensor Angle

LCD displays the right figure,  $\emptyset=20^\circ$  means the original angle = 20°. If the original sensor angle is not correct,

```
Sensor Angle
 $\emptyset=20^\circ$  No..Exit
```

push the spring board and turn the little gear until the angle is correct, see figure 14.

Then press “NO” to exit.

## Adjustment

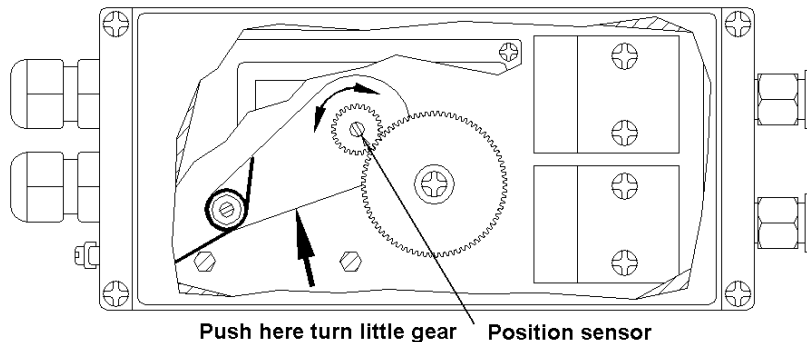


Fig.14 Adjust sensor angle by hand

### 6.5 Manual Calibrate

Note: Before calibrating, please check the sensor angle and make sure it is correct.

To know the meanings of Low, Mid and Hi, please see figure.11&12

LCD displays like the right figure,  $\emptyset$  means sensor angle, press “▼” or “▲” to drive the valve to zero position (0%), then press “YES”.

```
Low= 0%  $\emptyset$ =020°  
Sel..< >..YES NO
```

The valve will automatically move close to middle position, press “▼” or “▲” to drive the valve to the correct position (50%), then press “YES”.

```
Mid=50%  $\emptyset$ =050°  
Sel..< >..YES NO
```

The valve will automatically move close to high Position, press “▼” or “▲” to drive the valve to the correct position(100%), then press “YES”.

```
Hi=100%  $\emptyset$ =080°  
Sel..< >..YES NO
```

Note: If press “NO” to exit, Calibration can’t be completed.

Finally, the program will compute the parameters,

If it is correct, the right figure will display,

Press “YES” to complete the calibration.

If incorrect, you may check the lever and other reasons.

```
Save it?  
Sel..< >..YES NO
```

## Auto Calibrate

### Chapter 7 Auto Calibrate

The positioner can be auto calibrated and configure the parameters such as normal-open or normal-close actuator, zero point and full-scale point. The process will spend few minutes.

1. Detect zero position and display.

```
STEP1:DetectZero  
Zero Angle φ=025
```

2. Detect the direction of action: Rise or Fall.

```
STEP2:Detect Dir  
Direction=Rise
```

3. Detect full-scale value and display.

```
STEP3:DetectFull  
Full Angle φ=085
```

4. Detect exhausting time (position<5%) and display.

```
STEP4:Exhaust  
Time(<5%)=004.15
```

5. Detect full-scale time (position >95%) and display.

```
STEP5:Full Time  
(>95%)=002.35
```

6. Drive valve to these points:0%, 25%, 50%, 75% and 100%, get hysteresis value at these points and display.

```
STEP6:Test= 0.0%  
0% OK Lin_W/+
```

7. When all the process are completed, press “YES” to save, press “NO” to exit without save.

```
STEP7:Finish  
YES.Save No.Exit
```

Note: if the process can't be complete, please check the sensor angle and other parts .

# Order Instructions

## Chapter 8 Order Instructions

Single-action	ET-SP2-A	ET-SP2-A-P	ET-SP2-A-L	ET-SP2-A-P-L
Double-action	ET-SP2-D	ET-SP2-D-P	ET-SP2-D-L	ET-SP2-D-P-L
Descriptions	Basic device	Basic device Position Feedback	Basic device Limit Switch	Basic device Position Feedback Limit Switch
System Input	4.0-20.0mA 2-wire 9.0V	4.0-20.0mA 2-wire 9.0V	4.0-20.0mA 2-wire 9.0V	4.0-20.0mA 2-wire 9.0V
	Ui=28VDC Ii=93mA Pi=0.65W Ci=0μF Li=52μH	Ui=28VDC Ii=93mA Pi=0.65W Ci=0μF Li=52μH	Ui=28VDC Ii=93mA Pi=0.65W Ci=0μF Li=52μH	Ui=28VDC Ii=93mA Pi=0.65W Ci=0μF Li=52μH
Position Feedback Output		4.0-20.0mA		4.0-20.0mA
		Ui=28VDC Ii=93mA Pi=0.65W Ci=0.04μF Li=0μH		Ui=28VDC Ii=93mA Pi=0.65W Ci=0.04μF Li=0μH
Limit Switch Output			8-32VDC NC/NO OFF:<1.0mA ON:>3.0mA	8-32VDC NC/ NO OFF:<1.0mA ON:>3.0mA
			Ui=15.5VDC Ii=20mA Pi=64mW	Ui=15.5VDC Ii=20mA Pi=64mW