



JK-591 Series  
Intelligent Monocrystalline  
Silicon Transmitter

OPERATING MANUAL



**CN BOILER ENGINEERING SOLUTION LLC**



## Warning

- ★ Please pay attention to the warning signs of the packing!
- ★ The measured medium should not be frozen to prevent from breaking the sensor!
- ★ Only qualified and authorized personnel can install, use and maintain the transmitter. The qualified personnel is the persons with the related certificates of qualification and authorization, who are experienced in the assembly, electrical connection, use, and operation of the transmitters and similar devices.
- ★ The tools with the required dielectric strength should be used to ensure safety during the electric connection.
- ★ Please comply with the related safety regulations of electrical installation. For the anti-explosion transmitters, the anti-explosion regulations and standards should be observed. This transmitter can be used under high pressure and in corrosive mediums, it should be handled properly to avoid personal injuries and possible damage. While used in other countries, the corresponding national regulations should also be observed.
- ★ The power supply of the device should be double isolated from the network voltage.

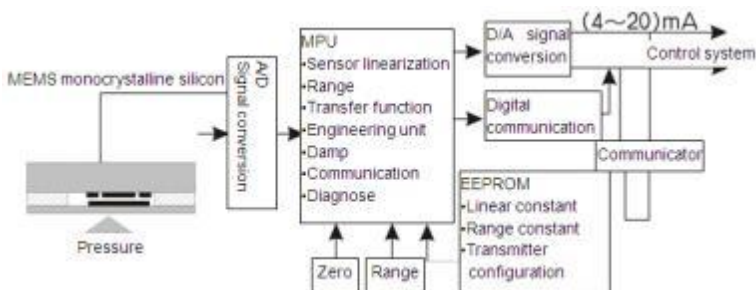
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## 1. Working principle

### 1.1 Schematic diagram

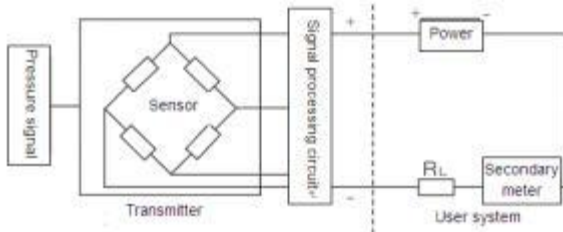
Please see Fig1- 1 for the schematic diagram of JK591 series intelligent transmitter.



**Fig. 1-1 Block diagram for working principle**

### 1.2 Working principle of JK591 series intelligent transmitter

The transmitter is composed of a sensor and signal processing circuit. There is a Wheatstone bridge on the pressure-sensing surface of the sensor. The resistance value of the bridge arm will change with the increasing pressure and then convert to standard (4~20)mA signal output via the signal processing circuit, as shown in Fig. 1-2.



**Fig. 1-2**

**D/A conversion**

After D/A conversion, the corrected digital signals, which are transmitted by the microprocessor, can be converted into 4~20mA analog signals and then output.

### **Digital communication**

Test and configure the JK591 intelligent transmitter through a communicator or complete the communication by an upper computer with HART communication protocol. HART protocol adopts the BELL202 Frequency Shift Keying (FSK) technology and realizes the communication by overlaying the 1200Hz or 2200Hz digital signal onto the 4~20mA signals. While communicating, there is no frequency signal interference.

## **2. Specification**

### **2.1 Performance index**

(Zero-base range, reference conditions, silicone oil filling liquid, 316SS isolation diaphragm, 4~20mA analog output)

The fine-tuned value is equal to the set point value of range.)

**Influence of zero point:** correct the zero position again or execute the pressure zero drift according to the field installation position etc.

**Damping time constant:** the total damping time constant can be obtained by the damping time constant of amplifier unit plus that of the diaphragm capsule. The damping time constant of amplifier unit is adjustable within the range of 0~100s.

Diaphragm capsule (silicone oil)

Time constant (S) (Set the time constant according to the actual condition of the field. It is suggested to be 1s.)

**Influence of installation position:** there will be no null drift effect by changing the installation position, which is parallel to the diaphragm surface. If the change between the installation position and

## JK-591 Series Intelligent Monocrystalline Silicon Transmitter

the diaphragm surface do not exceed 90°, the null shift within 0.4KPa can be corrected by zero setting without influencing the range.

Influence of power supply: less than  $\pm 0.005\%$  range/v

### 2.2 Functional parameters

Transmitter range and sensor limit value

Table 1. Range of JK591 series transmitter and the limit value of sensor

Converter type	Range code	Min. range	Range upper limit
JK591D	M	1KPa	40KPa
	H	2.5KPa	250KPa
	V	10KPa	1000KPa
JK591R	E	200Pa	1KPa
	L	600Pa	6KPa

Adjustment of zero point and range

- The zero point and range can be adjusted within the range limit indicated in Table 1.
- The range should be greater than or equal to the min. range indicated in Table 1.

Applications: measurement of liquid, gas and steam

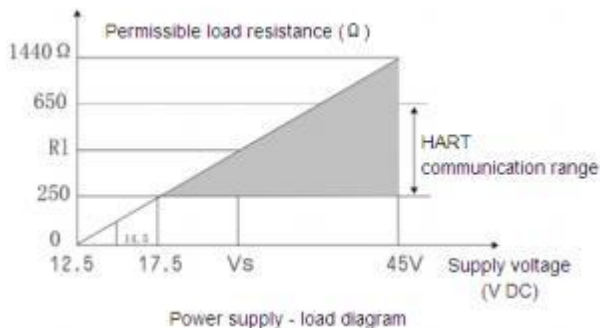
Output: two-wire 4-20mA, linear output or square root output is optional.  
The digital process variable overlaying on the 4-20mA signal can apply to all the host machines with HART protocol.

Power supply: An external power supply is needed. When the standard transmitter (4-20mA) works without load, the voltage is 14.5-45V DC.

Loop load limit

The max. Loop resistance is decided by the voltage of the external power supply, shown as in the following figure:

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Note: The supply voltage range of the transmitter with backlight display is 14.5~45V

The supply voltage range of the intrinsic-safety series transmitter is 14.5~28V.

The working voltage during HART communication should be larger than 17.5V.

### Fault mode

#### Output code

While discovering the faults of sensor or microprocessor by self diagnosis, the transmitter will output one high or low alarm signal to prompt the users. The alarm output value is subject to the factory configuration mode of the transmitter:

Linear output:  $3.8 < I < 20.8$

C4:  $I=20.8\text{mA}$  high fault

CN:  $I=3.8\text{mA}$  low fault

## 2.3 Temperature limit

Environment:  $-20^{\circ}\text{C} \sim +70^{\circ}\text{C}$

Storage:  $-46^{\circ}\text{C} \sim 110^{\circ}\text{C}$

With header:  $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$

Process: if  $\geq$  atmospheric pressure, please see the following table:

**Table 2. Process temperature limit of JK591 series transmitter**

Sensor (filled with Silicon oil)	-40 to 121 $^{\circ}\text{C}$
Sensor (filled with Inert liquid)	-30 to 121 $^{\circ}\text{C}$

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Humidity limit: 0- 100% relative humidity

Starting time: after power on, the transmitter will reach to the performance index within 2s

### 2.4 Mechanical performance index

Electrical interface:

ANSI (American Standard), NPT1/2(F) female resistance

ISO (Chinese standard), M20×1.5 female thread

Process interface:

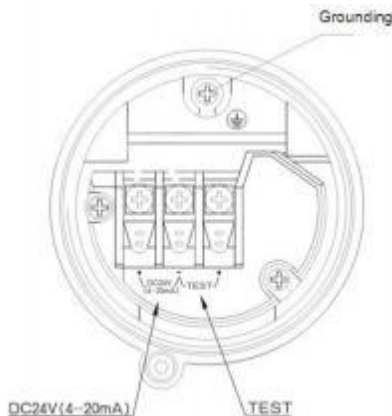
Without process joint (1/4 female NPT on the flange)

With waist-shaped joint: 1/2 taper tube female NPT

With T-shaped joint: M20×1.5 male NPT and back welding connecting tube (stainless steel)

With waist-shaped joint, 1/2 NPT transit joint and back welding connecting tube (stainless steel)

Wiring diagram of terminal side





### Connecting terminal

DC24V(4~20mA) <sup>+</sup> <sub>-</sub>	Power supply and output end
TEST <sup>+</sup> <sub>-</sub>	Connect to the testing terminal of ampere meter (impedance should be less than 10Q)
⏏	Grounding terminal

## 3. Calibration

JK591 series intelligent transmitter has been calibrated before out of factory. Please refer to this manual for the detailed modifications. This section introduces how to set the output unit, range, output type, damp, zero position of sensor and 4~20mA output.



Fig. 3-1 LCD display screen

### 3.1 Menu

- 1) Buttons
- 2) Present measured value/full range (%)
- 3) Present measured value (or display the PV value or the corresponding current value) or fault messages
- 4) Menu name or fault messages
- 5) Unit of the measured value

### 3.2 Adjustment of zero position and range

1) Button introduction:

Zero setting button (Z), full-scale setting button (S) & function button (M)

2) Zero setting and full-scale setting by buttons

Unlocking: simultaneously press button (Z) and button (S) for more than 3s (the LCD displays: OPEN).

Zero setting: if the range of the gauge pressure transmitter exceeds 10Mpa, zero setting should be executed in the field. Apply the zero-point pressure on the transmitter. After unlocking, press button (Z) for 3s, the output current will be 4.000mA. Then zero setting is finished (the LCD displays: LSET).

Full-scale setting: apply the full-scale pressure on the transmitter. After locking, press button (S) for 3s, the output current will be 20.000mA. Then the full-scale setting is finished (the LCD screen displays: HSET).

### 3.3 PV value reset

- 1) Under the measurement state, simultaneously press button (S) and button (Z) for more than 3s. The LCD displays OPEN (Unlocking);
- 2) Release and then repress the above mentioned two buttons for more than 3s. The LCD displays 0000. Then back to the measurement state;
- 3) Release the button and the reset is finished.

### 3.4 HART configuration software of intelligent transmitter

JK591Plus also provides the HART upper computer software and HART decoder. The transmitter can be debugged via HART communication interface and the parameters can also be set, adjusted and recovered.

## 3.5 Parameter settings:

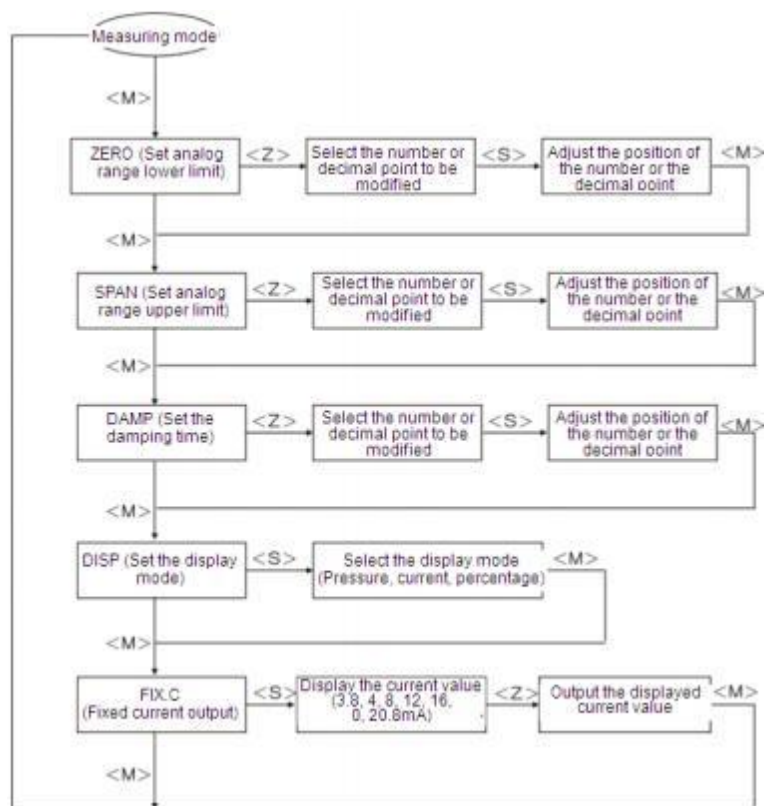


Fig. 3-2

Explanation: while setting the parameters, the transmitter will return to the measurement mode without pressing any button within 2 minutes (the set data will not be saved.)

### 3.6 Connection between the instrument and the communicator

Firstly, we will briefly introduce the connection of the external hardware. The traditional connecting circuit of the two-wire-system transmitter is shown as in the following figure:

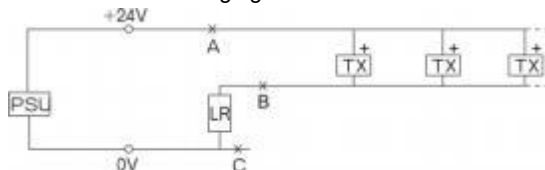


Fig. 3-3

The communication circuit of the master machine cannot be connected to the two terminals of the power supply directly. However, it can be connected to the two ends of the field (A, B) as well as to those of the load resistance (B, C) (Under both circumstances, the circuit should be powered by the power supply.). The permissible load resistance of HART is 250~650Ω. Shown as in Fig. 3-2, PSU is the power, LR is the load resistance and TX is the intelligent transmitter. It is a multilevel on-line mode of HART, which can allow up to 15 intelligent instruments every time.

## 4. Introduction of anti-explosion

### 4.1 Anti-explosion sign

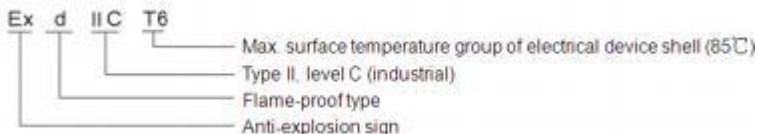
Sign for flame-proof type: Exd IIC T6 Gb

Product standard: Q/FSJY 008-2014

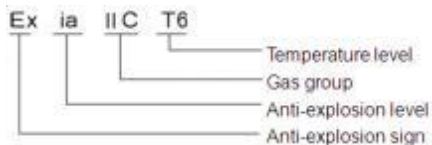
Sign for intrinsically safe type: Exia IIC T6 Ga

Product standard: Q/FJSR 001-2014

#### a) Flame-proof type



## b) Intrinsically safe type



## 4.2 Notices for anti-explosion

### 4.2.1 Flame-proof type

- 1) Please open the cover after power off;
- 2) The outer diameter of the lead-in cable should be same as the inner diameter of the seal ring. Please tighten the gland nut so that the seal ring can grip the cable shroud;
- 3) The shell of the transmitter should be grounded;
- 4) The users are not allowed to replace the parts by themselves;
- 5) The highest surface temperature grade of the shell is T6 ( $\leq 85^{\circ}\text{C}$ );
- 6) Please install, use and maintain the transmitter according to the operating manual and the related terms of **GB3836. 15-2000 Electrical Apparatus for Explosive Gas Atmospheres. Part 15: Electrical Installation in Hazardous Areas (Other Than Mines)**.

### 4.2.2 Intrinsically safe type

- 1) For the anti-explosion gaseous environment, please adopt the intrinsically safe systems composed of the associated anti-explosion apparatuses. The grounding of the system should comply with the operating manual of the transmitters and other associated apparatuses. The wiring terminal should be connected correctly;
- 2) The parameters and the max. internal equivalent parameters of intrinsic safety are as follows:

Max. input voltage $U_i$ (V)	Max. input current $I_i$ (mA)	Max. input power $P_i$ (W)	Max. internal equivalent parameter	
			$C_i$ (nF)	$L_i$ (mH)
28	93	0.65	0.03	0

- 3) It is not allowed to open the cover before power off;
- 4) The users are not allowed to replace the parts by themselves to avoid unnecessary breakdown;
- 5) Please repair the transmitter in the occasions without flammable gas;
- 6) The shield cable with insulating sheath should be used as cable jumper and the shielding layer should be grounded.
- 7) Please install, use and maintain the transmitter according to the operating manual and **GB3836. 13- 1997 Electrical Apparatus for Explosive Gas Atmospheres Part 13: Repair and Overhaul for Apparatus Used in Explosive Gas Atmospheres**, **GB3836. 15-2000 Electrical Apparatus for Explosive Gas Atmospheres. Part 15: Electrical Installation in Hazardous Areas (Other Than Mines)** , **GB3836. 16-2006 Electrical Apparatus for Explosive Gas Atmospheres Part 16: Inspection and Maintenance of Electrical Installation (Other Than Mines)** and **GB50257- 1996 Code for Construction and Acceptance of Electric Device for Explosion Atmospheres and Fire Hazard Electrical Equipment Installation Engineering**.

## 5. Parts of JK591 series transmitter

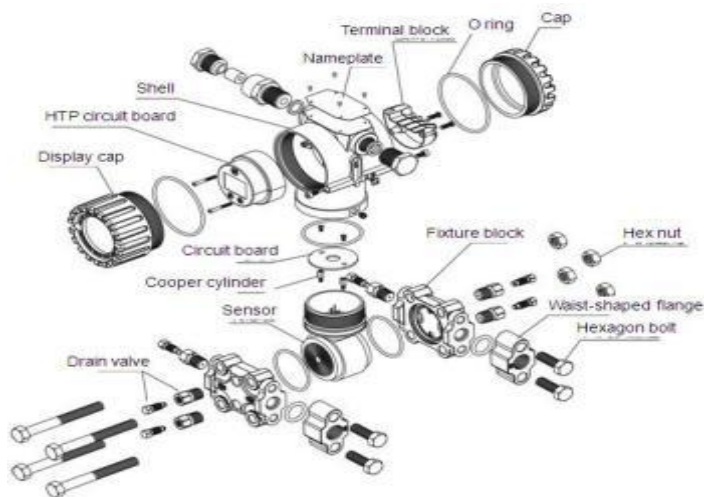


Fig. 5-1

## 6. Vulnerable parts

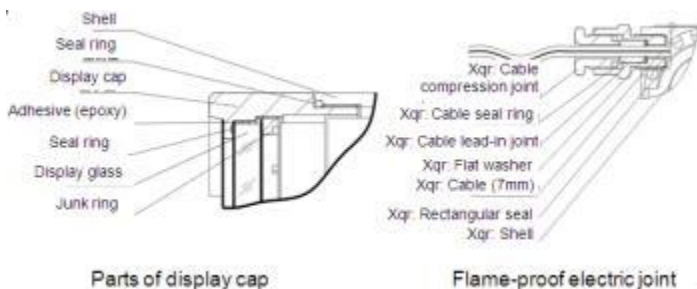


Fig. 6-1

## 7. Installation

### 7.1 External wiring diagram

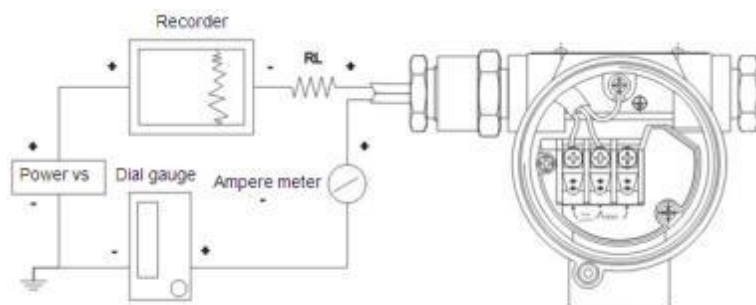
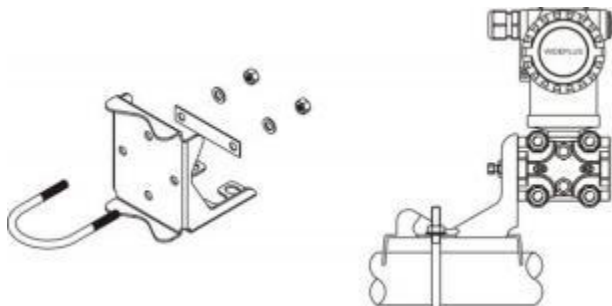
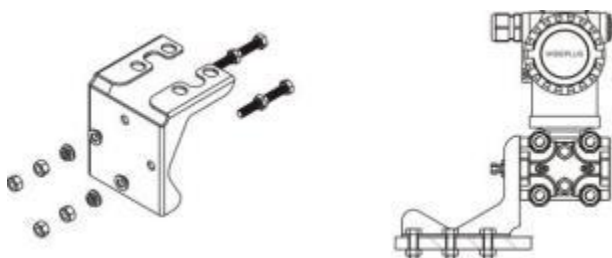


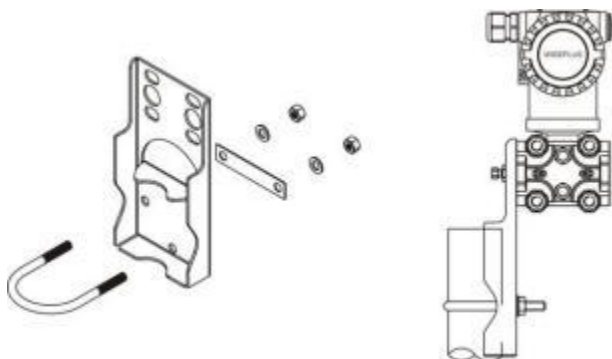
Fig. 7-1 External wiring diagram of JK591 series intelligent transmitter



Pipe installation (Code: B1)



Panel mounting (Code: B2)



Panel mounting (Code: B3)

**Fig. 7-2 Installation modes**



### **7.1.1 Installation and operating requirements**

- A. The transmitter can be directly installed on the measured point at any angles. If the interface cannot accord with the interface on the field, it can be connected by adapters;
- B. The transmitter should be installed in the occasions with less temperature changes, vibrations and shocks.
- C. If the transmitter should be used outdoors, please place it in a protection box so as to prevent from sunlight and rains;
- D. While measuring steam or other media at high temperature, please don't exceed the temperature limit. If necessary, install the lead-in tube or other cooling devices.
- E. A pressure stop valve should be installed between the transmitter and the medium for inspection and overhaul. Pressure buffers should be used in the occasions with large pressure fluctuations.

### **7.2 Unpack and product completeness**

Unpack, Before unpacking, please check the outer packing, transmitter model, specification and accessories.

#### **Product completeness**

Product	Quantity
Transmitter	1 piece
Operating manual	1 copy
Product qualification certificate	1 copy

### **7.3 Transportation and storage**

- 1) The transmitter can be transported by land and waterway.
- 2) The transmitter and its accessories can be stored indoors (ambient temperature:  $-20\sim 80^{\circ}\text{C}$ , relative humidity:  $\leq 90\%$ ) and there should not be corrosive gas which will corrode the transmitter.

### **7.4 Ordering instruction**

The matters needing attention while selecting the models:

- A. Sensor material; B. Whether used in an anti-explosion occasion;
- C. Connector material and connecting mode; D. Sealing element material;
- E. Accuracy; F. Range; G. Whether have other requirements.

## 8. Selection guide

### JK591D Series Monocrystalline Silicon Differential Pressure Transmitter

<b>Model</b>	<b>Transmitter type</b>	
JK591D-	Monocrystalline Silicon differential pressure transmitter	
<b>Code</b>	<b>Pressure measuring range</b>	
M	0-1 ~40KPa	
H	0-2.5~250KPa	
V	0-10 ~ 1000KPa	
<b>Code</b>	<b>Transmitter output</b>	
S	Standard intelligent type (4~20) mA DC with HART protocol	
J	Standard intelligent type (4~20) mA DC with HART+ $\sqrt{\Delta P}$ output	
<b>Code</b>	<b>Filling liquid</b>	<b>Diaphragm</b>
1	Silicone oil	316L stainless steel
2	Fluorocarbon oil	316L stainless steel
3	Silicone oil	Hastelloy C
4	Fluorocarbon oil	Hastelloy C
<b>Code</b>	<b>Electrical interface</b>	
A	1/2 female NPT	
M	M20×1.5 female NPT	
<b>Code</b>	<b>Gauge outfit</b>	
-M	LCD display	
-N	Without gauge outfit	
<b>Code</b>	<b>Anti-explosion grade</b>	
N	Ordinary type (without anti-explosion)	
D	Flame-proof type ExdIICT6	
I	Intrinsically safe type ExiaIICT6	
<b>Code</b>	<b>Mounting bracket</b>	
B3	Pipe-mounted flat bracket (2" pipe)	
B1	Pipe-mounted bent bracket (2" pipe)	
B2	Plate-mounted bent bracket	
<b>Code</b>	<b>Process connecting type</b>	
P	Without process joint (1/4 female NPT on the flange)	
N	With waist-shaped joint: 1/2 taper tube female NPT	
J	With T-shaped joint: M20×1.5 male NPT and back welding connecting tube (stainless steel)	
C	With waist-shaped joint, 1/2 NPT transit joint and back welding connecting tube (stainless steel)	
<b>Code</b>	<b>Installed with valve bank (Optional)<sup>(1)</sup></b>	

## JK591 Series Intelligent Monocrystalline Silicon Transmitter

T3	3-valve manifold
V3	3-valve manifold
V5	5-valve manifold
<b>Code</b>	<b>Other options</b>
H	The measuring accuracy is 0.075%FS
S	The contacted parts adopt 316 stainless steel <sup>(2)</sup>
D0	The drain valve is on the back surface of the fixture block
D1	The drain valve is on the top of the fixture block's side face
D2	The drain valve is on the bottom of the fixture block's side face
Q4	Verification certificate (please contact Wide Plus)
C4	High alarm
CN	Low alarm (If the user do not select, it will be no alarm for default.)
<b>Example</b>	<b>JK591D-MS1A-MDB3NDO</b>

Note: If needing higher precision, please contact the marketing representatives of CN boiler.

Note (1): "Installed with valve bank" is optional. Unless otherwise requested, the materials will be 316 stainless steels. If you choose this option, only "P: without process joint" can be selected.

Note (2): The default contact parts adopt 304 stainless steels.

## JK591R Series Monocrystalline Silicon Micro Differential Pressure Transmitter

Model	Transmitter type	
JK591R-	Monocrystalline Silicon micro differential pressure transmitter	
Code	Pressure measuring range	One-way overpressure
E	0-0.2 ~ 1KPa	200KPa
L	0-0.6 ~6KPa	4MPa
Code	Transmitter output	
S	Standard intelligent type (4~20) mA DC with HART protocol	
J	Standard intelligent type (4~20) mA DC with HART+ $\sqrt{M\bar{P}}$ output	
Code	Filling liquid	Diaphragm
1	Silicone oil	316L stainless steel
2	Fluorocarbon oil	316L stainless steel
3	Silicone oil	Hastelloy C
4	Fluorocarbon oil	Hastelloy C
Code	Electrical interface	
A	1/2 female NPT	
M	M20×1.5 female NPT	
Code	Gauge outfit	
-M	LCD display	

## JK591 Series Intelligent Monocrystalline Silicon Transmitter

-N	Without gauge outfit
<b>Code</b>	<b>Anti-explosion grade</b>
N	Flame-proof type ExdIICT6
D	Intrinsically safe type ExiaIICT6
I	Flame-proof type ExdIICT6
<b>Code</b>	<b>Mounting bracket</b>
B3	Pipe-mounted flat bracket (2" pipe)
B1	Pipe-mounted bent bracket (2" pipe)
B2	Plate-mounted bent bracket
<b>Code</b>	<b>Process connecting type</b>
P	Without process joint (1/4 female NPT on the flange)
N	With waist-shaped joint: 1/2 taper tube female NPT
J	With T-shaped joint: M20×1.5 male NPT and back welding connecting tube (stainless steel)
C	With waist-shaped joint, 1/2 NPT transit joint and back welding connecting tube (stainless steel)
<b>Code</b>	<b>Installed with valve bank (Optional)<sup>(1)</sup></b>
T3	3-valve manifold
V3	3-valve manifold
V5	5-valve manifold
<b>Code</b>	<b>Other options</b>
H	The measuring accuracy is 0.2%FS
S	The contacted parts adopt 316 stainless steel <sup>(2)</sup>
D0	The drain valve is on the back surface of the fixture block
D1	The drain valve is on the top of the fixture block' s side face
D2	The drain valve is on the bottom of the fixture block' s side face
Q4	Verification certificate (please contact Wide Plus)
C4	High alarm
CN	Low alarm (If the user do not select, it will be no alarm for default.)
<b>Example</b>	<b>JK591R-ES1A-MDB3ND0</b>

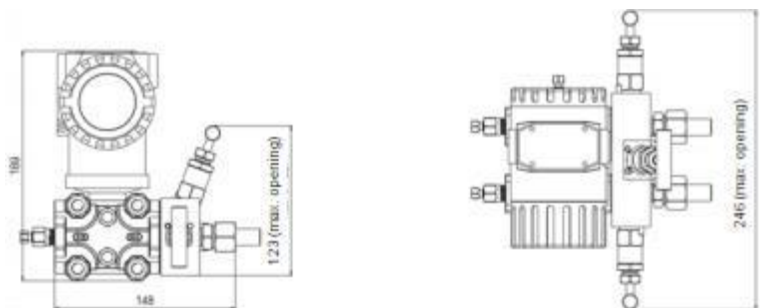
Note: If needing higher precision, please contact the marketing representatives of Wide Plus.

Note (1): "Installed with valve bank" is optional. Unless otherwise requested, the materials will be 316 stainless steels. If you choose this option, only "P: without process joint" can be selected.

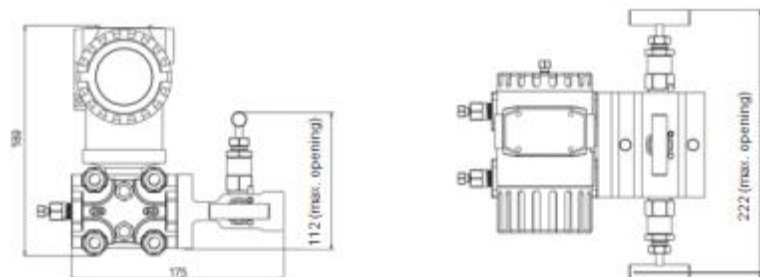
Note (2): The default contact parts adopt 304 stainless steel.

### 9. Dimension (with valve banks)

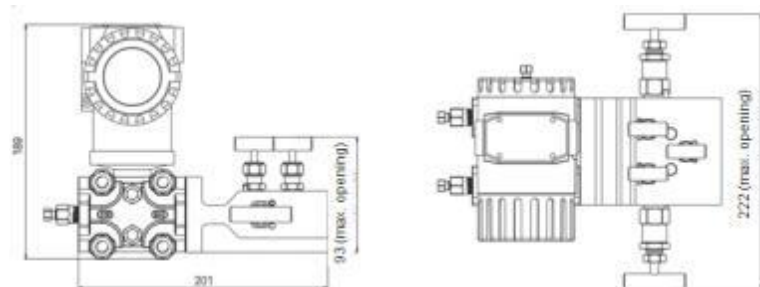
## JK591 Series Intelligent Monocrystalline Silicon Transmitter



Dimension (with T3 series 3-valve manifold)



Dimension (with V3 series 3-valve manifold)



Dimension (with V5 series 5-valve manifold)

**CN BOILER ENGINEERING SOLUTION LLC**

**ADD:** Building 7, No.16 Jinzhan Street, High & New Technology  
Development Zone, Zhengzhou City

**Tell:** 0371-56520101 17638563962

**Technical Service:** 17638562515 17638569108

**Email:** heidyhan89@cnboilersolution.com