

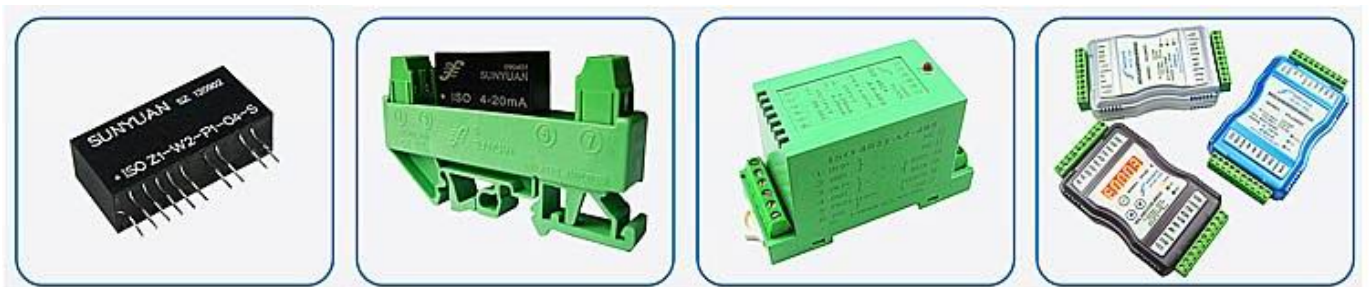
The Referential Solution on the Connection Scheme between PLC System and Sensor

Generalization:

In industrial field, the technical design used in analog sensors for pressure, displacement, temperature, flow rate, rotational speed etc is different. In the sensor, two-wire and four-wire are the common modes in its power distribution, and there are differences in analog signal output, the most common output signals are 0-20mA /4-20mA current signal and 0-75mV, 0-5V,1-5V voltage signal. And in order to successfully gather all kinds of analog signal of sensors into PLC/DC/FCS/MCU/FA/PC system, a matching selection needs to be done on the basis of the functions and technical features of sensors and data acquisition system, and the power supply differences of sensors and data acquisition system as well as the EMC interference in industrial field also need to be considered. Usually the analog signal is transmitted to PLC and other data acquisition system after being isolated, amplified and converted. PLC gathers the analog or digital signals from sensor through signal wire, then process the signals, if the output of sensor is analog type, the PLC should be connected to analog input port, otherwise it should be connected to digital input port.

Switch value sensor is a zero contact switch, it can be used as the switch value to input signal, usually as the switch value controlling equipments like in machine, machine tools, etc. Analog sensor transforms different physical quantities (e.g.:pressure, flow rate, temperature) into analog quantities (4-20mA current/ 1-5V voltage). Analog sensor as the analog input module usually used in process control to input signal. Digital sensor refers to the sensor which outputs digital signal or code by adjusting or modifying the A/D conversion module in traditional analog sensors, such as amplifier, A/D transformer, microprocessor, communication interface circuit etc.

The commonly used analog sensors are mainly divided into two types: two wires sensor and four wire sensor, both of them only have two signal wires. The differences between them is that the two signal wires of two-wire sensor not only need to supply the power to sensor or transformer, but also need to supply current and voltage signal, but the two signal wires of four-wire sensor only supply current signal. Therefore, the sensor which supplies two-wire current and voltage signal is usually passive sensor, and the sensor which supplies four-wire current signal is usually active sensor. Consequently, when the input channel of data acquisition system module (PLC or others) is set to link with four-wire sensor, PLC only gathers analog signal from the terminal of template channel; and when the input channel of data acquisition system module (PLC or others) is set to link with two-wire sensor, analog input template of PLC needs to output the 24 VDC power source to drive the two-wire sensor. The current 4-20mA, connected with electro-technical standard, is set by the IEC which used as the analog signal standard in process controlling system. In China, the technician begins to adopt this international signal system in DDZ-III electrodynamic instrument, the input signal is 4-20mA, the link signal is 1-5VDC, that means they adopt current transmission, voltage acquisition signal system. And because the starting point current 4mA provides the static operation current for the transmitter, and electrical zero position of instrument 4mA is not coincide with the mechanical zero position, that dynamic zero position is contribute to recognize the malfunctions like power supply interruption, disconnection etc.



IC Package and Standard DIN 35 Products

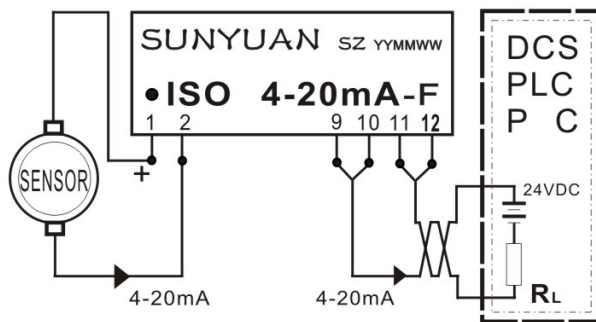
The Application Scheme of Sensor and Data Acquisition System in Industrial Field

I. The Model Selection Based on the Performance of the Analog Signal Sensor

1. Two-wire current/voltage output sensor (No power supply, need load supplies 16-24V power distribution, output 4-20mA/0-5V power).

1.1 4-20mA two-wire passive sensor (input model) receives power distributed by current isolated distributor, then connect it to PLC.

As shown in Fig.1, connect positive terminal of distance measuring sensor and weighing sensor with 16-24 VDC power, the negative terminal outputs 4-20mA current.

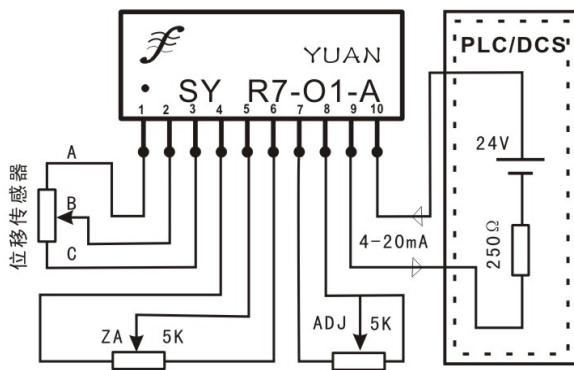


(ISO 4-20mA-F)

Fig.1 Typical Application Diagram of 4-20mA Two-wire Isolated Distributor

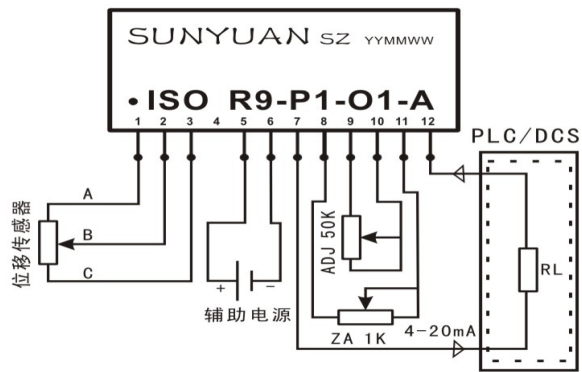
1.2 4-20mA two-wire passive sensor (input model) receives power distributed by voltage isolated distributor, then connect it to PLC.

As shown in Fig.2, Fig.3, the positive and negative terminals of displacement sensor and electric scale sensor are connected with 16-24VDC voltage.



(SY R-O1-A)

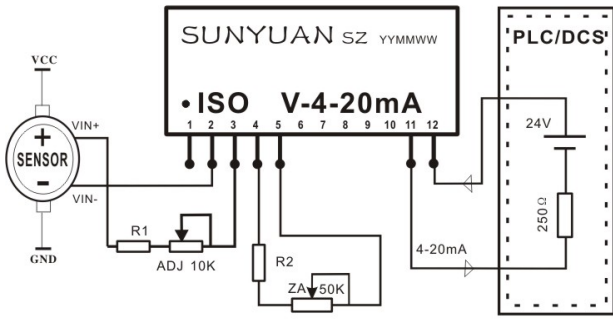
Fig. 2 Two-wire Non-isolated Passive Voltage Distributor



(ISO R-P-O-A)

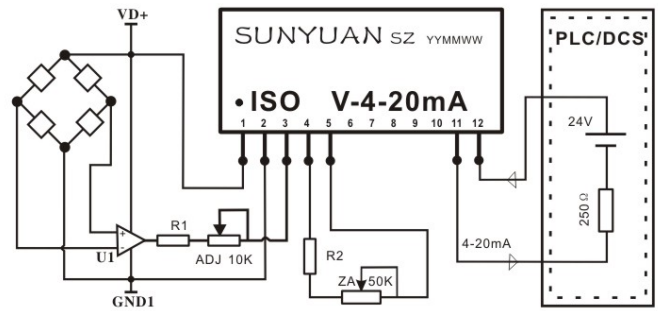
Fig.3 Isolated Voltage Distributor

As shown in Fig.4, Fig.5, the positive and negative terminals of stress patches sensor and weighing bridge sensor are connected with 16-24 VDC voltage.



(ISO V-4-20mA)

Fig. 4 Isolated Voltage Signal Conversion Amplifier

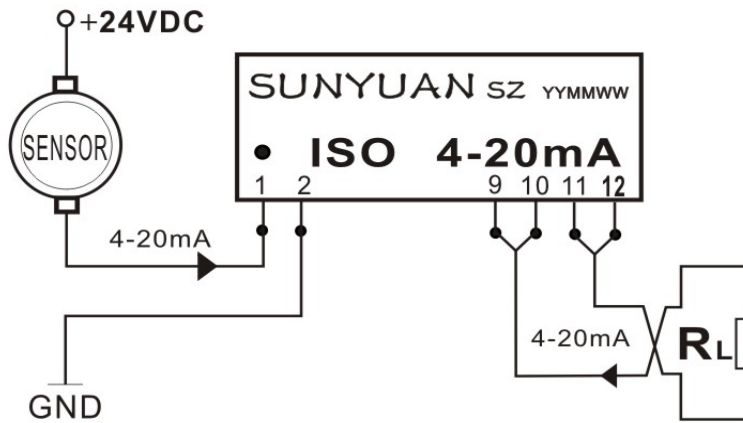


(ISO V-4-20mA)

Fig. 5 Isolated Electric Bridge Voltage Distributor

1.3 Two-wire sensor outputs 4-20mA current loop isolated by isolator, then connect it with PLC.

As shown in Fig. 6 , the positive terminal of pressure sensor and flow sensor are connected with 9-32 VDC voltage, the negative terminal outputs 4-20mA current.

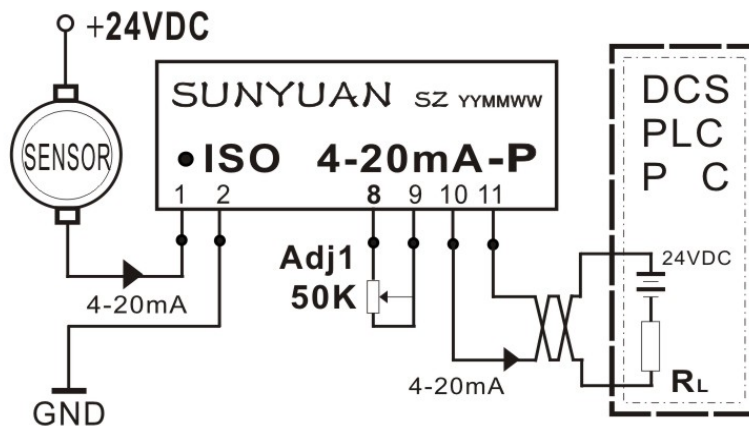


(ISO 4-20mA)

Fig.6 Typical Application Circuit Diagram of Two-wire 4-20mA Isolated Distributor

1.4 Two-wire sensor outputs 4-20mA current loop isolated and adjusted by isolator (avoid conflicts between input and output), then to do connection with PLC.

As shown in Fig. 7, the positive terminal of temperature sensor and speed sensor are connected with 12-24 VDC voltage, the negative terminal outputs 4-20mA current



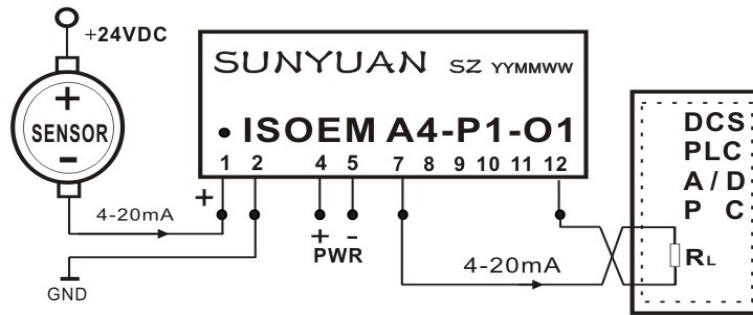
(ISO 4-20mA-P)

Fig. 7 The Circuit Diagram on the Link and Isolation Application between Two-wire 4-20mA Signal and PLC

2. Four-wire Current/Voltage (Input/Output) Sensor (Have its own power supply 24VDC, input/output: 4-20mA/ 0-5V)

2.1 Isolated and Amplified by analog signal, four-wire current output mode sensor is connected with PLC.

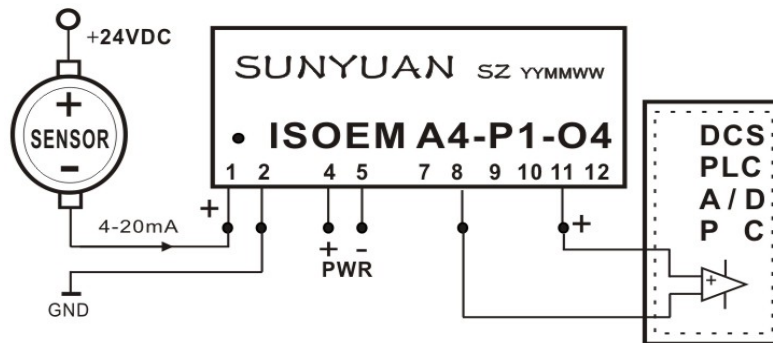
2.1.1 As shown in Fig. 8, the positive terminal of temperature sensor, humidity sensor are connected with 24 VDC voltage, the negative terminal outputs 4-20mA current.



(ISO EM-A-P-O)

Fig. 8 The Application Circuit Diagram on the Connection between Isolated and Amplified Four-wire Sensor Signal I/I and PLC

2.1.2 As shown in Fig.9, the positive terminal of pressure sensor and speed sensor are connected with 24 VDC voltage, the negative terminal outputs 4-20mA current.

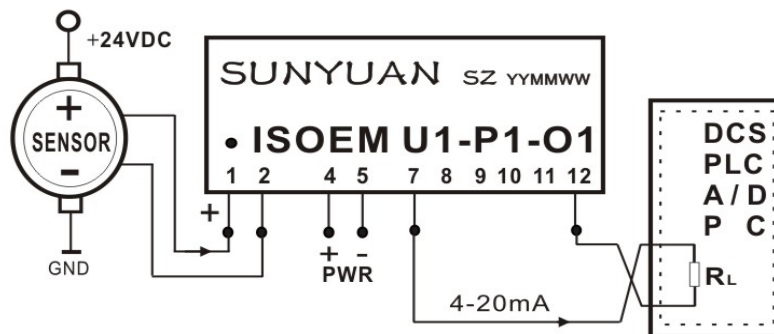


(ISO EM-A-P-O)

Fig.9 The Application Circuit Diagram between Converted Four-wire Sensor Signal I/V and PLC

2.2 Isolated and Amplified by analog signal, four-wire voltage output mode sensor is connected with PLC.

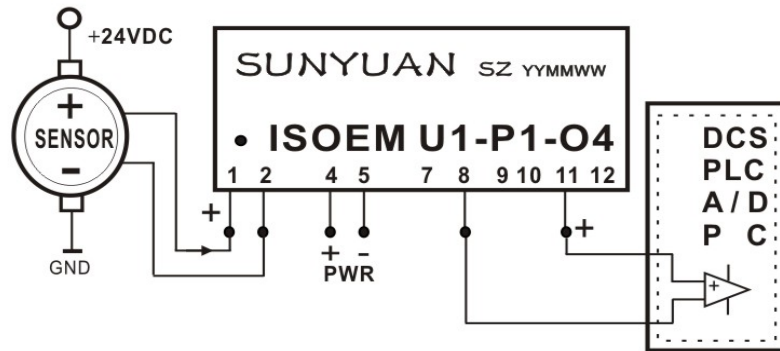
2.2.1 As shown in Fig. 10, the positive terminal of pressure sensor and speed sensor are connected with 24 VDC voltage, the negative terminal outputs 0-5 VDC voltage.



(ISO EM-U-P-O)

Fig.10 The Application Circuit Diagram between Converted Four-wire Sensor Signal V/I and PLC

2.2.2 As shown in Fig. 11, the positive and negative of flow sensor and liquid level sensor are connected with 24VDC power, output 0-5VDC voltage.



(ISO EM-U-P-O)

Fig.11 The application Circuit Diagram on the Connection between PLC and Isolated Four-wire Sensor Signal V/V

II The Connection Scheme between PLC and Sensor

The Application Case in PLC (2#: Vout +, 3#: Vout -)

1. In two-wire mode, the negative 2# outputs 24VDC Voltage, 3# receives current, so there are two connection methods: A: 2# is connected with the sensors' positive, 3# is connected with sensors' negative, the jumper is set to two-wire current signal. B: 2# is at zero gate voltage, 3# is connected with sensors' negative, and the positive of sensor should be connected with the 24VDC power in the cabinet, the jumper is set to two-wire current signal. (in this case, 2#: Vout+, 3#: Vout-)
2. In four-wire mode, Vout 2# receives current, 3# is negative. In the connection scheme, 2# is connected with the sensors' positive, 3# is connected with sensors negative, the jumper of PLC is set to four-wire current signal. (The advantage of four-wire mode is that when the negative signal of sensor and M in the cabinet is different, it has little effect on the accuracy, because the sensor itself is the recirculating loop of current)
3. The connection method between four-wire sensor and PLC jumper: connect the signal negative with M in the cabinet, the sensors' positive is connected with 3#, 2# is at zero gate voltage, the jumper is set to two-wire current.
4. Voltage signal: Connect 2# with sensor's positive, connect 3# with sensor's negative, the jumper wire of PLC is set to voltage signal.