AI-7011/7021 Temperature Transmitter/ Signal Isolator User Manual

1. Overview

The AI-7011/7021 is an intelligent, programmable temperature transmitter/signal isolator designed for DIN rail mounting. It supports programmable input signals from thermocouples, resistance temperature detectors (RTDs), and linear voltage (mV), as well as current signals. The output is in standard current (4~20mA or 0~20mA), with the input featuring digital filtering capabilities. The AI-7021 can operate as two independent transmitters or signal isolators, reducing costs and equipment installation volume, offering flexibility and convenience. The instrument supports a selectable power supply of 24VDC/AC or 100-240VAC and has passed ISO9001 quality certification, ensuring high reliability and compliance with EMC electromagnetic compatibility standards. The power supply and all I/O terminals have passed 4KV Electrical Fast Transient (EFT) anti-interference test, enabling reliable operation in high-interference environments.

Model Definition: AI-7011D5 Single-channel Temperature Transmitter/Signal Isolator
AI-7021D5 Dual-channel Temperature Transmitter/Signal Isolator

The main functions of the instrument are as follows:

● The programmable measurement input loop supports a variety of thermocouple (K, S, E, J, B, N, T, WRe5-WRe26), RTDs (Pt100, Cu50), and voltage/current signal inputs (0~20mV, 0~100mV, 0~1V, 0.2~1V, 0~20mA, 4~20mA). The thermocouples feature automatic cold-end compensation, and the output range for the temperature transmitter can be freely defined. Each input loop is equipped with digital filtering, with the filtering strength adjustable independently or completely disabled.

● The use of high-performance components greatly reduces temperature drift and minimizes interference between channels.

● DIN-rail mounting with a width of only 22.5mm, occupying a smaller cabinet volume.

● Digital current output calibration, without potentiometers, further enhancing current output accuracy and stability.

● It can be directly connected to the E8 handheld display via a 1394 cable for programming, providing ease of use.

2. Technical Specifications

● Input specifications:

Thermocouples: K, S, R, E, J, T, B, N, WRe5-WRe26
Resistance Temperature Detectors (RTDs): Pt100, Cu50
Linear voltage: 0~20mV, 0~60mV, 0~100mV, 0~1V, 0.2~1V, - 20~+20mV, - 100~+100mV, etc.
Linear current: 0-20mA, 4-20mA

● Measurement range:
K(-50~+1300°C), S(-50~+1700°C), R(-50~+1700°C),
T(-200~+350°C), E(0~+1000°C), J(0~+1200°C),
B(0~+1800°C), N(-50~+1300°C),
WRe5~WRe26 (0~+2300°C), Ptl00 (-200~+900°C)

● Linear signal input: Freely defined by the user using SCH and SCL parameters
● Transmission accuracy: ±0.3% FS ±1 digit (including input and output errors)
● Temperature drift: ≤0.015% FS/°C (including input and output temperature drift)
● Electromagnetic compatibility: IEC61000-4-4 (Electrical Fast Transient EFT), ±4KV/5KHz; IEC61000-4-5 (Surge), 4KV
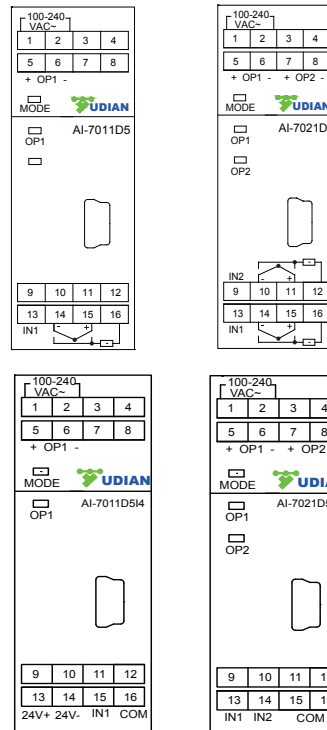● Isolation withstand voltage:
≥2300VDC between the power terminal and signal input/output terminals;
≥200VDC between input and the 2-channel output
● Output specifications: Freely defined within the 0~22mA range, with a maximum output voltage of ≥ 11V
● Power supply: 100~240VAC/50Hz+ 10%, -15% or 24VDC/AC (optional)
● Power consumption: ≤ 3W
● Operating environment: Temperature: -10~+60°C; Humidity: 0~90%RH
Note: Type B thermocouples can measure temperatures in the range of 60~400℃ , but the accuracy will not meet the calibration accuracy. The accuracy can be guaranteed in the range of 400~1800°C.

3. Wiring Method

Note: Due to technical upgrades or special orders, if the wiring diagram provided with the instrument differs from this manual, please refer to the included wiring diagram.

The indicator lights and terminal layout are as shown in the figure:

Terminals 1~2 are for power input, 100~240VAC or 24VAC/DC, +10%, -15%.
OP1~OP2 indicator, 1~2 channel output indicator, reflect the output size by brightness.
Terminals 5 and 6 are the positive and negative terminals for the 1st channel current transmitter output.
Terminals 7 and 8 are the positive and negative terminals of the 2nd channel current transmitter output (AI-7021 only).

4. External Handheld Display

The AI-7011/7021 D5 can be connected to a dedicated E8 handheld display programmer via the 1394 socket and specialized cable to program the internal parameters of the instrument. This handheld programmer allows hot-swapping and can be used only when programming is needed or mounted on the DIN rail as a long-term display.

Each part is described as follows:
① Upper display window, showing the measurement value or parameter name for loop 1
② Lower display window, showing the measurement value or parameter value for loop 2
③ Set key
④ Data shift
⑤ Data decrease key
⑥ Data increase key

Parameter setting method: When the parameter lock is not engaged, press and hold the ⟳ key for about 2 seconds, then release it when the parameters are displayed. Next, press the ⟳ key again, and the instrument will sequentially display parameters, such as loop 1 input specification InP1, parameter lock Loc, and others.

For instruments with configured and locked parameters, simply press the ⟳ key to display parameters (without holding for 2 seconds). Only the parameters necessary for operation (field parameters) will be displayed. Use the ◁ , ▽ , △ keys to modify parameter values. To exit the parameter setting mode, press the ◁ , then the ⟳ key. Press and hold the ◁ key to return to check the previous parameter.

Note: The 1394 socket on this instrument is exclusively for connecting the company's programming device and cannot be used to connect other 1394 devices.

5. Parameter Table

The AI-7011/7021D5 defines the input and output modes of the instrument through parameters. The following is the parameter function table. (Note: Only the 7021 model has second-channel parameters such as INP2, SCL2, etc.)

Parameter	Function	Function Explanation		Setting Range
INP1~2	Input pecifications	INP1~2 define the input specifications for channels 1 and 2 respectively		0~32
		INP	Input spec.	
		0	K	
		1	S	
		2	R	
		3	T	
		4	E	
		5	J	
		6	B	
		7	N	
		8	WRe3-WRe25	
		9	WRe5-WRe26	
		10	User-specified expanded input specifications	
		11~19	Spare	
		20	Cu50	
		21	Pt100	
		22~24	Spare	
		25	0~75mV	
		26~27	Spare	
		28	0~20mV voltage input	
		29	0~100mV; 0~20mA	
		30	0~60mV voltage input	
		31	0~1V	
		32	0.2~1V	
		33	4~20mA	
SCL1~2	Signal Transmitter Scale Lower Limit	Define the lower limit of the signal transmitter output scale.		9990~ +30000 Linear Unit
SCH1~2	Signal Transmitter Scale Upper Limit	Signal transmitter defines the upper limit of the signal transmitter output scale. For example, if channel 1 needs to transmit a temperature range of 0~600 ℃, set SCL1=0, SCH1=600; for channel 2 transmitting a range of 0~1000 ℃, set SCL2=0, SCH=1000.		

Parameter	Function	Function Explanation	Setting Range
Scb1~2	Input Offset Correction	The Scb parameter is used for input signal offset correction to compensate for errors in the sensor or the input signal itself or to correct the cold-end compensation input offset error in the instrument. When the instrument undergoes annual calibration and has been used in harsh environments for an extended period, if the calibration error exceeds the range, cleaning and drying the instrument internally may resolve the issue. If accuracy cannot be achieved, modifying the Scb parameters may help with the correction.	-1999~ +4000 Defined Unit or 0.1°C
FIL1~2	Digital Filtering Strength	FIL is used to set the strength of digital filtering for the input signal. A value of 0 means no filtering, 1 only applies the median value filtering, and 2–40 applies median value filtering simultaneously. The higher the FIL value, the more stable the measurement, but the slower the response. It is generally recommended to gradually increase the FIL value when the measurement is subjected to significant interference to reduce instant fluctuations in the reading (less than 2–5 digits). When the instrument is metrologically calibrated in the laboratory, the FIL should be set to 0 or 1 to improve response speed.	0~40
OPn (Only AI-7021)	Transmitter Output Channel Signal	Setting OPn=1 indicates the OUTP output will display the measurement value from channel 1, operating as 2-input, 2-output; setting OPn=2 means OUTP will also output channel 2's signal, operating as 1-input, 2-output when connected to the second channel.	0~2
OPL	Transmitter Output Current Lower Limit	OPL is used to define the lower limit of OUTP position transmitter current output, with the unit in 0.1mA.	0~110

Parameter	Function	Function Explanation	Setting Range
OPH	Transmitter Output Current Upper Limit	OPH is used to define the upper limit of the OUTP position transmitter current output, with the unit in 0.1mA. For example, to output a 4~20mA signal corresponding to a temperature range of 0~600 ℃ on channel 1, the parameters should be set as follows: SCL1=0, SCH1=600, OPn=1, OPL=40, OPH=200.	0~220
OPL2	Channel 2 Output Lower Limit	OPL2 is used to define the lower limit of the current output for channel 2, with the unit in 0.1mA.	0~100
OPH2	Channel 2 Output Upper Limit	OPH2 is used to define the upper limit of the current output for channel 2, with the unit being 0.1mA. For example, if the measurement range of channel 2 is 0~1000 ℃ and needs to be transmitted as a 4~20mA output, the parameters should be set as: SCL2=0, SCH2=1000, OPL2=40, OPH2=200.	0~220
IVF1	OP1 Current Calibration	This value is used to correct the OP1 current output size. The higher the value, the larger the output current. This parameter is typically factory-set correctly, and should not be modified to avoid inaccurate output.	0~3000
IVF2	OP2 Current Calibration	This value is used to correct the OP2 current output size. The higher the value, the larger the output current. This parameter is typically factory-set correctly, and should not be modified to avoid inaccurate output.	0~3000
Loc	Parameter Modification Level	When Loc is set to 0 or 808, users are allowed to modify parameters. When set to other values, parameter modification is not allowed.	0~9999