

# INSTRUCTION MANUAL

SIL2 Temp. Trip Amplifier with Zero/Span Trimmers  
DIN-Rail  
Model D5274S



## Characteristics

### General Description:

The Temperature Converter & Trip Amplifier D5274S accepts a low level dc signal from millivolt/thermocouple or 2-3-4 wire resistance/RTD or potentiometer sensors, located in Hazardous Area, and converts, with isolation, the signal to drive a Safe Area load, suitable for applications requiring SIL 2 level in safety related systems for high risk industries. Output signal can be direct or reverse. Front trimmers allow easy zero & span current adjustment. Cold junction compensation can be programmed as automatic, using an internal or external temperature sensor or fixed to a user customizable temperature value. D5274S offers two independent trip amplifiers via two SPDT output relays, whose thresholds are fully programmable. Extended power supply range guarantees functionality at 24 Vdc as well as 12 Vdc nominal voltage.

## Technical Data

### Supply:

12/24 Vdc nom (9 to 30 Vdc), reverse polarity protected.

**Current consumption:** 45 mA @ 24 Vdc with 20 mA output and relays energized, typical.

**Power dissipation:** 1.0 W @ 24 Vdc with 20 mA output on 250Ω load and relays energized, typical.

### Isolation:

I.S. In/Out 2.5 kV; I.S. In/Supply 2.5 kV; I.S. In/Alarms 2.5 kV; Out/Supply 500V; Out/Alarms 1.5 kV; Alarms/Supply 1.5 kV; Alarms/Alarms 1.5 kV.

### Input:

Millivolt/thermocouple, 2-3-4 wire resistance/RTD or 3 wire potentiometer.

**Response Time:** 1 s.

**Input range:** ±500 mV (mV), 0-5 kΩ (res), up to 10 kΩ (pot).

### Output:

Current 0/4 to 20 mA.

**Maximum load resistance:** 300 Ω.

**Maximum output voltage:** 30 V.

**Minimum output voltage:** 15 V.

**Short circuit current:** 24 mA, typical

**Transfer characteristic:** linear, direct or reverse on all input sensors.

**Trimmers:** two front trimmers allow easy independent zero/span calibration. Trimmers can be modified in range or they can be excluded.

### Alarm:

**Trip point range:** within rated limits of input sensor.

**Output:** two voltage free SPDT relay contacts.

**Contact rating:** 4 A 250 Vac 1000 VA, 4 A 250 Vdc 120 W (resistive load).

Linear derating from 4 A (60 °C) down to 2 A (70 °C).

### Fault:

Fault can be issued in case of input sensor burnout.

**Response time:** 1 s.

**Fault signalling:** common fault bus, alarm contacts, output current.

### Performance:

**Ref. Conditions:** 24 Vdc supply, 250 Ω load, 23 ± 1 °C Tamb.

**Input accuracy:**

**Linearity accuracy:** ≤ ±25 μV (mV), ±0.25 mΩ (res), ±0.05% (pot).

**Calibration accuracy:** ≤ ±30 μV (mV), ±0.5 mΩ (res).

**Temp. influence (1°C):** ≤ ±10 μV (mV), ±0.2 mΩ (res), ±0.02% (pot).

**Output accuracy:**

**Linearity accuracy:** ≤ ±10 μA.

**Calibration accuracy:** ≤ ±10 μA.

**Temp. influence (1°C):** ≤ ±1 μA.

### Compatibility:



CE mark compliant, conforms to Directive: 2014/34/EU ATEX, 2014/30/EU EMC, 2014/35/EU LVD, 2011/65/EU RoHS.

### Environmental conditions:

**Operating:** temperature limits – 40 to + 70 °C, relative humidity 95 %, up to 55 °C.

**Storage:** temperature limits – 45 to + 80 °C.

**Max altitude:** 2000 m a.s.l.

### Safety Description:



**ATEX:** II 3(1)G Ex ec nC [ja Ga] IIC T4 Gc, II (1)D [Ex ia Da] IIIC, I (M1) [Ex ia Ma] I. **IECEx:** Ex ec nC [ja Ga] IIC T4 Gc, [Ex ia Da] IIIC, [Ex ia Ma] I.

**UL:** NI / I / 2 / ABCD / T4, AIS / I, II, III / 1 / ABCDEFG, AEx ec nC [ja Ga] IIC T4 Gc; **C-UL:** NI / I / 2 / ABCD / T4, AIS / I, II, III / 1 / ABCDEFG, Ex ec nC [ja Ga] IIC T4 Gc X.

associated apparatus and non-sparking electrical equipment.

Uo/Voc = 7 V, Io/Isc = 22 mA, Po/Po = 38 mW at terminals 13-14-15-16.

Um = 250 Vrms, -40 °C ≤ Ta ≤ 70 °C.

### Approvals:

UL 24 ATEX 3257X conforms to EN60079-0, EN60079-7, EN60079-11, EN60079-15. IECEx ULD 24.0020 X conforms to IEC60079-0, IEC60079-7, IEC60079-11, IEC60079-15.

UL & C-UL E222308 conforms to UL61010-1, UL913, UL 121201, UL 60079-0, UL60079-11, UL60079-7, UL60079-15 for UL

and CAN/CSA C22.2 No. 61010-1-12, CSA C22.2 No. 213, CAN/CSA C22.2 No. 60079-0, CAN/CSA C22.2 No. 60079-11, CAN/CSA No. 60079-7, CAN/CSA No. 60079-15 for C-UL.

SIL 2 conforms to IEC61508:2010 Ed.2.

KR Type Approval Certificate No. MIL20769-EL002 for maritime applications.

### Mounting:

DIN-Rail 35 mm, with or without Power Bus.

**Weight:** about 195 g.

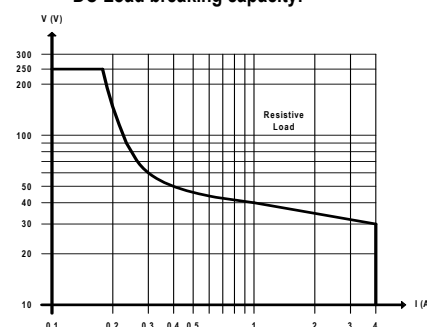
**Connection:** by polarized plug-in disconnect screw terminal blocks to accommodate terminations up to 2.5 mm<sup>2</sup> (13 AWG).

**Location:** installation in Safe Area/Non Hazardous Locations or Zone 2, Group IIC T4 or Class I, Division 2, Group A,B,C,D, T4 or Class I, Zone 2, Group IIC, T4.

**Protection class:** IP 20.

**Dimensions:** Width 22.5 mm, Depth 123 mm, Height 120 mm.

DC Load breaking capacity:



## Programming

The module is fully programmable. Operating parameters can be changed from PC via PPC5092 adapter connected to USB serial line and SWC5090 software.

Measured values and diagnostic alarms can be read on both serial configuration or Modbus output line.

SWC5090 software also allows the Monitoring and Recording of values. For details please see SWC5090 manual ISM0154.

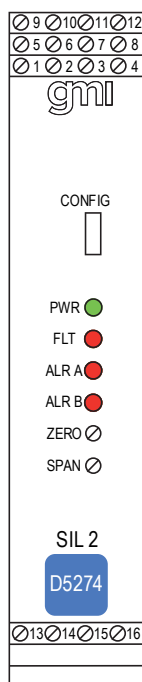
## Ordering Information

Model:	D5274	
1 channel		S

Power Bus and DIN-Rail accessories:  
Connector JDFT050

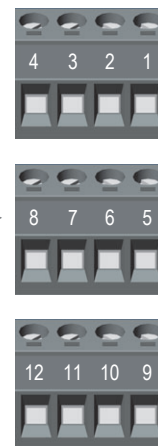
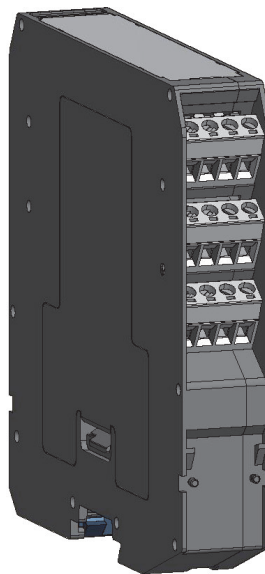
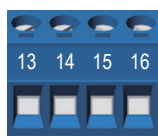
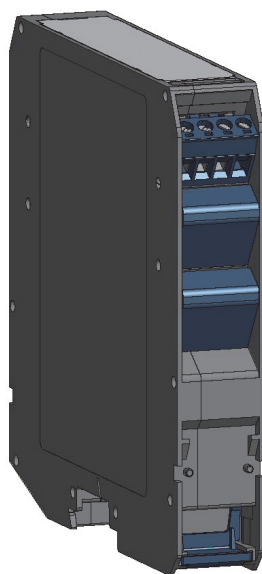
Bus Mounting Kit OPT5096

## Front Panel and Features



- Input from Zone 0/Div. 1
- Installation in Zone 2/Div. 2
- mV, TC, 2/3/4 wire res./RTD or potentiometer input
- Two independent Trip Amplifiers (SPDT relay contacts)
- Inversion/scaling/custom output
- Selectable CJC: internal PT1000, external RTD or fixed
- Burnout fault monitor
- Alarm output with user-settable trip points
- Zero/span output current trimmers
- Extended power supply for 12/24 Vdc nominal voltage
- Fully programmable operating parameters
- High Accuracy,  $\mu$ P controlled A/D converter
- Three port isolation, Input/Output/Supply

## Terminal block connections



### HAZARDOUS AREA

- |    |  |
|----|--|
| 13 | + Input for thermocouple TC or for 3, 4 wire RTD or potentiometer    |
| 14 | - Input for thermocouple TC or for 2, 3, 4 wire RTD or potentiometer |
| 15 | Input for 2, 3, 4 wire RTD or potentiometer                          |
| 16 | Input for 4 wire RTD   |

### SAFE AREA

- |    |  |
|----|--|
| 1  | Common pole (CM1) of Alarm 1 output  |
| 2  | Normally Open pole (NO1) of Alarm 1 output                                   |
| 3  | Normally Closed pole (NC1) of Alarm 1 output                                 |
| 5  | Common pole (CM2) of Alarm 2 output  |
| 6  | Normally Open pole (NO2) of Alarm 2 output                                   |
| 7  | Normally Closed pole (NC2) of Alarm 2 output                                 |
| 9  | + Power Supply 24 Vdc  |
| 10 | - Power Supply 24 Vdc  |
| 11 | + Analog Output (source current mode) or - Analog Output (sink current mode) |
| 12 | - Analog Output (source current mode) or + Analog Output (sink current mode) |

## Parameters Table

In the system safety analysis, always check the Hazardous Area/Hazardous Locations devices to conform with the related system documentation, if the device is Intrinsically Safe check its suitability for the Hazardous Area/Hazardous Locations and group encountered and that its maximum allowable voltage, current, power ( $U_i/V_{max}$ ,  $I_i/I_{max}$ ,  $P_i/P_i$ ) are not exceeded by the safety parameters ( $U_o/V_o$ ,  $I_o/I_{sc}$ ,  $P_o/P_o$ ) of the D5274S Associated Apparatus connected to it. Also consider the maximum operating temperature of the field device, check that added connecting cable and field device capacitance and inductance do not exceed the limits ( $C_o/C_a$ ,  $L_o/L_a$ ,  $L_o/R_o$ ) given in the Associated Apparatus parameters for the effective group. See parameters indicated in the table below:

D5274S Terminals	D5274S Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
13-14-15-16	$U_o / V_o = 7 \text{ V}$	$\leq$	$U_i / V_{max}$
13-14-15-16	$I_o / I_{sc} = 22 \text{ mA}$	$\leq$	$I_i / I_{max}$
13-14-15-16	$P_o / P_o = 38 \text{ mW}$	$\leq$	$P_i / P_i$
D5274S Terminals	D5274S Associated Apparatus Parameters Cenelec (US)	Must be	Hazardous Area/ Hazardous Locations Device + Cable Parameters
13-14-15-16	IIC (A, B) $C_o / C_a = 15.6 \mu\text{F}$ IIB (C) $C_o / C_a = 299 \mu\text{F}$ IIA (D) $C_o / C_a = 999 \mu\text{F}$ I $C_o / C_a = 999 \mu\text{F}$ IIIC (E, F, G) $C_o / C_a = 299 \mu\text{F}$	$\geq$	$C_i / C_i \text{ device} + C \text{ cable}$
13-14-15-16	IIC (A, B) $L_o / L_a = 77.6 \text{ mH}$ IIB (C) $L_o / L_a = 310.6 \text{ mH}$ IIA (D) $L_o / L_a = 621.1 \text{ mH}$ I $L_o / L_a = 1000 \text{ mH}$ IIIC (E, F, G) $L_o / L_a = 312.1 \text{ mH}$	$\geq$	$L_i / L_i \text{ device} + L \text{ cable}$
13-14-15-16	IIC (A, B) $L_o / R_o = 954 \mu\text{H}/\Omega$ IIB (C) $L_o / R_o = 3818 \mu\text{H}/\Omega$ IIA (D) $L_o / R_o = 7636 \mu\text{H}/\Omega$ I $L_o / R_o = 12528 \mu\text{H}/\Omega$ IIIC (E, F, G) $L_o / R_o = 3818 \mu\text{H}/\Omega$	$\geq$	$L_i / R_i \text{ device and } L \text{ cable} / R \text{ cable}$

When used with separately powered intrinsically safe devices, check that maximum allowable voltage, current ( $U_i/V_{max}$ ,  $I_i/I_{max}$ ) of the D5274S Associated Apparatus are not exceeded by the safety parameters ( $U_o/V_o$ ,  $I_o/I_{sc}$ ) of the Intrinsically Safe device, indicated in the table below:

D5274S Terminals	D5274S Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
13-14-15-16	$U_i / V_{max} = 20 \text{ V}$	$\geq$	$U_o / V_o$
13-14-15-16	$C_i = 4.5 \text{ nF}$ , $L_i = 0 \text{ nH}$		

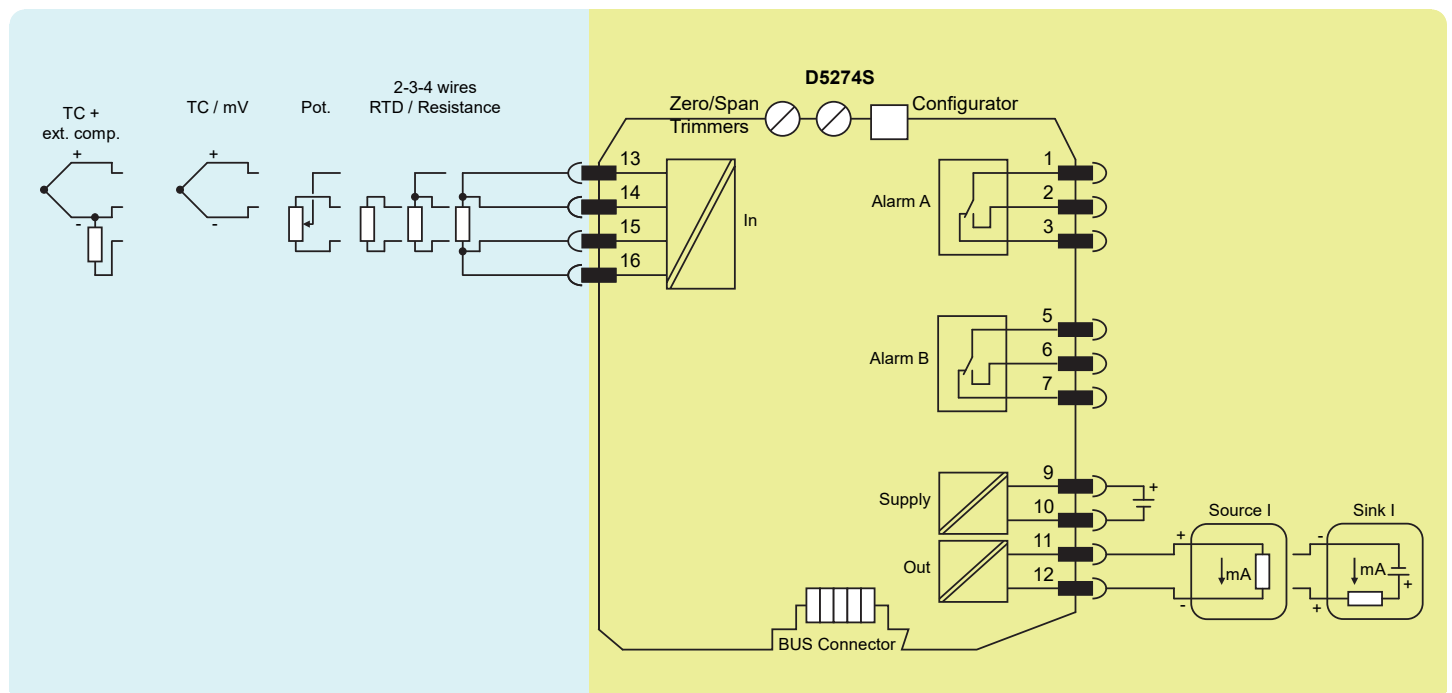
For installations in which both the  $C_i$  and  $L_i$  of the Intrinsically Safe apparatus exceed 1 % of the  $C_o$  and  $L_o$  parameters of the Associated Apparatus (excluding the cable), then 50 % of  $C_o$  and  $L_o$  parameters are applicable and shall not be exceeded (50 % of the  $C_o$  and  $L_o$  become the limits which must include the cable such that  $C_i \text{ device} + C \text{ cable} \leq 50 \% \text{ of } C_o$  and  $L_i \text{ device} + L \text{ cable} \leq 50 \% \text{ of } L_o$ ). The reduced capacitance of the external circuit (including cable) shall not be greater than 1  $\mu\text{F}$  for Groups I, IIA, IIB and 600 nF for Group IIC.

If the cable parameters are unknown, the following values may be used: Capacitance 200pF per meter (60pF per foot), Inductance 1 $\mu\text{H}$  per meter (0.20 $\mu\text{H}$  per foot).

## Function Diagram

HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC,  
HAZARDOUS LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C, D,  
CLASS II, DIVISION 1, GROUPS E, F, G, CLASS III, DIVISION 1,  
CLASS I, ZONE 0, GROUP IIC

SAFE AREA, ZONE 2 GROUP IIC T4,  
NON HAZARDOUS LOCATIONS, CLASS I, DIVISION 2,  
GROUPS A, B, C, D T-Code T4



## Warning

D5274 series is isolated Intrinsically Safe Associated Apparatus installed into standard EN/IEC60715 TH 35 DIN-Rail located in Safe Area or Zone 2, Group IIC, Temperature T4 or Class I, Division 2, Group A, B, C, D, T4 Hazardous Area within the specified operating temperature limits Tamb -40 to +70 °C, and connected to equipment with a maximum limit for power supply Um of 250 Vrms or Vdc. Not to be connected to control equipment that uses or generates more than 250 Vrms or Vdc with respect to earth ground.

D5274 series must be installed, operated and maintained only by qualified personnel, in accordance to the relevant national/international installation standards (e.g. IEC/EN60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)), following the established installation rules, particular care shall be given to segregation and clear identification of I.S. conductors from non I.S. ones.

De-energize power source (turn off power supply voltage) before plug or unplug the terminal blocks when installed in Hazardous Area or unless area is known to be nonhazardous.

**Warning: substitution of components may impair Intrinsic Safety and suitability for Zone 2/Division 2. Avertissement: la substitution des composants peut nuire à la sécurité intrinsèque et à l'aptitude à la Zone 2/Div. 2.**

**Explosion Hazard: to prevent ignition of flammable atmospheres, disconnect power before servicing or unless area is known to be nonhazardous. Danger d'Explosion: pour éviter l'inflammation d'atmosphères inflammables, débrancher l'alimentation avant l'entretien ou à moins que région est connue pour être non dangereuse.**

**Warning: de-energize main power source (turn off power supply voltage) and disconnect plug-in terminal blocks before opening the enclosure to avoid electrical shock when connected to live hazardous potential. Avertissement: débrancher l'alimentation (couper la tension d'alimentation) et les blocs de jonction enfichables avant d'ouvrir le boîtier pour éviter les chocs électriques lorsqu'ils sont connectés à un potentiel dangereux.**

Failure to properly installation or use of the equipment may risk to damage the unit or severe personal injury. The unit cannot be repaired by the end user and must be returned to the manufacturer or his authorized representative. Any unauthorized modification must be avoided.

## Operation

The input channel of Temperature Signal Converter, Trip amplifiers D5274 accepts a low level dc signal from millivolt, thermocouple or 2-3-4 wire RTD temperature or transmitting Potentiometer sensor, located in Hazardous Area, and converts, with isolation, the signal to a 4-20 mA floating output current to drive a Safe Area load.

Presence of supply power is displayed by a "POWER ON" green signaling LED; integrity of field sensor and connecting line can be monitored by a configurable burnout circuit which, if enabled, can drive analog output signal to upscale or downscale limit. Burnout condition is signaled by red front panel fault LED. Front trimmers allow easy zero & span current adjustment, following this procedure:

- Power on the module and put an ammeter in series with output loop.
- Put a device simulating the minimum quantity to be measured on the input connection; turn zero trimmer until output ammeter measures 4mA.
- Put a device simulating the maximum quantity to be measured on the input connection; turn span trimmer until output ammeter measures 20mA.
- Turn off the module.

## Installation

D5274 series is temperature signal converter housed in a plastic enclosure suitable for installation on EN/IEC60715 TH 35 DIN-Rail, with or without Power Bus.

D5274 series can be mounted with any orientation over the entire ambient temperature range.

Electrical connection are accommodated by polarized plug-in removable screw terminal blocks which can be plugged in/out into a powered unit without suffering or causing any damage **(for Zone 2 installations check the area to be nonhazardous before servicing)**. Connect only one individual conductor per each clamping point, use conductors from 0.2 mm<sup>2</sup> (24 AWG) up to 2.5 mm<sup>2</sup> (13 AWG) and a torque value of 0.5-0.6 Nm. For USA and Canada installations, use only cables that are suitable for a temperature of at least 80°C. The wiring cables have to be proportionate in base to the current and the length of the cable.

On the section "Function Diagram" and enclosure side a block diagram identifies all connections.

Identify the function and location of each connection terminal using the wiring diagram on the corresponding section.

Intrinsically Safe conductors must be identified and segregated from non I.S. and wired in accordance to the relevant national/international installation standards (e.g. EN/IEC60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)), make sure that conductors are well isolated from each other and do not produce any unintentional connection. Isolation in accordance with EN/IEC 60079-11 clause 6.3.13 is provided between non-intrinsically safe circuits and intrinsically safe circuits.

Connect alarm contacts checking the load rating to be within the contact maximum rating 4 A 250 Vac 1000 VA, 4 A 250 Vdc 120 W (resistive load).

**To prevent alarm relay contacts from damaging, connect an external protection (fuse or similar), chosen according to the relay breaking capacity diagram from installation instructions.**

The enclosure provides, according to EN60529, an IP20 minimum degree of protection (or similar to NEMA Standard 250 type 1). The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC 60664-1. When installed in Zone 2, the unit shall be installed in an enclosure that provides a minimum ingress protection of IP54 in accordance with IEC 60079-0. When installed in a Class I, Zone 2 Hazardous Location, the unit shall be mounted in a supplemental AEx or Ex enclosure that provides a degree of protection not less than IP54 in accordance with UL/CSA 60079-0. When installed in a Class I, Division 2 Hazardous Location, the unit shall be mounted in a supplemental enclosure. The enclosure must have a door or cover accessible only by the use of a tool. The end user is responsible to ensure that the operating temperature of the module is not exceeded in the end use application.

Units must be protected against dirt, dust, extreme mechanical (e.g. vibration, impact and shock) and thermal stress, and casual contacts. If enclosure needs to be cleaned use only a cloth lightly moistened by a mixture of detergent in water.

**Electrostatic Hazard: to avoid electrostatic hazard, the enclosure of D5274 series must be cleaned only with a damp or antistatic cloth.**

Any penetration of cleaning liquid must be avoided to prevent damage to the unit. Any unauthorized card modification must be avoided.

D5274 series must be connected to SELV or PELV supplies.

All circuits connected to D5274 series must comply with the overvoltage category II (or better) according to EN/IEC60664-1.

**Warning: de-energize main power source (turn off power supply voltage) and disconnect plug-in terminal blocks before opening the enclosure to avoid electrical shock when connected to live hazardous potential.**

## Start-up

Before powering the unit check that all wires are properly connected, particularly supply conductors and their polarity, input and output wires, also check that Intrinsically Safe conductors and cable trays are segregated (no direct contacts with other non I.S. conductors) and identified either by color coding, preferably blue, or by marking.

Check conductors for exposed wires that could touch each other causing dangerous unwanted shorts.

Check that the module has been correctly configured through SWC5090 software. For details please see SWC5090 manual ISM0154.

Turn on power, the "power on" green leds must be lit, output signal must be in accordance with the corresponding input signal value and input/output chosen transfer function, alarm LED should reflect the input variable condition with respect to trip points setting. If possible change the sensor condition and check the corresponding Safe Area output.

**Input specifications:**

Input	Type	Alpha	Standards	Linearity Error	Factory Calibration	Overall Accuracy	Accuracy Range	Maximum Range	Temperature Influence
RTD	Pt50	0.003851 °C <sup>-1</sup>	IEC 60751 GOST 6651 JIS C 1604	±0.34 °C	±0.34 °C	±0.48 °C	-200 to 850 °C	-200 to 850 °C	±0.14 °C/°C
	Pt100			±0.17 °C	±0.17 °C	±0.24 °C			±0.07 °C/°C
	Pt200			±0.43 °C	±0.85 °C	±0.95 °C			±0.34 °C/°C
	Pt300			±0.28 °C	±0.57 °C	±0.64 °C			±0.23 °C/°C
	Pt400			±0.21 °C	±0.43 °C	±0.48 °C			±0.17 °C/°C
	Pt500			±0.17 °C	±0.34 °C	±0.38 °C			±0.14 °C/°C
	Pt1000			±0.09 °C	±0.17 °C	±0.19 °C			±0.07 °C/°C
	Pt46	0.003911 °C <sup>-1</sup>	GOST 6651	±0.34 °C	±0.34 °C	±0.48 °C	-200 to 650 °C	-200 to 650 °C	±0.14 °C/°C
	Pt50			±0.31 °C	±0.31 °C	±0.44 °C			±0.12 °C/°C
	Pt100			±0.16 °C	±0.16 °C	±0.22 °C			±0.06 °C/°C
	Pt200			±0.39 °C	±0.78 °C	±0.87 °C			±0.31 °C/°C
	Pt300			±0.26 °C	±0.52 °C	±0.58 °C			±0.21 °C/°C
	Pt400			±0.19 °C	±0.39 °C	±0.44 °C			±0.16 °C/°C
	Pt500			±0.16 °C	±0.31 °C	±0.35 °C			±0.12 °C/°C
	Pt100	0.003916 °C <sup>-1</sup>	JIS C 1604	±0.15 °C	±0.15 °C	±0.21 °C	-200 to 500 °C	-200 to 500 °C	±0.06 °C/°C
	Pt100	0.003926 °C <sup>-1</sup>	-	±0.15 °C	±0.15 °C	±0.22 °C	-200 to 630 °C	-200 to 630 °C	±0.06 °C/°C
	Cu9.035	0.004274 °C <sup>-1</sup>	-	±1.32 °C	±1.32 °C	±1.86 °C	-200 to 260 °C	-200 to 260 °C	±0.53 °C/°C
	Cu50	0.00428 °C <sup>-1</sup>	GOST 6651	±0.23 °C	±0.23 °C	±0.33 °C	-50 to 200 °C	-50 to 200 °C	±0.09 °C/°C
	Cu53	0.00426 °C <sup>-1</sup>		±0.22 °C	±0.22 °C	±0.32 °C	-50 to 180 °C	-50 to 180 °C	±0.09 °C/°C
	Cu100	0.00428 °C <sup>-1</sup>		±0.12 °C	±0.12 °C	±0.17 °C	-50 to 200 °C	-50 to 200 °C	±0.05 °C/°C
	Ni100	0.006178 °C <sup>-1</sup>	DIN 43760	±0.11 °C	±0.11 °C	±0.15 °C	-60 to 180 °C	-60 to 180 °C	±0.04 °C/°C
	Ni120	0.00672 °C <sup>-1</sup>	-	±0.08 °C	±0.08 °C	±0.11 °C	-80 to 260 °C	-80 to 260 °C	±0.03 °C/°C
TC	A1		GOST 8.585	±0.65 °C	±1.04 °C	±1.23 °C	0 to 2500 °C	0 to 2500 °C	±0.26 °C/°C
	A2		GOST 8.585	±0.44 °C	±0.71 °C	±0.83 °C	0 to 1800 °C	0 to 1800 °C	±0.18 °C/°C
	A3		GOST 8.585	±0.44 °C	±0.71 °C	±0.83 °C	0 to 1800 °C	0 to 1800 °C	±0.18 °C/°C
	B		IEC 60584 GOST 8.585 ASTM E230	±1.09 °C	±1.74 °C	±2.05 °C	450 to 1820 °C	0 to 1820 °C	±0.43 °C/°C
	C		ASTM E230 ASTM E988	±0.55 °C	±0.88 °C	±1.04 °C	0 to 2315 °C	0 to 2315 °C	±0.22 °C/°C
	D		ASTM E988	±0.53 °C	±0.85 °C	±1.00 °C	0 to 2315 °C	0 to 2315 °C	±0.21 °C/°C
	E		IEC 60584 GOST 8.585 ASTM E230	±0.14 °C	±0.22 °C	±0.26 °C	-270 to 1000 °C	-270 to 1000 °C	±0.06 °C/°C
	J		IEC 60584 GOST 8.585 ASTM E230	±0.15 °C	±0.24 °C	±0.28 °C	-210 to 1200 °C	-210 to 1200 °C	±0.06 °C/°C
	K		IEC 60584 GOST 8.585 ASTM E230	±0.21 °C	±0.34 °C	±0.40 °C	-270 to 1372 °C	-270 to 1372 °C	±0.08 °C/°C
	L		DIN 43710	±0.16 °C	±0.26 °C	±0.31 °C	-200 to 900 °C	-200 to 900 °C	±0.07 °C/°C
	LR		GOST 8.585	±0.18 °C	±0.29 °C	±0.34 °C	-200 to 800 °C	-200 to 800 °C	±0.07 °C/°C
	N		IEC 60584 GOST 8.585 ASTM E230	±0.31 °C	±0.50 °C	±0.59 °C	-150 to 1300 °C	-270 to 1300 °C	±0.12 °C/°C
	R		IEC 60584 GOST 8.585 ASTM E230	±0.77 °C	±1.23 °C	±1.45 °C	50 to 1768 °C	-50 to 1768 °C	±0.31 °C/°C
	S		IEC 60584 GOST 8.585 ASTM E230	±0.77 °C	±1.23 °C	±1.45 °C	50 to 1768 °C	-50 to 1768 °C	±0.31 °C/°C
	T		IEC 60584 GOST 8.585 ASTM E230	±0.18 °C	±0.28 °C	±0.33 °C	-100 to 400 °C	-270 to 400 °C	±0.07 °C/°C
	U		DIN 43710	±0.30 °C	±0.48 °C	±0.56 °C	-200 to 600 °C	-200 to 600 °C	±0.12 °C/°C
Voltage				±25 ppm	±40 ppm	±47 ppm	-100 to 100 mV	-100 to 100 mV	±10 ppm/°C
Resistance				±50 ppm	±100 ppm	±112 ppm	0 to 5000 Ω	0 to 5000 Ω	±40 ppm/°C
Potentiometer				±500 ppm	±0 ppm	±500 ppm	0 to 100%	0 to 100%	±200 ppm/°C