INSTRUCTION MANUAL

SIL 2 Temperature Signal Converter and Trip Amplifiers
DIN-Rail
Model D5273S

gmi technology for safety

Characteristics

General Description: The Temperature Converter & Trip Amplifier D5273 accepts a low level dc signal from millivolt, thermocouple or 2-3-4 wire RTD or transmitting potentiometer sensors, located in Hazardous Area, and converts, with isolation, the signal to drive a Safe Area load, suitable for applications requiring SIL 2 (according to IEC 61508:2010) level in safety related systems for high risk industries. Output signal can be direct or reverse. Modbus RTU RS-485 output is available on Bus connector. Cold junction compensation can be programmed as automatic, using an internal temperature sensor or fixed to a user-customizable temperature value. D5273S offers two independent trip amplifiers via two SPDT output relays. Mounting on standard DIN-Rail, with or without Power Bus.

Fault Detection: D5273S is able to detect multiple fault sources:

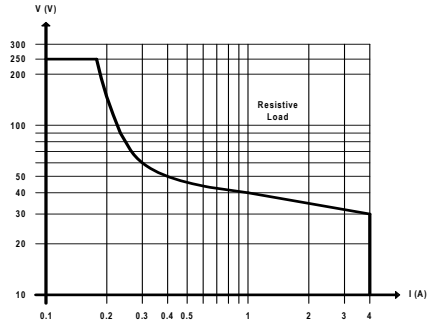
- Sensor Burnout (i.e. when input is disconnected);
- Sensor out of configured range;
- Analog output saturation (beyond user-configured output limits);
- Internal module fault;
- Module out of allowed temperature range (-40 to + 70 °C).

The module can be programmed to reflect such fault conditions on Analog Output (Upscale, Downscale, Custom Value) and/or on each Alarm Output.

Technical Data

Supply: 24 Vdc nom (18 to 30 Vdc) reverse polarity protected, ripple within voltage limits ≤ 5 Vpp, 2 A time lag fuse internally protected.
Current consumption @ 24 V: 72 mA with 20 mA output and relays energized, typical.
Power dissipation @ 24 V: 1.7 W with 20 mA output and relays energized, typical.
Isolation (test voltage): I.S. In/Out 2.5 kV; I.S. In/Supply 2.5 kV; Out/Supply 500V; Out/Alarms 1.5 kV; Alarms/Supply 1.5 kV; Alarms/Alarms 1.5 kV.
Input: See section "Input specifications" for more details on Input sensors. Possibility of configuring user customized sensor (TC or RTD). Choice between °C/°F.
Integration time: from 50 ms to 500 ms.
Resolution: 1 µV on mV/TC, 1 mΩ on RTD/resistance, 0.0001 % on potentiometer.
Visualization: 0.1 °C on temp., 10 µV on mV, 100 mΩ on resistance, 0.1 % on pot.
Input range: -500 to +500 mV for TC/mV, 0-4 kΩ for resistance.
Measuring RTD current: ≤ 0.15 mA.
Thermocouple reference junction compensation: programmable: internal Pt1000, fixed, external or remote.
Thermocouple burnout current: ≤ 50 µA.
Output: Fully customizable 0/4 to 20 mA, on max. 300 Ω load source mode, current limited at 24 mA. In sink mode, external voltage generator range is V min. 3.5V at 0Ω load and V max. 30V. If generator voltage Vg > 10 V, a series resistance ≥ (Vg - 10)/0.024 Ω is needed. The maximum value of series resistance is (Vg - 3.5)/0.024 Ω.
Resolution: 1 µA current output.
Transfer characteristic: linear, direct or reverse on all input sensors.
Response time: ≤ 20 ms (10 to 90 % step).
Output ripple: ≤ 20 mVrms on 250 Ω load.
Modbus Output: Modbus RTU RS-485 up to 115.2 kbps for monitor/configuration/control.

DC Load breaking capacity:



Alarm:
Trip point range: within rated limits of input sensor.
ON-OFF delay time: 0 to 1000 s, 100 ms step.
Hysteresis: within rated limits of input sensor.
Output: two voltage free SPDT relay contacts (NO and NC).
Contact material: Ag Alloy (Cd free), gold plated.
Contact rating: 4 A 250 Vac 1000 VA, 4 A 250 Vdc 120 W (resistive load),
1 A 24 Vdc, 220 mA 125 Vdc, 110 mA 250 Vdc for UL.
Contact min. switching current: 1 mA.
Mechanical / electrical life: 5 * 10^6 / 3 * 10^4 operations, typical.
Operate / release time: 8 / 4 ms, typical.
Bounce time NO / NC contact: 3 / 8 ms, typical.
Frequency response: 10 Hz maximum.
Fault: Enabled/disabled. Analog output can be programmed to reflect fault conditions via downscale, highscale or customized value forcing. Fault conditions are also signaled via BUS and by red LED on front panel for each channel.
Fault conditions are: Sensor burnout, Sensor out of range, Output saturation, Internal fault, Module out of temperature range.
Performance: Ref. Conditions 24 V supply, 250 Ω load, 23 ± 1 °C ambient temperature, slow integration speed, 4 wires configuration for RTD.
Input: ***Calibration and linearity accuracy:*** see section "Input specifications"
Temp. influence: see section "Input specifications".
Ref. junction compensation accuracy: ≤ ± 1 °C (internal Pt1000 sensor).
Output: ***Calibration accuracy:*** ≤ ± 10 µA
Linearity accuracy: ≤ ± 10 µA.
Supply voltage influence: ≤ ± 0.02 % FSR for a min to max supply change.
Load influence: ≤ ± 0.02 % FSR for a 0 to 100 % load resistance change.
Temp. influence: ≤ ± 2 µA/°C.
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 [ia Ga] IIC T4 Gc, II (1)D [Ex ia Da] IIIC, I (M1) [Ex ia Ma] I
IECEx / INMETRO: Ex ec nC [ia 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 ia Ga] IIC; ***C-UL:*** NI / I / 2 / ABCD / T4, AIS / I, II, III / 1 / ABCDEFG, [Ex ia Ga] IIC
FM: NI-AIS / I / 2 / ABCD / T4, AIS / I,II,III / 1 / ABCDEFG, I / 2 / AEx nA nC [ia] / IIC / T4; ***FMC:*** NI-AIS / I / 2 / ABCD / T4, AIS / I,II,III / 1 / ABCDEFG, I / 2 / Ex nA nC [ia] / IIC / T4
EAC-EX: 2Ex nA nC [ia Ga] IIC T4 Gc X, [Ex ia Da] IIIC, [Ex ia Ma] I. ***UKR TR n. 898:*** 2ExnAnCiaIICT4 X, Exial X associated apparatus and non-sparking electrical equipment.
Uo/Voc = 7.2 V, Io/Isc = 23 mA, Po/Po = 40 mW at terminals 13-14-15-16. Um = 250 Vrms, -40 °C ≤ Ta ≤ 70 °C.
Approvals:
BVS 12 ATEX E 053 X conforms to EN60079-0, EN60079-7, EN60079-11, EN60079-15.
IECEx BVS 12.0050X conforms to IEC60079-0, IEC60079-7, IEC60079-11, IEC60079-15.
INMETRO DNV 13.0110 X conforms to ABNT NBR IEC60079-0, ABNT NBR IEC60079-11, ABNT NBR IEC60079-15, ABNT NBR IEC60079-26.
UL & C-UL E222308 conforms to UL 61010-1, UL913, UL 60079-0, UL60079-11, UL121201 for UL
and CAN/CSA C22.2 No. 61010-1-12, CSA-E60079-0, CSA-E60079-11, CSA-C22.2 No. 213 for C-UL.
FM 3046304 and FMC 3046304C conforms to Class 3600, 3610, 3611, 3810, ANSI/ISA-60079-0, ANSI/ISA-60079-11, ANSI/ISA-60079-15, C22.2 No.142, C22.2 No.157, C22.2 No.213, C22.2 No. 60079-0, C22.2 No. 60079-11, C22.2 No. 60079-15.
C-IT.MH62.B.04182 conforms to GOST R IEC 60079-0,GOST R IEC 60079-11, GOST R IEC 60079-15.
СЦ 16.0036 X conforms to ДСТУ 7113, ГОСТ 22782.5-78, ДСТУ IEC 60079-15.
DNV Type Approval Certificate No.A-13625 and KR No.MIL20769-EL002 Certificates for maritime applications.
TÜV Certificate No. C-IS-722160171, SIL 2 conforms to IEC61508:2010 Ed.2 .
TÜV Certificate No. C-IS-236198-09, SIL 3 Functional Safety Certificate conforms to IEC61508:2010 Ed.2, for Management of Functional Safety.
Mounting: EN/IEC60715 TH 35 DIN-Rail, with or without Power Bus.
Weight: about 195 g.
Connection: by polarized plug-in disconnect screw terminal blocks to accomodate terminations up to 2.5 mm² (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.

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.

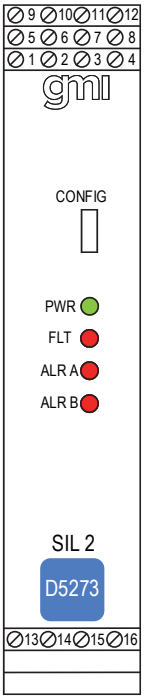
Ordering Information

Model:	D5273	
1 channel		S

Power Bus and DIN-Rail accessories:

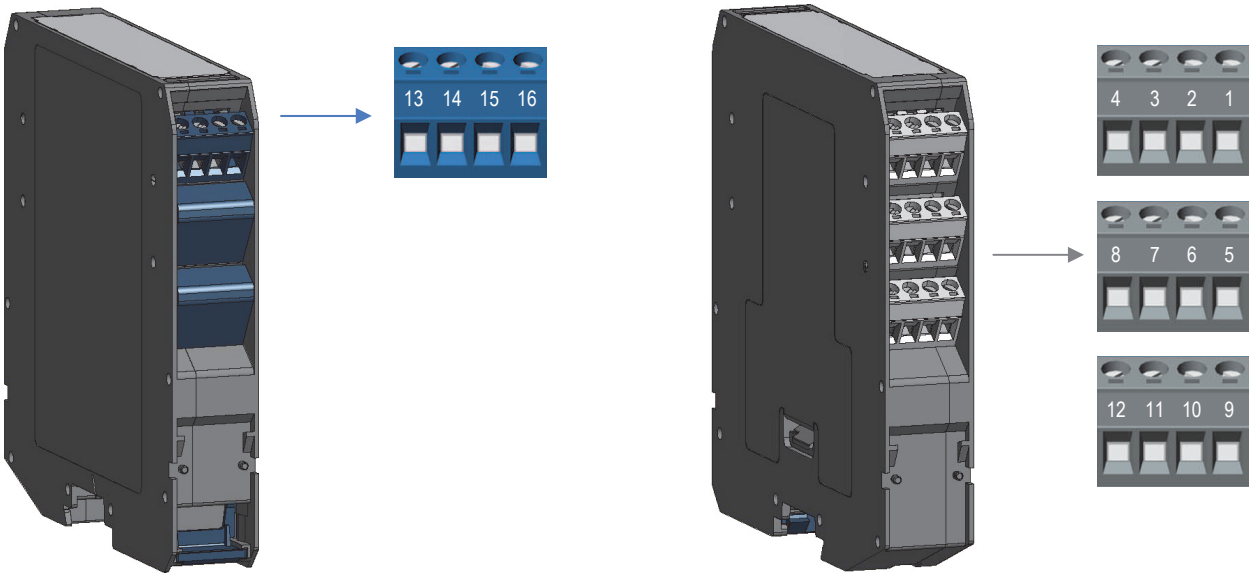
Connector JDFT050	Cover and fix MCHP196
Terminal block male MOR017	Terminal block female MOR022

Front Panel and Features



- SIL 2 according to IEC 61508:2010 (Route 2H) with Tproof = 10 / 20 years (≤10% / >10 % of total SIF), for analog current source/sink output.
- SIL 2 according to IEC 61508:2010 (Route 2H) with Tproof = 5 / 20 years (≤10% / >10 % of total SIF), for single alarm trip amplifier with relay output.
- SIL 2 according to IEC 61508:2010 (Route 2H) with Tproof = 17 / 20 years (≤10% / >10 % of total SIF), for 1oo2 arch. of alarm trip amplifiers with relay outs.
- SC 3: Systematic Capability SIL 3.
- Input from Zone 0 (Zone 20) / Division 1, installation in Zone 2 / Division 2.
- mV, TC, 2/3/4wire res./RTD or potentiometer input.
- Selectable CJC: internal PT1000, external RTD or fixed.
- Fastest integration time: 50 ms.
- High Accuracy, µP controlled A/D converter.
- Burnout/internal/cjc/in sensor fault monitor.
- Fully customizable Output range from 0 to 24 mA Output Signal linear or reverse (typical 0/4-20 mA).
- Two independent Trip Amplifiers (SPDT relay contacts).
- High Density, one Analog Output + two Alarms.
- Modbus RTU RS-485 for monitor & configuration.
- Fully programmable operating parameters.
- Three port isolation, Input/Output/Supply.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1, EN61326-3-1 for safety system.
- ATEX, IECEx, UL & C-UL, FM, FMC, INMETRO, EAC-EX, UKR TR n. 898, TÜV Certifications.
- Type Approval Certificate DNV and KR for maritime applications.
- 250 Vrms or Vdc (Um) max. voltage allowed to the instruments associated with the barrier.
- Simplified installation using standard DIN-Rail and plug-in terminal blocks, with or without Power Bus.

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 (Ui/Vmax, Ii/Imax, Pi/Pi) are not exceeded by the safety parameters (Uo/Voc, Io/Isc, Po/Po) of the D5273 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 (Co/Ca, Lo/La, Lo/Ro) given in the Associated Apparatus parameters for the effective group. See parameters indicated in the table below:

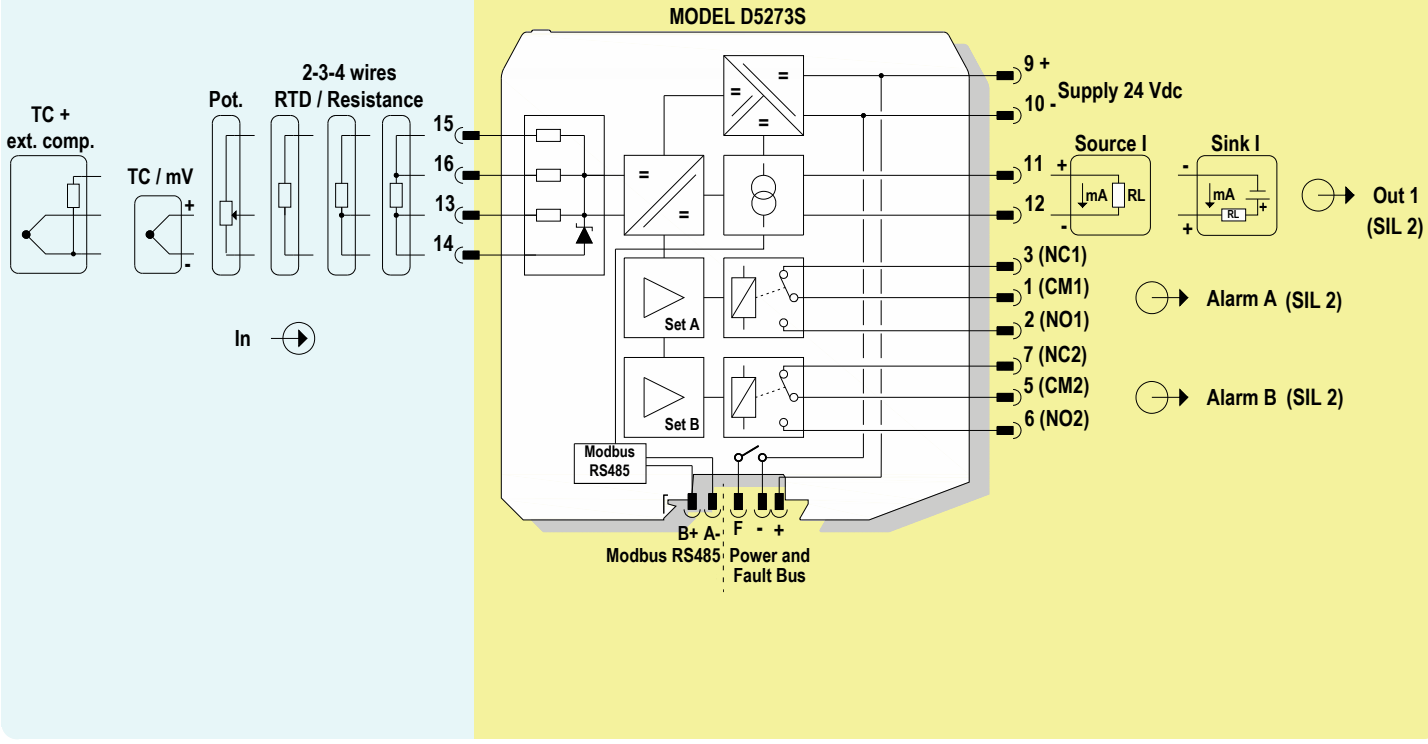
D5273 Terminals	D5273 Associated Apparatus Parameters		Must be	Hazardous Area/ Hazardous Locations Device Parameters
13-14-15-16	Uo / Voc = 7.2 V		≤	Ui / Vmax
13-14-15-16	Io / Isc = 23 mA		≤	Ii/ Imax
13-14-15-16	Po / Po = 40 mW		≤	Pi / Pi
D5273 Terminals	**D5273 Associated Apparatus Parameters Cenelec (US)**		**Must be**	**Hazardous Area/ Hazardous Locations Device + Cable Parameters**
13-14-15-16	IIC (A, B) IIB (C) IIA (D) I IIIC (E, F, G)	Co / Ca = 13.5 µF Co / Ca = 240 µF Co / Ca = 1000 µF Co / Ca = 1000 µF Co / Ca = 240 µF	≥	Ci / Ci device + C cable
13-14-15-16	IIC (A, B) IIB (C) IIA (D) I IIIC (E, F, G)	Lo / La = 67.2 mH Lo / La = 268.8 mH Lo / La = 537.7 mH Lo / La = 882.2 mH Lo / La = 268.8 mH	≥	Li / Li device + L cable
13-14-15-16	IIC (A, B) IIB (C) IIA (D) I IIIC (E, F, G)	Lo / Ro = 875 µH/Ω Lo / Ro = 3500 µH/Ω Lo / Ro = 7000 µH/Ω Lo / Ro = 11480 µH/Ω Lo / Ro = 3500 µH/Ω	≥	Li / Ri device and L cable / R cable

For installations in which both the Ci and Li of the Intrinsically Safe apparatus exceed 1 % of the Co and Lo parameters of the Associated Apparatus (excluding the cable), then 50 % of Co and Lo parameters are applicable and shall not be exceeded (50 % of the Co and Lo become the limits which must include the cable such that Ci device + C cable ≤ 50 % of Co and Li device + L cable ≤ 50 % of Lo). The reduced capacitance of the external circuit (including cable) shall not be greater than 1 µF 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 1µH per meter (0.20µH 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

D5273 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.
D5273 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 D5273 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.

Installation

D5273 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.
D5273 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 up to 2.5 mm² (13 AWG) and a torque value of 0.5‑0.6 Nm. Use only cables that are suitable for a temperature of at least 85°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,
as an example (thermocouple input, source current output, both trip amplifier outputs of alarms):
Connect 24 Vdc power supply positive at terminal "9" and negative at terminal "10".
Connect positive output of analog channel at terminal "11" and negative output at "12".
Connect trip amplifier output of alarm 1 at terminal "1" - "2" (for Normally Open NO contact) or "1" - "3" (for Normally Closed NC contact).
Connect trip amplifier output of alarm 2 at terminal "5" - "6" (for Normally Open NO contact) or "5" - "7" (for Normally Closed NC contact).
Connect thermocouple positive extension wire at terminal "13", negative and shield (if any) at terminal "14".
Make sure that compensating wires have the correct metal and thermal e.m.f. and are connected to the appropriate thermocouple terminal, note that a wrong compensating cable type or a swapped connection is not immediately apparent but introduces a misleading measurement error that appears as a temperature drift.

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.
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 EU 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 that provides a degree of protection not less than IP54. 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 D5273S 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.
D5273 series must be connected to SELV or PELV supplies.
All circuits connected to D5273 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 [°C^{-1}]	Nominal resistance [Ω]	Standards	Min Span [°C (°F)]	Accuracy [°C (°F)]	Accuracy Range [°C (°F)]	Maximum Range [°C (°F)]	Temperature Influence per °C typical [°C (°F)]
RTD	Platinum	0.003851	50	IEC 60751 GOST 6651 JIS C 1604	40 (72)	±0.5 (±0.9)	-200 to 850 (-328 to 1562)	-200 to 850 (-328 to 1562)	≤ ±0.015 (≤ ±0.027)
			100		20 (36)	±0.2 (±0.4)			
			200		10 (18)	±0.1 (±0.2)			
			300						
			400						
			500						
			1000						
		0.003916	100	JIS C 1604	20 (36)	±0.2 (±0.4)	-200 to 630 (-328 to 1166)	-200 to 630 (-328 to 1166)	≤ ±0.015 (≤ ±0.027)
		0.003926	100	---	20 (36)	±0.2 (±0.4)	-200 to 630 (-328 to 1166)	-200 to 630 (-328 to 1166)	≤ ±0.015 (≤ ±0.027)
		0.003911	46	GOST 6651	40 (72)	±0.5 (±0.9)	-200 to 650 (-328 to 1202)	-200 to 650 (-328 to 1202)	≤ ±0.015 (≤ ±0.027)
			50						
			100		20 (36)	±0.2 (±0.4)			
			200		10 (18)	±0.1 (±0.2)			
			300						
			400						
			500						
	Nickel	0.006178	100	DIN 43760	20 (36)	±0.2 (±0.4)	-60 to 180 (-76 to 356)	-60 to 180 (-76 to 356)	≤ ±0.015 (≤ ±0.027)
		0.006720	120	---		±0.2 (±0.4)	-80 to 260 (-112 to 500)	-80 to 260 (-112 to 500)	≤ ±0.015 (≤ ±0.027)
	Copper	0.004260	53	GOST 6651	40 (72)	±0.4 (±0.7)	-50 to 180 (-58 to 356)	-50 to 180 (-58 to 356)	≤ ±0.015 (≤ ±0.027)
		0.004280	50	GOST 6651	40 (72)	±0.4 (±0.7)	-50 to 200 (-58 to 392)	-50 to 200 (-58 to 392)	≤ ±0.015 (≤ ±0.027)
			100		20 (36)	±0.2 (±0.4)			
		0.004274	9.035	---	100 (180)	±1.7 (±3.1)	-200 to 260 (-328 to 500)	-200 to 260 (-328 to 500)	≤ ±0.050 (≤ ±0.090)
TC	A1		---	GOST 8.585	150 (270)	±0.7 (±1.3)	0 to 2500 (32 to 4532)	0 to 2500 (32 to 4532)	≤ ±0.090 (≤ ±0.162)
	A2		---	GOST 8.585	100 (180)	±0.5 (±0.9)	0 to 1800 (32 to 3272)	0 to 1800 (32 to 3272)	≤ ±0.050 (≤ ±0.090)
	A3		---	GOST 8.585	100 (180)	±0.5 (±0.9)	0 to 1800 (32 to 3272)	0 to 1800 (32 to 3272)	≤ ±0.050 (≤ ±0.090)
	B		---	IEC 60584 GOST 8.585 ASTM E230	200 (360)	±1.1 (±2.0)	450 to 1820 (842 to 3308)	0 to 1820 (32 to 3308)	≤ ±0.060 (≤ ±0.108)
	C		---	ASTM E230 ASTM E988	100 (180)	±0.6 (±1.1)	0 to 2315 (32 to 4199)	0 to 2315 (32 to 4199)	≤ ±0.080 (≤ ±0.144)
	D		---	ASTM E988	100 (180)	±0.6 (±1.1)	0 to 2315 (32 to 4199)	0 to 2315 (32 to 4199)	≤ ±0.080 (≤ ±0.144)
	E		---	IEC 60584 GOST 8.585 ASTM E230	50 (90)	±0.2 (±0.4)	-150 to 1000 (-238 to 1832)	-270 to 1000 (-454 to 1832)	≤ ±0.050 (≤ ±0.090)
	J		---	IEC 60584 GOST 8.585 ASTM E230	50 (90)	±0.2 (±0.4)	-150 to 1200 (-238 to 2192)	-210 to 1200 (-346 to 2192)	≤ ±0.050 (≤ ±0.090)
	K		---	IEC 60584 GOST 8.585 ASTM E230	50 (90)	±0.3 (±0.5)	-150 to 1372 (-238 to 2502)	-270 to 1372 (-454 to 2502)	≤ ±0.050 (≤ ±0.090)
	L (type "L" DIN)		---	DIN 43710	50 (90)	±0.2 (±0.4)	-200 to 900 (-328 to 1652)	-200 to 900 (-328 to 1652)	≤ ±0.050 (≤ ±0.090)
	LR (type "L" GOST)		---	GOST 8.585	50 (90)	±0.3 (±0.5)	-200 to 800 (-328 to 1472)	-200 to 800 (-328 to 1472)	≤ ±0.050 (≤ ±0.090)
	N		---	IEC 60584 GOST 8.585 ASTM E230	50 (90)	±0.4 (±0.7)	-150 to 1300 (-238 to 2372)	-270 to 1300 (-454 to 2372)	≤ ±0.060 (≤ ±0.108)
	R		---	IEC 60584 GOST 8.585 ASTM E230	150 (270)	±0.8 (±1.4)	50 to 1768 (122 to 3214)	-50 to 1768 (-58 to 3214)	≤ ±0.060 (≤ ±0.108)
	S		---	IEC 60584 GOST 8.585 ASTM E230	150 (270)	±0.8 (±1.4)	50 to 1768 (122 to 3214)	-50 to 1768 (-58 to 3214)	≤ ±0.060 (≤ ±0.108)
	T		---	IEC 60584 GOST 8.585 ASTM E230	50 (90)	±0.2 (±0.4)	-100 to 400 (-148 to 752)	-270 to 400 (-454 to 752)	≤ ±0.020 (≤ ±0.036)
	U		---	DIN 43710	50 (90)	±0.4 (±0.7)	-200 to 600 (-328 to 1112)	-200 to 600 (-328 to 1112)	≤ ±0.040 (≤ ±0.072)
	Type		**Nominal resistance [Ω]**		**Min Span [Ω]**	**Accuracy [Ω]**	**Accuracy Range [Ω]**	**Maximum Range [Ω]**	**Temperature Influence per °C typical [Ω]**
Ohm	Resistance standard		0 to 1000		5	±0.2	0 to 1000	0 to 1000	≤ ±0.02
	Resistance extended		0 to 4000		20	±0.4	0 to 4000	0 to 4000	≤ ±0.20
	Potentiometer		100 to 10000		1%	±0.1%	0 to 100%	0 to 100%	≤ ±0.02%
	Type				**Min Span [mV]**	**Accuracy [µV]**	**Accuracy Range [mV]**	**Maximum Range [mV]**	**Temperature Influence per °C typical [µV]**
mV	DC standard				1	±10	-50 to 80	-100 to 100	≤ ±3
	DC extended				10	±100	-500 to 500	-500 to 500	≤ ±20

Notes:
RTD/resistance accuracy shown in 4-wires configuration, in slow acquisition mode, after calibration.
TC/mV Accuracy shown in slow acquisition mode, after calibration.

Supported Modbus functions:

Code	Name	Notes
03	read holding registers	reads a stream of words from memory
04	read input registers	reads a stream of words from memory
08	diagnostics: subcode 0	returns query data
06	write single register	writes a word in memory
16	write multiple registers	writes a stream of words in memory

Supported Modbus parameters:

The unit can communicate via Modbus RTU RS-485 protocol. Below is a list of all available registers.
Each Modbus parameter is described by one 16-bit word.
- 'Addr.' is the address of the parameter.
- 'Description' explains the function of the parameter.
- 'Rights' identifies the operation that can be executed by the user:
  RO (Read Only);
  WO (Write Only);
  RW (Read and Write).
- 'Type' indicates the kind of the variable:
  SINT8 / UINT8: signed / unsigned 8 bits integer;
  SINT16 / UINT16: signed / unsigned 16 bits integer;
  SINT32 / UINT32: signed / unsigned 32 bits integer;
  FLOAT: floating point single precision real;
  DOUBLE: floating point double precision real;
  the suffix '[n]' indicates an array of n elements of the corresponding type.

Addr.	Description	Rights	Type
IDENTIFICATION			
0	GM International code	RO	UINT16
1	Software revision	RO	UINT16
2	Product code	RO	UINT16
3	Option code	RO	UINT16
4	Hardware revision	RO	UINT16
COMMAND EXECUTION			
100	Command (*1)	WO	UINT16
GENERAL CONFIGURATION			
202	Fault on bus mask (*2)	RW	UINT32
MODBUS COMMUNICATION			
300	Modbus address	RW	UINT16
301	Modbus baud-rate (*3)	RW	UINT16
302	Modbus format (*4)	RW	UINT16
GENERAL DEBUG			
400	Time stamp [100ms]	RO	UINT32
404	Cumulative faults (*2)	RO	UINT32
TAG			
700	Tag 1	RW	UINT8[16]
OUTPUT CONFIGURATION			
800	Input to analog out 1 function (*5)	RW	UINT16
ALARM CONFIGURATION			
802	Input to alarm 1 function (*5)	RW	UINT16
803	Input to alarm 2 function (*5)	RW	UINT16
INPUT CONFIGURATION			
804	Integration speed (*6)	RW	UINT16
900	Ch1: sensor family (*7)	RW	UINT16
901	Ch1: sensor connection (*8)	RW	UINT16
902	Ch1: sensor type (*9)	RW	UINT16
903	Ch1: sensor burnout configuration (*10)	RW	UINT16
904	Ch1: cold junction compensation (*11)	RW	UINT16
905	Ch1: cold junction external type (*9)	RW	UINT16
906	Ch1: damping factor [s]	RW	UINT16
1100	Ch1: cold junction fixed value [0.1°C]	RW	SINT32
1102	Ch1: 2-wire rtd correction [mOhm]	RW	SINT32
1104	Ch1: rtd multiplier	RW	FLOAT
MEASURE			
1500	Ch1: sensor value (volt, res, ratio) [uV, mOhm, ppm]	RO	SINT32
1502	Ch1: cold junction resistance value [mOhm]	RO	SINT32
1504	Ch1: sensor temperature [0.1°C]	RO	SINT32
1506	Ch1: cold junction temperature [0.1°C]	RO	SINT32

Addr.	Description	Rights	Type
OUTPUT CONFIGURATION			
1900	Ch1: output downscale [100nA]	RW	SINT32
1902	Ch1: output upscale [100nA]	RW	SINT32
1904	Ch1: output underrange [100nA]	RW	SINT32
1906	Ch1: output overrange [100nA]	RW	SINT32
1908	Ch1: output in case of fault [100nA]	RW	SINT32
1910	Ch1: output fault mask (*2)	RW	UINT32
1916	Ch1: output damping factor [s]	RW	UINT32
1918	Ch1: input downscale [uV, mOhm, ppm]	RW	SINT32
1920	Ch1: input upscale [uV, mOhm, ppm]	RW	SINT32
OUTPUT DEBUG			
2302	Ch1: output virtual value [100nA]	RO	SINT32
ALARM CONFIGURATION			
2500	Ch1: alarm configuration (*13)	RW	UINT32
2504	Ch1: alarm start lock (*14)	RW	UINT32
2506	Ch1: contact position in case of alarm (*15)	RW	UINT32
2508	Ch1: alarm fault configuration (*16)	RW	UINT32
2510	Ch1: alarm fault mask (*2)	RW	UINT32
2512	Ch1: delay to alarm issue [ms]	RW	UINT32
2514	Ch1: delay to alarm removal [ms]	RW	UINT32
2516	Ch1: alarm low threshold [uV, mOhm, ppm]	RW	SINT32
2518	Ch1: alarm low threshold hysteresis [uV, mOhm, ppm]	RW	SINT32
2520	Ch1: alarm high threshold [uV, mOhm, ppm]	RW	SINT32
2522	Ch1: alarm high threshold hysteresis [uV, mOhm, ppm]	RW	SINT32
2600	Ch2: alarm configuration (*13)	RW	UINT32
2604	Ch2: alarm start lock (*14)	RW	UINT32
2606	Ch2: contact position in case of alarm (*15)	RW	UINT32
2608	Ch2: alarm fault configuration (*16)	RW	UINT32
2610	Ch2: alarm fault mask (*2)	RW	UINT32
2612	Ch2: delay to alarm issue [ms]	RW	UINT32
2614	Ch2: delay to alarm removal [ms]	RW	UINT32
2616	Ch2: alarm low threshold [uV, mOhm, ppm]	RW	SINT32
2618	Ch2: alarm low threshold hysteresis [uV, mOhm, ppm]	RW	SINT32
2620	Ch2: alarm high threshold [uV, mOhm, ppm]	RW	SINT32
2622	Ch2: alarm high threshold hysteresis [uV, mOhm, ppm]	RW	SINT32
ALARM DEBUG			
2706	Ch1: alarm virtual state (*17)	RO	UINT32
2806	Ch2: alarm virtual state (*17)	RO	UINT32
OUTPUT CONFIGURATION			
2900	Ch1: output drive (*18)	RW	UINT16
INPUT CONFIGURATION			
3100	Callendar-van dusen coeff. A [1/°C]	RW	FLOAT
3102	Callendar-van dusen coeff. B [1/°C2]	RW	FLOAT
3104	Callendar-van dusen coeff. C [1/°C4]	RW	FLOAT
3106	Callendar-van dusen res. at 0°C [mOhm]	RW	UINT32
3108	Table minimum temperature [0.1°C]	RW	SINT32
3110	Table maximum temperature [0.1°C]	RW	SINT32
3200	Sensor family (*7)	RW	UINT32
3202	Table minimum temperature [0.1°C]	RW	SINT32
3204	Table maximum temperature [0.1°C]	RW	SINT32
3206	Table temperature step [0.1°C]	RW	UINT32
3210	Custom sensor table [uV, mOhm]	RW	SINT32[100]

Modbus parameters details:

***1 Command List**

Bit pos.	Value	Description
0..3	10	full eeprom write

***2 Fault Mask**

Bit pos.	Value	Description
0..0	0	no internal/hardware fault
	1	internal/hardware fault
1..1	0	no configuration fault
	1	configuration fault
2..2	0	no input 1 open/burnout
	1	input 1 open/burnout
4..4	0	no input 1 cold junction
	1	input 1 cold junction
6..6	0	no input 1 cable resistance
	1	input 1 cable resistance
8..8	0	no input 1 out of spec
	1	input 1 out of spec
10..10	0	no analog out 1 saturation
	1	analog out 1 saturation

***3 Modbus Baudrate**

Bit pos.	Value	Description
0..2	0	baud rate = 4800 bit/s
	1	baud rate = 9600 bit/s
	2	baud rate = 19200 bit/s
	3	baud rate = 38400 bit/s
	4	baud rate = 57600 bit/s
	5	baud rate = 115200 bit/s

***4 Modbus Format**

Bit pos.	Value	Description
0..1	0	parity none
	1	parity even
	2	parity odd
2..2	0	termination resistance off
	1	termination resistance on
3..3	0	32-bit endianness little
	1	32-bit endianness big

***5 Input-to-Output Assignment**

Bit pos.	Value	Description
0..3	0	input1 temp
	8	electrical measure 1
	10	electrical measure + cj voltage 1 (compensated sensor 1)

***6 Integration Speed**

Bit pos.	Value	Description
0..0	0	slow
	1	fast

***7 Sensor Family**

Bit pos.	Value	Description
0..2	0	thermocouple
	1	rtd
	2	voltage
	3	resistance
	4	potentiometer

***8 Sensor Connection**

Bit pos.	Value	Description
0..2	0	volt/tc 2 wires
	1	tc + external compensation
	2	res/rtd 2 wires
	3	res/rtd 3 wires
	4	res/rtd 4 wires
	5	potentiometer 3 wires

***9 Sensor Type**

Bit pos.	Value	Description
0..5	0	thermocouple A1
	1	thermocouple A2
	2	thermocouple A3
	3	thermocouple B
	4	thermocouple C
	5	thermocouple D
	6	thermocouple E
	7	thermocouple J
	8	thermocouple K
	9	thermocouple L
	10	thermocouple LR
	11	thermocouple N
	12	thermocouple R
	13	thermocouple S
	14	thermocouple T
	15	thermocouple U
	16	Pt50 rtd (a=0.003851)
	17	Pt100 rtd (a=0.003851)
	18	Pt200 rtd (a=0.003851)
	19	Pt300 rtd (a=0.003851)
	20	Pt400 rtd (a=0.003851)
	21	Pt500 rtd (a=0.003851)
	22	Pt1000 rtd (a=0.003851)
	23	Pt46 rtd (a=0.003911)
	24	Pt50 rtd (a=0.003911)
	25	Pt100 rtd (a=0.003911)
	26	Pt200 rtd (a=0.003911)
	27	Pt300 rtd (a=0.003911)
	28	Pt400 rtd (a=0.003911)
	29	Pt500 rtd (a=0.003911)
	30	Pt100 rtd (a=0.003916)
	31	Pt100 rtd (a=0.003926)
	32	Cu53 rtd (a=0.004260)
	33	Cu9.035 rtd (a=0.004274)
	34	Cu50 rtd (a=0.004280)
	35	Cu100 rtd (a=0.004280)
	36	Ni100 rtd (a=0.006178)
	37	Ni120 rtd (a=0.006720)
	38	voltage standard
	39	voltage extended
	40	resistance standard
	41	resistance extended
	42	potentiometer
	43	callendar Van Dusen
	44	custom sensor

***10 Input Burnout Configuration**

Bit pos.	Value	Description
0..0	0	input burnout active
	1	input burnout off

***11 Cold Junction Compensation**

Bit pos.	Value	Description
0..1	0	internal
	1	fixed
	3	external

***12 Cold Junction Force Command**

Bit pos.	Value	Description
0..0	0	cold junction measured
	1	cold junction fixed

***13 Alarm Configuration**

Bit pos.	Value	Description
0..2	0	no alarm
	1	alarm low
	2	alarm high
	3	alarm window
	4	fault repeater

***14 Alarm Lock**

Bit pos.	Value	Description
0..0	0	no alarm lock
	1	alarm lock activated

***15 Contact Position In Case Of Alarm**

Bit pos.	Value	Description
0..0	0	open
	1	closed

***16 Alarm Fault Configuration**

Bit pos.	Value	Description
0..1	0	ignore fault
	1	lock alarm state before fault
	2	alarm on in case of fault
	3	alarm off in case of fault

***17 Alarm Virtual State**

Bit pos.	Value	Description
0..0	0	alarm off
	1	alarm on

***18 Output Drive**

Bit pos.	Value	Description
0..0	0	output sink
	1	output source