

S2Ex-R



Intrinsically safe barrier

RESISTANCE CONVERTER (temperature, position) with separation

- "group I", "category M1" and "group II and III", "category 1" accompanying device,
- intrinsically safe input circuit with "ia" protection level – ATEX compliance,
- EC-Type Examination Certificate: KDB 04ATEX120

FEATURE II (1)G [Ex ia] IIC, II (1)D [Ex ia] IIIC, I (M1) [Ex ia] I

- "group II", "category 3" accompanying device with feature based on the conformity assessment procedure acc. to module A of the ATEX directive: II 3G Ex ec II T4 Gc
- Protection level IP20**
- Operating temperature range -30...+70°C**

- Intrinsically safe input circuit can work with a sensor of „ia” or „ib” protection level installed in ex zone „0, 1, 2, 20, 21, 22” of any explosive mixtures – including a temperature or position sensor.
- Output and supply circuit can work with non-intrinsically safe circuits of devices with voltage $U_m=253V$, e.g. supplied from 230Vac network.
- The converter can be installed only in an explosion safe, dry and dust free room that is protected against access of people not trained in maintenance and operation of the separator.
- The converter can be installed in any explosion hazardous zone in explosion-proof designed enclosure e.g. in a flameproof enclosure or another in accordance to the relevant standards. Basing on designation II 3G Ex ec II T4 (category 3 device) it can be installed basing on other rules – see pages 3.

Purpose:

S2Ex-R converter is design to convert the resistance increment of the sensors to standard signals (current or voltage). There is mutually galvanic separation between input, output and supply circuits. Converter allows linearization for platinum sensors Pt100÷Pt1000. Converter can be used as :

- linear converter of resistance increments: $f = k * \Delta R$,
- linear converter of temperature changes for sensors Pt, Ni, Cu $f = k * \Delta T$ (e.g. Pt100, Pt1000, Ni100, Cu100, Cu50, ...)
- converter of potentiometer position (fig.1).

When using a three-wire, homogenous (all three strands the same) connection line (or four-line at customer's request), S2Ex-R converter provides total compensation of changes in the sensor connection line parameters. This also means no necessity to adjust "zero" and "range" when the line is changed in length.

Specification:

Input signal:

- Pt100 , Ni100
- Pt500, Pt1000 etc.
- potentiometer position

Output signal:

- Class
- Nonlinearity error:
- Uz supply voltage change error
- Ambient temperature change error

- Zero and range regulation
- Sensor-converter connection

Maximum resistance of the sensor connection line

- two-wire - $\leq 10 \Omega$
- three- or four-wire - $\leq 30\Omega$

Supply voltage Uz - 20V±27V typically 60 mA

Note: If supply voltage exceeds 28V the fuse of the protection barrier may be burnt – repair only by the manufacturer.

Output load resistance:

- for 0÷20mA, 4÷20mA signals - $0 \div 800 \Omega$
- for voltage signals - $\geq 10 k\Omega$

Galvanic circuit separation - all circuits mutually separated

Isolation test voltage - 2,5 kV, 50Hz or equivalent

Time constant - $< 0,2s$, after arrangement 0.1÷1sec.

Housing dimensions: - 22.5mm x 99mm x 114.5mm (width x height x depth)

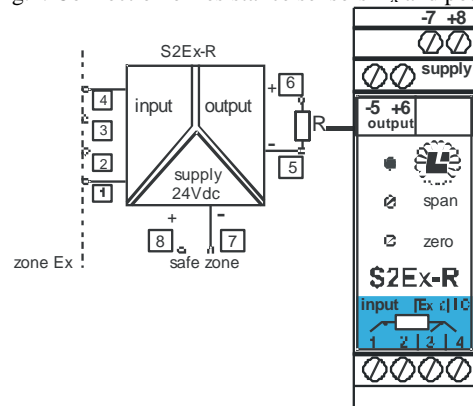
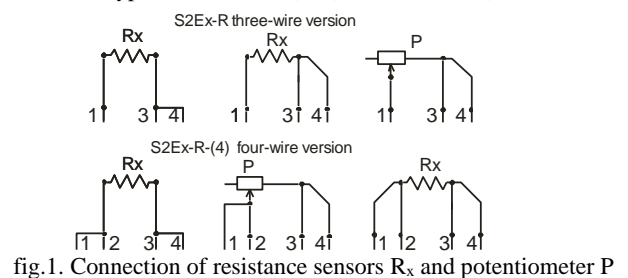
Ordering code:

- S2Ex-R - 5,4 - voltage converter with separation
- (4) - 4-wire connection, lack of this code means 3-wire connection
- P1÷P23 - measurement range in table 1
- N1÷N11 - measurement range in table 2
- R_{min} / R_{max} - resistance potentiometer min/max value
- 1 - output signal 0÷5mA
- 2 - output signal 0÷20mA
- 3 - output signal 4÷20mA
- 4 - output signal 0÷5V
- 5 - output signal 0÷10V
- 6 - output signal 1÷5V
- 7 - unusual output signal should be given descriptively
- L ---- linearization
- BL -- without linearization

Note: For other than table 1 or 2 ranges please provide minimum and maximum value of the temperature and sensor type.

Order example:

Resistance converter S2Ex-R-5,4-(4) (four-wire sensor connection), rail housing, sensor Pt1000, range 0÷15°C, output 4÷20mA, linearization: type S2Ex-R-5,4-(4)-(Pt1000; 0÷15°C)-3-L



Measurement ranges:

Table 1. - Pt 100

Range number	Range °C	Nonlinearity of the sensor [%]
P1	0...25	+0.11
P2	0...40	+0.12
P3	0...60	+0.22
P4	0...100	+0.39
P5	0...120	+0.46
P6	0...150	+0.57
P7	0...200	+0.76
P8	0...250	+0.96
P9	0...300	+1.16
P10	0...400	+1.58
P11	0...550	+2.22
P12	50...150	+0.38
P13	100...320	+0.87
P14	100...400	+1.2
P15	200...320	+0.49
P16	200...400	+0.81
P17	300...550	+1.06
P18	-10... +40	+0.18
P19	-20... +20	+0.16
P20	-30... +60	+0.34
P21	-30... +150	+0.69
P22	-100...+50	+0.62
P23	-220...+50	+1.37
Other ranges according to the order		

Table 2. - Ni 100

Range °C	Nonlinearity of the sensor [%]	Range °C
N 1	0...25	-0.67
N 2	0...40	-1.1
N 3	0...60	-1.6
N 4	0...100	-2.8
N 5	0...120	-3.5
N 6	0...150	-4.5
N 7	50...150	-3.0
N 8	-10... +40	-1.4
N 9	-20... +20	-1.15
N 10	-30... +60	-2.5
N 11	-30... +150	-5.2
Other ranges according to the order		

Input circuit (terminals 1, 2, 3, 4) of the S2Ex-R converter with “ia” protection level can work with intrinsically safe circuit with “ia” or “ib” protection level of device installed in zone „0, 1 and 2” of hazardous mixtures with air, which are in explosion groups IIA, IIB, IIC and in zone “20, 21 and 22” of dust explosion hazard (group III), according with its terms of use.

Converter is enclosed in self-extinguishing plastic (polyamide PA 6.6) intended for mounting on TS 35 rail.

The degree of housing and terminals protection is IP20.

Outer connections should be connected using cables of $\varnothing \leq 2.5$ mm wire diameter.

ATEX compliance: directive 94/9/WE: PN-EN 60079-0:2013,

PN-EN 60079-11:2012. PN-EN 60079-7:2016-02

EMC requirements - PN-EN 61000-6-1, PN-EN 61000-6-3

Intrinsically safe parameters for S2Ex-R-5.4 – input circuit with “ia” protection level:

a) Intrinsically safe input circuit with “ia” protection level - terminals 1, 2, 3, 4 two-, three- or four-wire resistance measurement: **Uo=5,4V, Io=9,8mA, Po=42mW,**

The values of Lo, Co and L/R connection cable parameters should be adopted according to the table shown below:

Explosive groups	Lo [mH]	Co [µF]	L/R [mH/Ω]
I i IIA	200	30	4,3
IIB i III	200	30	2,1
IIC	200	30	0,53

b) Nonintrinsically safe circuit parameters: „output” - terminals 5-6 and „supply” - terminals 7-8: **Um=253V**

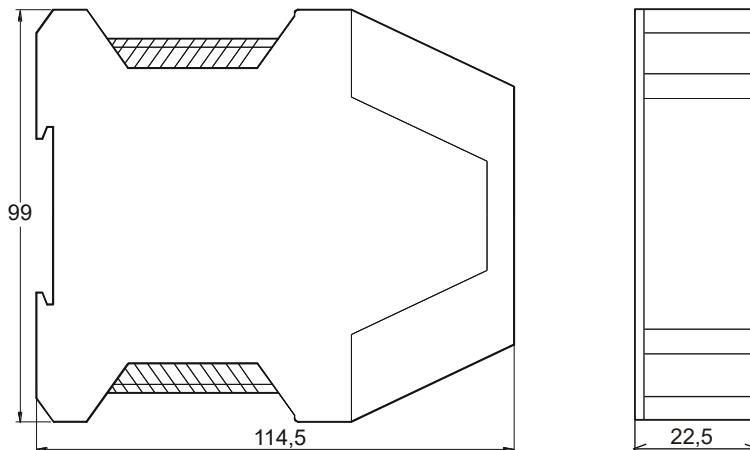
Safety parameters for group III (dusts) are the same as for group IIB (gas).

In installations where parameters Ci and Li of a device cooperating with intrinsically safe circuits (without connection cable) exceed 1% of the value of parameters Co and Lo in the above table you should:

- subtract values Ci, Li of the cooperating device from 50% of the values Co, Lo,
- the values remains for the parameters of the connection cable,
- if cable parameters are not known you can take for calculation values 200pF/m, 1µH/m

Operation conditions:

- Ambient temperature - storage - -30 ÷ +70°C
- Ambient temperature - operating - -30 ÷ +70°C
- Relative Humidity - max 85% without condensation
- Environment - no dusts and aggressive gases
- Working position - any



Housing sketch.

Conditions of use:

Typically the device should be installed in a safe zone. Maximal values of capacity and inductance connected to intrinsically safe terminals "1, 2, 3, 4" of the converter should be selected taking into consideration safety parameters of the connected circuits. They cannot exceed values given in the table above.

External connections should be led with cables of a wire core diameter $0,5 \div 2,5\text{mm}^2$.

The converter can be installed in a hazardous zone in a flameproof enclosure (or other according to the applicable rules). Using the converter in explosive group I does not require placing on the enclosure a warning and after the power supply is turned off it can be taken out of the housing without a delay. In case of using the converter in explosive group II on the outside part of the enclosure should be placed a warning "Do not open the housing within 10 min. after turning off the power."

In general cables and wires of intrinsically safe circuits should be led separately regarding to non-intrinsically safe cables and wires. If intrinsically safe cable is shielded and is blue it can be in cable trays together with other non-intrinsically safe cables. Shield of the cable should be connected to the ground PE only from one side e.g. only in safe zone with a wire of $2,5\text{mm}^2$ diameter. Maintain a distance of 50mm from the end of the shield braid to the stripped ends of the cable cores in both the hazardous and safe zones. Put the crimping sleeves on the stripped ends of the cable cores. If in a multicore intrinsically safe cable are several intrinsically safe circuits the cables must be of A or B type with insulation test of 500V and the insulation cannot be thinner than 0.2mm. Cables and wires must be permanently fixed and protected against the possibility of mechanical damage. It is recommended to use blue cables. Compare the parameters $U_o, I_o, P_o, C_o, L_o, U_i, I_i, P_i, C_i, L_i$ (L, C of the cable and L_i, C_i of the device installed in the hazardous area).

If the L, C clustered parameters in the connected circuit (and this is how the L_i, C_i parameters of the connected device should be treated) exceed 1% of the L_o, C_o value, for the calculation should be taken of the L_o, C_o parameters given in the certificate for the clustered values. If such parameters are not provided, then half of the C_o, L_o value from the certificate should be taken for calculations with the assumption that the C_o value cannot exceed $1 \mu\text{F}$ for groups I, IIA, IIB and III and $0,6 \mu\text{F}$ for IIC.

If a "simple device" made of plastic is installed in the hazardous area, the risk of electrostatics should be assessed. In the case of cable routes with high energy (power grid) or interferences, cables with measurement signals susceptible to the impact of interferences, apart from the use of shielded twisted-pair cables, should be led at a distance, e.g. in a separate tray, and the routes crossing each other should be at right angles.

For installation in zone 2:

- 1) The housing provides a minimum degree of protection IP20. The device can be installed inside a building provided it is protected against dirt, dust, especially conductive dust, extreme mechanical exposures (eg vibrations, impacts, shocks), and thermal stress.
- 2) Installation outside the building requires an additional enclosure with a higher degree of protection minimum IP54 or higher, eg IP65, in accordance with the surrounding environment in which the installation operates. It may be an enclosure **without an explosion-proof designation**, but:
 - with the warning label "Caution: risk of electrostatic discharge" (see point 6).
 - provided that it will be mounted with protection against falls and mechanical impacts.
- 3) It is the safest to install the device in zone 2, both inside and outside of the building, in an explosion-proof designed enclosure (eg with an "Ex e" protection level) providing a minimum IP54 protection degree or higher (eg IP65) in accordance with the surrounding environment in which the installation operates.
- 4) Regardless of the place of installation, the devices must be protected against dirt, dust, especially conductive dusts, extreme mechanical infections (eg vibrations, impacts, shocks) and thermal stress.
- 5) In order to prevent self-loosing of cables in non-intrinsically safe screw terminals numbers 8, 7, 5, 6 one should place non-tinned cables in each of the clamp:
 - a single wire or cable with a twisted tip with a cross-section of $0,25 \div 2,5 \text{mm}^2$. It is recommended to use a tube sleeve with plastic crimped by a specialized tool.
 - 2 cables with the same cross-section of $0,5 \div 1,5 \text{mm}^2$ type wire with a twisted tip placed in a common tube sleeve with plastic crimped by a specialized tool.Tighten the terminal firmly with a torque of 0.5 Nm (typically 2 kfg force on the handle of a screwdriver with a diameter of 2.5 cm) with a flat screwdriver 3.0...3.5 mm wide. Every 6 months, check the tightening of the terminals by tightening with a torque of 0.5 Nm using a screwdriver with a width of 3...3.5 mm.
- 6) If the housing needs cleaning, use a cloth lightly moistened with a mixture of detergent and water.
Electrostatic hazard: to avoid the risk of electrostatic discharge, the casing of the device and / or the enclosure in which the device is installed should be cleaned only with a damp or antistatic cloth (soaked in antistatic liquid).
Avoid any penetration of cleaning liquid into the interior to prevent damage to the device.
- 7) Non-intrinsically safe circuits (including 24Vdc power supply) must be connected to power suppliers and devices galvanically separated from the power grid (SELV or SELV-E circuits) with a CE designation.
- 8) If an explosive atmosphere is present or can occur, non-intrinsically safe terminals numbers 8, 7, 5, 6 must not be connected/disconnected to/from cables of non-intrinsically safe circuits with voltage. If an explosive atmosphere is present or can occur during service work, disconnect non-intrinsically safe circuits only in the safe area. If there is no explosive atmosphere during service work, the above-mentioned principles from point 8 are not required.