

S2Ex-F



ATEX

FREQUENCY CONVERTER to analog signal with separation

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

FEATURE II (1)G [Ex ia] IIC, II (1)D [Ex ia] IIIC Protection level IP20
I (M1) [Ex ia] I Operating temperature range -30..+70°C

- Intrinsically safe input circuit can work with an intrinsically safe circuit of "ia" or "ib" protection level of a device installed in hazardous zone "0, 1, 2, 20, 21, 22" of any explosive mixtures, including e.g. proximity sensor, turbine sensor etc.. Safety parameters (U_o, I_o, P_o) of the input circuit should be chosen according to the order code.
- The output and supply circuits can work with non-intrinsically safe circuits of devices with U_m=253V e.g. supplied from 230Vac network.
- 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.
- Converter can be mounted in hazardous zone in a flameproof or hermetic enclosure. Using in I explosive group does not require putting warning on the enclosure. After turning off the supply it can be taken out of the enclosure without delay. In case of using it in II and III explosive group, on outer part of the enclosure must be warning: "Do not open the enclosure within 10 minutes after turning off the power".

Purpose

The converter linearly changes frequency of the input signal to a standard separated output signal 0÷5mA, 0÷20mA, 4÷20mA, 0÷5V, 0÷10V, 1÷5V. There is mutually galvanic separation between input, output and supply circuits.

The intrinsically safe input also provides supply to sensors.

In the special version S2Ex-F can transmit a stream of input pulses to the output.

The input circuit is adapted to small and big amplitudes of input signal.

Typical application of the converter is working with:

- angular-pulse road converters;
- proximity sensors;
- shakes and vibration sensors;
- turbine and vortex flow meters;
- flowmeters with pulse output signal e.g. COMMON flowmeter with 1.2/2.1mA signal;

For small input signals connection should be led with shielded cable to reduce the impact of interferences.

Technical data.

Input signal:
- voltage - 1 mV ÷ 30V
- current - 10 µA ÷ 30 mA
- frequency band - f_{min}=0Hz, f_{max}=1Hz÷10 kHz

Voltage input resistance : - 100 kΩ
Current input resistance - 0.1 Ω ÷ 1 kΩ
Output signal 0÷5mA, 0÷20 mA, 4÷20mA,
or any other signal 0÷5V, 0÷10V, 1÷ 5V

Output load resistance:
-for signal 0÷20mA, 4÷20mA - 0 ÷ 850Ω
-for voltage signals - ≥ 10 kΩ

Class - 0.1%
Nonlinearity error - 0.1%
Error due to changes in supply voltage or load - ±0.02%
Error due to changes in ambient temperature - 0.005% / °C

Auxiliary supply voltage
(terminals: 4→SUP+, 1→GND -): - 8,2 ÷ 27V
U=8.2 V I_o=19mA, P_o=0.11W
U=12 V I_o=86mA, P_o=0.58W
U=16 V I_o=86mA, P_o=0.58W
U=18 V I_o=86mA, P_o=0.58W
U=20 V I_o=86mA, P_o=0.58W
U=22 V I_o=86mA, P_o=0.58W
U=24 V I_o=86mA, P_o=0.58W
U=5,1+ 24V I_o=66mA
U=24 V / 2W I_o=119mA, P_o=0.80W
U=27 V I_o=97,3mA, P_o=0.688W

Zero and range regulation - ±7.5% by potentiometers
Supply voltage - 20V ÷ 27V, typically 50mA
Note: If supply voltage exceeds 28V the fuse of the protection barrier may be burnt – repair only by the manufacturer
Galvanic separation of the circuits -all circuits mutually separated from each other

Isolation test voltage
Mutually between supply, 2,5 kV, 50Hz
input and output or equivalent
Time constant - τ∈(0,1 ÷ 4)s, typically 50ms

The amplitude and max input frequency (f_{LOWER} is always 0Hz) of the input signal should be given in the order code as a description (table or graph). Also time constant from range 0.1÷4 s is required.

Order code.

S2Ex-F - ----- frequency converter
U - ----- version U_o, I_o,
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

Order example:

1. Frequency converter S2Ex-F, rail housing, auxiliary voltage 16V, output signal 0-10V:
type S2Ex-F-16-5.
- lower frequency: 0Hz,
- upper frequency: 900Hz,
- input signal amplitude: (-2...0...+5V) or (0...+5V),
- time constant: 0.2s

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 with a cross section of 0,5 ÷ 2.5 mm².

ATEX compliance - directive 94/9/WE: PN-EN 60079-0:2013, PN-EN 60079-11:2012.

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

Safety requirements - PN-EN 61010-1:2002

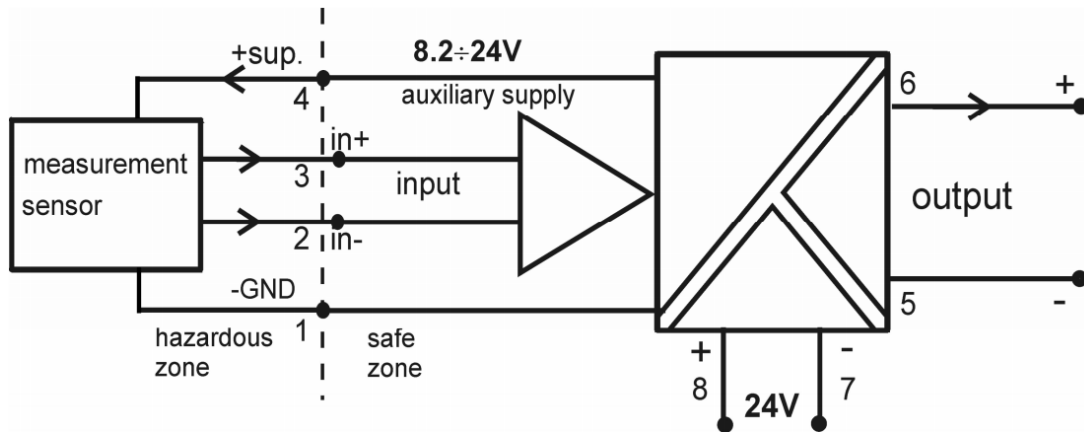


Fig.1. Block diagram of the converter with example sensor connected to the input.

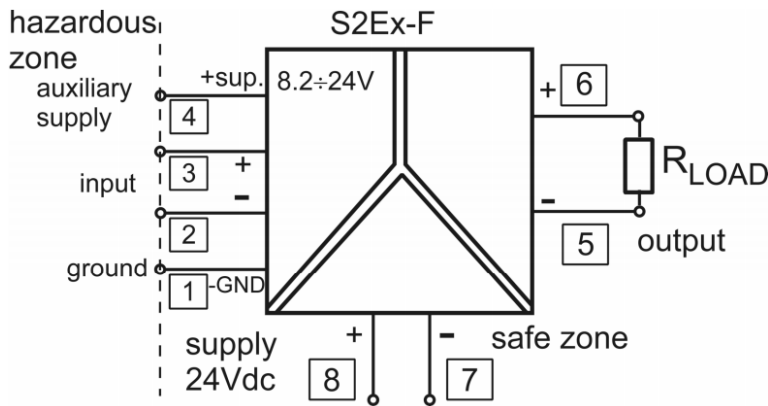


Fig.2. Block diagram.

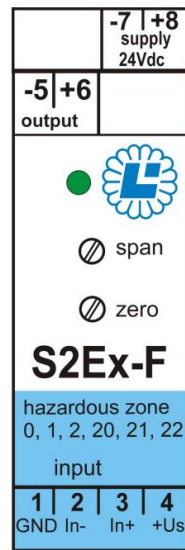


Fig.3. Terminals description.

Safety parameters for S2Ex-F – input circuit with “ia” protection level:

Terminals “4-1” and terminals set “3-1, 2-1” are two separated intrinsically safe circuits. For simultaneous connection of two circuits can be used separate cables or one multicore cable which provides isolation voltage test 500V (according to IEC 60079-14).

Safety parameters for S2Ex-F:

a) Intrinsically safe input circuit: “input” - terminals “4-1” – with “ia” protection level

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

Version	U_o [V]	I_o [mA]	P_o [W]	L/R [mH/Ω]			L_o [mH]			C_o [μF]		
				I and IIA	IIB and IIB	IIC	I and IIA	IIB and IIB	IIC	I and IIA	IIB and IIB	IIC
S2Ex-F-8,2	8,6	86	0,11	0,48	0,24	0,061	100	100	50	1000	55	6,2
S2Ex-F-12	12,6						31	19	3,3	27	7,4	1,15
S2Ex-F-16	16,8						30	18	2,4	9,3	2,29	0,39
S2Ex-F-18	18,9						30	18	2,2	6,4	1,6	0,26
S2Ex-F-20	21						30	18	2,2	4,78	1,27	0,188
S2Ex-F-22	23,1						30	18	2,2	3,67	1,02	0,14
S2Ex-F-24	25,2						30	18	2,2	2,9	0,82	0,107
S2Ex-F-(13,5÷24)/66	$U_{wyj} +5\%$	66	0,446	0,63	0,31	0,079	54	33	5,3	2,9	0,82	0,107
S2Ex-F-12/66	12,6						55	34	6,3	27	7,4	1,15
S2Ex-F-10/66	10,5						50	35	7,0	75	16,8	2,41
S2Ex-F-8,2/66	8,6						58	37	7,7	1000	50	5,9
S2Ex-F-6,8/66	7,2						60	39	8,3	1000	240	13,5
S2Ex-F-5,1/66	5,4						62	41	9,3	1000	1000	65
S2Ex-F-24/119	25,2						119	0,8	0,35	0,17	0,044	15
S2Ex-F-27	28	97,3	0,688	0,41	0,20	0,051	22,0	12,0	0,59	2,15	0,65	0,083

Characteristic of the circuits is trapezoidal.

b) intrinsically safe parameters “input” - terminals 2-1, 3-1: $U_i=30V$, I_i any, P_i any

$U_o=5,4V$, $I_o=1,66mA$, $P_o=2,3mW$, $L_i \approx 0$, $C_i \approx 0$,

c) non-intrinsically safe circuit parameters:

“output” - terminals 5-6 and “supply” - terminals 7-8: $U_m=253V$

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

Conditions of use:

Maximal values of capacitance and inductance connected to intrinsically safe terminals 1, 2, 3, 4 of the converter should be selected taking into account the safety parameters of the connected circuits (given in the conditions of use of the device which the input of the S2Ex-F separator will be connected to). However, they cannot exceed the values given in the table above.

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

To terminals 1, 2, 3 of the S2Ex-F converter should be connected only intrinsically safe circuits with “ia” or “ib” protection level and with following maximal parameters: $U_i=30V$, I_i any, P_i any.

The supplying input circuit (terminals 1, 4) of the converter can cooperate with voltage-free intrinsically safe circuit with “ia” or “ib” protection level. From terminals “1-4” of the S2Ex-F converter to the outside (this means to the hazardous zone) can be transmit maximal U_o , I_o and P_o given in the table above and in the EC-Type Examination Certificate.

The output terminals “5-6” and supplying terminals “7-8” can work with non-intrinsically safe of the devices with voltage $U_m=253V$ e.g. supplied from 230Vac network.

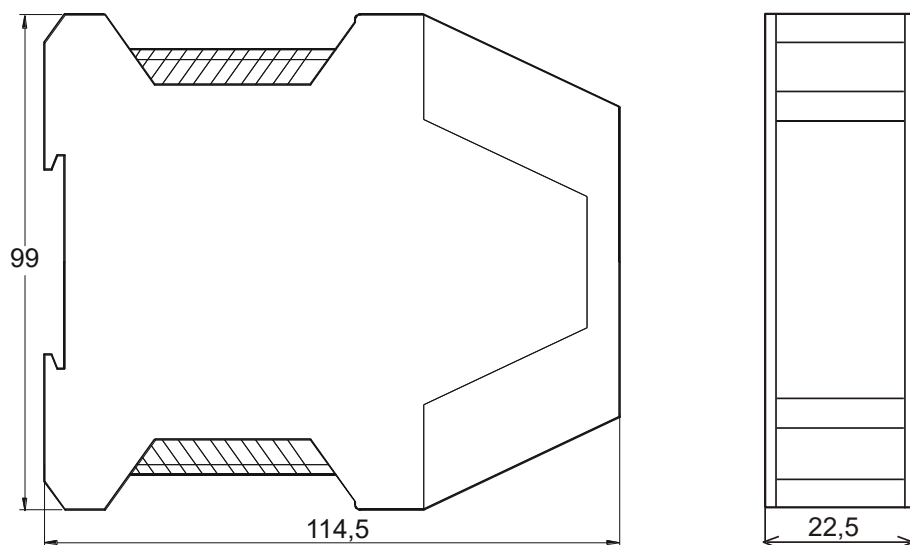
In general cables and wires of intrinsically safe circuits should be led separately regarding to non-intrinsically safe cables and wires. If intrinsically safe cable is shielded and is blue it can be in cable trays together with other non-intrinsically safe cables. Shield of the cable should be connected to the ground PE only from one side e.g. only in safe zone with a wire of 2,5mm² 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 μF for groups I, IIA, IIB and III and 0.6 μF 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.

Operation conditions:

Storage temperature	-	-30 ÷ +70°C
Ambient working temperature	-	-30 ÷ +70°C
Relative humidity	-	max 90%
Ambient atmosphere	-	dust and aggressive fumes free
Operating position	-	any



Housing sketch.