



ATEX

SBEx-1S, SBEx-2S BINARY SEPARATOR

1 or 2 channels in one rail housing (TS35, 22.5mm width)

- accompanying device of group I of category (M1), group II i III category (1),

- device of "group II" "category 3",

- EC Type Test Certificate: KDB 04ATEX061

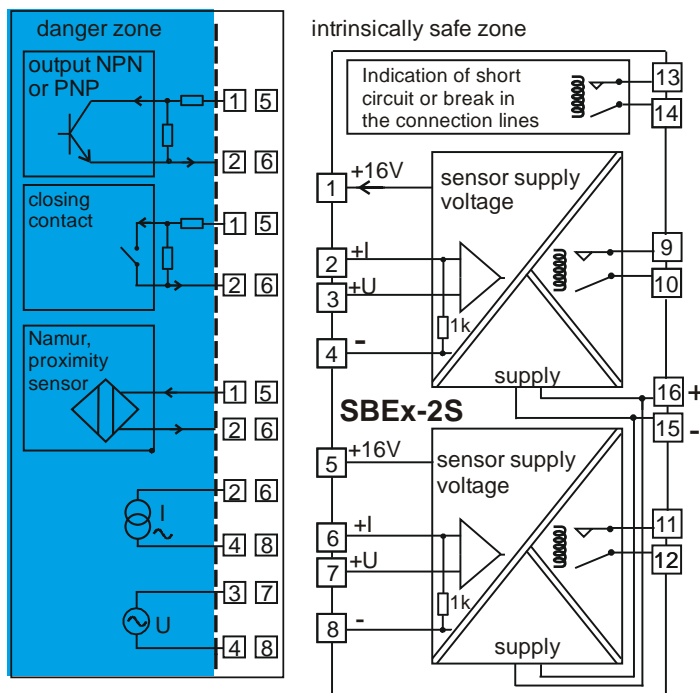
FEATURE: I (M1) [Ex ia] I; II (1) G [Ex ia] IIC; II (1) D [Ex ia] IIIC; II 3G Ex nA IIC T4

Protection Level IP20

Operating temperature range -25..+70°C

- **resistance, voltage or current comparator,**
- **input for proximity sensor, contacts, voltage and current signals,**
- **short-circuit or open-circuit signaling of the inductive proximity sensor connection,**
- **relay, opto-relay or open-collector output,**
- **operate phase adjustable with on-housing switches,**
- **inputs, outputs and power supply mutually galvanically separated.**

- Intrinsically safe input circuits can operate with intrinsically safe circuits of protection level ia, ib or ic (see page 3 – Conditions of use) of a device installed in explosion hazardous area "0, 1, 2, 20, 21, 22" of any explosive mixtures and mine undergrounds including e.g. proximity sensor, flow turbine sensor, contact or transistor NPN/PNP etc.
- Non-intrinsically safe output circuits, signaling circuit and power supply circuit can operate with non-intrinsically safe circuits of devices with voltage $U_m=253V$ e.g. supplied from the 230Vac network.
- The device as accompanying device should be installed in explosion safe zone or in explosion hazardous zone in suitable explosion-proof designed enclosure (see page 3). Atmosphere should be dry, dust free and protected against access of people not trained in maintenance and operation of the device.
- The device can be installed in explosion hazardous zone in "1, 2, 21, 22" and mine undergrounds only in flameproof enclosure Ex d (or another in accordance to the relevant standards). In zone "2" basing on designation Ex 3G nA IIC T4(category 3 device) it can be also installed basing on other rules – see page 3.



- Note:**
1. While the power is turned off all outputs are logically „0” – relay contacts are opened.
 2. To ensure a good operation of the "ALARM" signalization in default NAMUR realization, the input of unused measurement channel should be shorted by resistor R: $6k\Omega > R > 4k\Omega$
 3. The following terminals are available for the 1-channel version: 5,6,7,8 input, 11,12 output, 13,14 ALARM, 15,16 power supply

Order example:

Binary separator, two channels for 3-wire sensors $U_{sup}=12V$:
 channel 1 and 2 – voltage input of 4V / 6V switching levels:
 SBEx-2S / U – (5V; 1V) / U – (5V; 1 V).

Purpose:

Separator can be used to compare resistance (such as protective conductor or control line) as well as to transfer state of contacts, binary transistor sensor or any signal to galvanically separated side. It is designed to be used with NAMUR proximity sensors.

Separator has also two types of inputs:

type U - voltage input (e.g. levels 0/24V),

type I - current input, signal from proximity sensor contact or transistor and comparison resistance value connected to "1-2" and "5-6" terminals .

There is a possibility to select voltage or current input switching level and to adjust width of hysteresis. These parameters must be given in the order code. Shaping circuit with hysteresis allows to work with slow and fast rising signal slopes.

Ordering code:

SBEx- binary separator,
 1S or 2S - --- 1 or 2 channels
 Tor 1 - ----- channel 1 parameters
 (X; H) -- input parameters X – switching level,
 H – hysteresis width
 Tor 2 - channel 2 parameters
 (X; H)- input parameters X – switching level,
 H – hysteresis width

Desired voltage value U_{sup} on contacts "1" and "5" should be chosen from the range $0 \div 17.4V$.

Voltage between terminals 1 – 4 and 5 – 8 is 16V (**0÷17,4V after agreement**). In case of driving separator from “open-collector” transistor terminals 1 and 5 should be connected to the collector.

The source of current signal can be e. g. resistance change or output of any sensor watching significant changes in physical value.

Depending on user needs switching thresholds and hysteresis are required in order for each channel separately

Increase of input signal (U or I) above value (switching level + hysteresis)

will cause short circuit of output relay contact and lighting of the green LED.

In standard version the separator can operate with NAMUR sensors e.g. two-wire inductive proximity sensors type PCIN (offer can be found on our website). While operating with sensors PNP, NPN, OC transistors or contact the separator indicates shorting or opening of the connection line. Then red LED described as ALARM lights up and contacts connected to terminals 13 and 14 short. It is shared indication for both channels – user should check which channel is related to the fault. Activation phase of the relay and red LED can be changed with the switch located on the side of the housing.

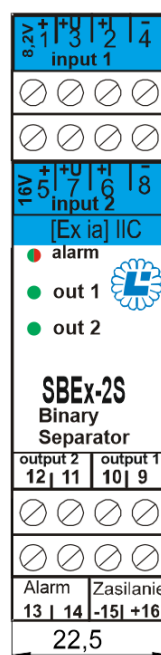
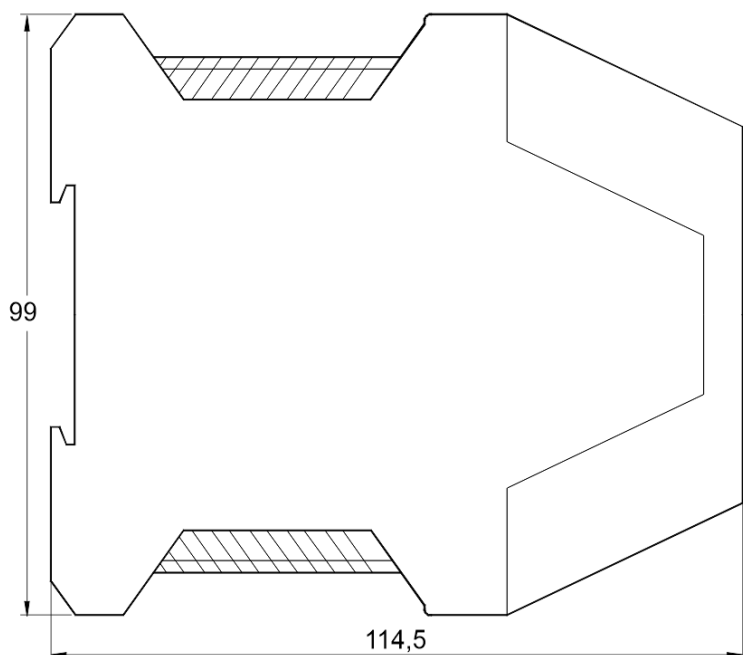
Lighting of the ALARM LED (regardless of color) indicates the presence of 24Vdc voltage supplying the separator.

Note: to let “short / open in sensor channel indication” work properly (when working with contact or NPN, PNP transistor) connect in parallel resistor 22÷36kΩ and in serial resistor 2.4÷3 kΩ to the terminals of the sensor (terminals 1-2 channel 1 ⇒ check figure on page 1).

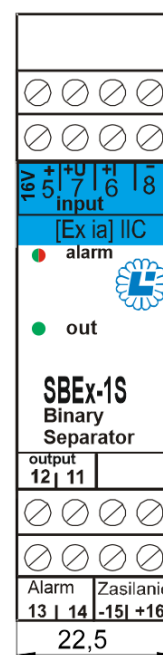
Technical specification: One or two channels with the following parameters.

Input signal type	- resistance change - proximity sensor, - contact or transistor switch, - current or voltage.
Current input threshold	- <1,4mA / >1,9mA
Voltage input threshold	- <4V / >5,6V
Maximum input voltage	- U < 30V
Maximum input current	- I < 100 mA
Input resistance - current	- 0 ÷ 1 kΩ
Input resistance - voltage	- typically 50 kΩ
Open signalization threshold in inductive sensor circuit	- opened I < 0.15mA not opened I > 0.35mA
Short signalization threshold in inductive sensor circuit	- shorted R < 1.6kΩ not shorted R > 2.1kΩ
Sensor supply voltage	- typically U = 16V - I _{LOAD} · 560Ω
Output - relay contact	
- switching time	3 ms max
- switching frequency	- max 10 Hz
- mechanical durability	- 10 ⁷ (for 1Hz ⇒ 4 months)
- switched power	- max 250Vac / 0.3A - max 30Vdc / 1A
- minimal switched signal	- U > 10mV, I > 10μA
After agreement – OPTO-A	- 350V, 0.1A, 800 Hz, r=30Ω
After agreement – OPTO-B	- 30V, 1A, 800 Hz
Separator supply voltage	- 20 ÷ 28V DC / max 50 mA
Note: If supply voltage exceeds 29V the fuse of the protection barrier may be burnt – repair only by the manufacturer.	
Galvanic isolation	- all circuits are mutually separated
Isolation test voltage	- 2 kV
Compliance with directive EMC 2014/30/EU	- PN-EN 61326-1:2013-06

Detailed reconciliation of switching thresholds is recommended. This also applies to additional resistors which allow indication of shorting and opening of connection line with ALARM signal.



2-channel version



1-channel version

The separator can be made in a wall-mounted housing with power supply 220V/50Hz.

1. Safety parameters given separately for terminals “1-2; 1-4; 5-6; 5-8” and “2-4; 3-4; 6-8; 7-8”.

Terminals “1-2, 1-4” in channel 1 (similar to terminals “5-6, 5-8” in channel 2) and set of terminals “2-4, 3-4” in channel 1 (similar to terminals “6-8, 7-8” in channel 2) are a separate, galvanically connected with each other, intrinsically safe circuits. One multi-wire type A or B IEC 60079-14 cable or separate cables may be used to connect both circuits simultaneously.

- a) **Intrinsically safe power supply input circuit: “channel 1” - terminals “1-2”, “1-3”, “1-4” and “channel 2” - terminals “5-6”, “5-7”, “5-8” with “ia” protection level:**

In channel 1 terminals 1-2 or 1-4 are used (similar to terminals 5-6 or 5-8 in channel 2).

Clustered parameters Lo, Co.

Clustered values Co, Lo and connection cable parameters L/R should be taken according to the table below. Data refer to clustered values can also be applied to cables.

Realization	Uo [V]	Io [mA]	Po [mW]	L/R [mH/Ω]			Lo [mH]			Co [μF]		
				I and IIA	IIB	IIC	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	0÷17.4	32.7	142.3	2.0	1.0	0.25	20	10	2	1.3	1	0,25

Characteristic of circuits is trapezoidal.

Distributed parameters Lo, Co.

Distributed values Co, Lo for connection cable should be taken according to the table on the right. L/R connection cable parameters should be taken according to the table above.

Realization	Lo [mH]			Co [μF]		
	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	100	100	38	8.4	2.02	0.346

Characteristic of circuits is trapezoidal.

- b) **passive measurement inputs.**

- Intrinsically safe input circuit: “channel 1” - terminals “2-4”, “3-4” and “channel 2” – terminals “6-8”, “7-8” with “ia” protection level.

In channel 1 terminals 2-4 or 3-4 are used (similar to terminals 6-8 or 7-8 in channel 2).

Lo, Co values for clustered and distributed parameters.

Clustered values Co, Lo and connection cable parameters L/R should be taken according to the table below. Data refer to clustered values can also be applied to cables.

Realization	Uo [V]	Io [mA]	Po [mW]	L/R [mH/Ω]			Lo [mH]			Co [μF]		
				I and IIA	IIB	IIC	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	6.51	0.46	2	138	69	17.3	100	50	20	9.1	6.2	1.5

Characteristic of circuits is linear.

- Intrinsically safe input circuit parameters: “channel 1” - terminals “2-4”, “3-4” and “channel 2” - terminals “6-8”, “7-8” with “ia” protection level:

$$U_i=30V, I_i=any, P_i=any, L_i \cong 0, C_i \cong 0.$$

2. Safety parameters given together for terminals “1+2+3 and 4” and “5+6+7 and 8”.

One multi-wire type A or B IEC 60079-14 cable or separate cables may be used to connect terminals “1, 2, 3, 4” in channel 1 and set of terminals “5, 6, 7, 8” in channel 2.

- a) **Intrinsically safe output circuits: “channel 1” - terminals “1, 2, 3, 4” and “channel 2” - terminals “5, 6, 7, 8” with “ia” protection level.**

Clustered parameters Lo, Co.

Clustered values Co, Lo and connection cable parameters L/R should be taken according to the table below. Data refer to clustered values can also be applied to cables.

Realization	Uo [V]	Io [mA]	Po [mW]	L/R [mH/Ω]			Lo [mH]			Co [μF]		
				I and IIA	IIB	IIC	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	6.5÷17.4	33.6	146	2.0	1.0	0.25	20	10	2	1.3	1	0.25

Characteristic of circuits is trapezoidal.

Data refer to clustered values can also be applied to cables.

Distributed parameters Lo, Co.

Distributed values Co, Lo for connection cable should be taken according to the table on the right. L/R connection cable parameters should be taken according to the table above.

Realization	Lo [mH]			Co [μF]		
	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	100	100	37	8.4	2.02	0.346
Characteristic of circuits is trapezoidal.						

- b) Intrinsicly safe input circuit parameters: “channel 1” - terminals “2,-4”, “3-4” and “channel 2” - terminals “6-8”, “7-8” with “ia” protection level:
Ui=30V, Ii=any, Pi=any, Li ≅ 0, Ci ≅ 0.

3. Safety parameters when both intrinsically safe circuits are serially galvanically connected given for terminals “1+2+3+4+5+6+7+8”.

Terminals “1, 2, 3, 4, 5, 6, 7, 8” can be connected with one multi-wire.

- a) Intrinsicly safe, connected with each other serially both input: “channel 1” - terminals “1, 2, 3 and 4” and “channel 2” - terminals “5, 6, 7 and 8” with “ia” protection level.

Clustered parameters Lo, Co.

Clustered values Co, Lo and connection cable parameters L/R should be taken according to the table below. Data refer to clustered values can also be applied to cables.

Realization	Uo [V]	Io [mA]	Po [mW]	L/R [mH/Ω]			Lo [mH]			Co [μF]		
				I and IIA	IIB	IIC	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	13÷34.8	33.6	292	0.97	0.48	0.12	10	2	0.5	0.26	0.23	0.46
Characteristic of circuits is trapezoidal.												

Distributed parameters Lo, Co.

Distributed values Co, Lo for connection cable should be taken according to the table on the right. L/R connection cable parameters should be taken according to the table above.

Realization	Lo [mH]			Co [μF]		
	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	100	100	22	1,3	0.39	0.046
Characteristic of circuits is trapezoidal.						

- b) Intrinsicly safe input circuit parameters: “channel 1” - terminals “2,-4”, “3-4” and “channel 2” - terminals “6-8”, “7-8” with “ia” protection level:
Ui=30V, Ii=any, Pi=any, Li ≅ 0, Ci ≅ 0.

4. Safety parameters when both intrinsically safe circuits are parallelly galvanically connected given for terminals “1+2+3+4+5+6+7+8”.

Terminals “1, 2, 3, 4, 5, 6, 7, 8” can be connected with one multi-wire.

- a) Intrinsicly safe, connected with each other parallelly both input: “channel 1” - terminals “1, 2, 3 and 4” and “channel 2” - terminals “5, 6, 7 and 8” with “ia” protection level.

Clustered parameters Lo, Co.

Clustered values Co, Lo and connection cable parameters L/R should be taken according to the table below. Data refer to clustered values can also be applied to cables.

Realization	Uo [V]	Io [mA]	Po [mW]	L/R [mH/Ω]			Lo [mH]			Co [μF]		
				I and IIA	IIB	IIC	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	6.5÷17.4	67.2	292	0.97	0.48	0.12	10	10	2	1.3	0.9	0.23
Characteristic of circuits is trapezoidal.												

Distributed parameters Lo, Co.

Distributed values Co, Lo for connection cable should be taken according to the table on the right. L/R connection cable parameters should be taken according to the table above.

Realization	Lo [mH]			Co [μF]		
	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2S	59	38	2	8.4	2.02	0.346
Characteristic of circuits is trapezoidal.						

- b) Intrinsicly safe input circuit parameters: “channel 1” - terminals “2,-4”, “3-4” and “channel 2” - terminals “6-8”, “7-8” with “ia” protection level:
Ui=30V, Ii=any, Pi=any, Li ≅ 0, Ci ≅ 0.

5) Non-intrinsically safe circuits parameters:

“channel 1 output” - terminals “9-10”; “channel 2 output” – terminals “11-12”; “alarm” – terminals “13-14” and
“24V supply” - terminals “15-16”: $U_m=253V$

In installations in which parameters C_i and L_i of device cooperating with intrinsically safe circuit (connection cable excluded) exceeds 1% of the value of parameters C_o and L_o given in the table above you should:

- from 50% of the value of C_o , L_o subtract C_i , L_i of cooperating device,
- these values remains for parameters of connection cable,
- if cable parameters are unknown you can take 100pF/m, 0,7μH/m for calculation.

The maximum values of capacitance and inductance attached to the intrinsically safe terminals 1, 2, 3, 4, 5, 6, 7, 8 should be chosen taking safety parameters of the attached circuits (given in terms of equipment that will be connected to the input separator SBEx-2) into account, but may not exceed the values given in the tables above.

Conditions of use:

If the intrinsically safe circuits has operated with intrinsically safe circuit with “ic” protection level, it may in the future operate with “ia” or “ib” protection circuits, provided that the device is sent to the manufacturer for technical verification of its “ia” protection level.

The device has a plastic, non-flammable housing and is adapted for mounting on a DIN T35 rail.

In the event of damage, the device cannot be repaired by the end-user and must be returned to the manufacturer or his authorized representative. All unauthorized modifications should be avoided.

The intrinsically safe conductors must be identifiable, separated from non-intrinsically safe ones and wired in accordance with the relevant national / international installation standards. Make sure that the wires are well insulated from each other and do not cause any unintentional connections. Intrinsically safe wiring (between the intrinsically safe circuit located in the hazardous area and the intrinsically safe circuit of the device) must have a minimum insulation thickness of 0.25 mm.

Typically, the device, as an accompanying device, should be mounted in a safe zone.

The device can be installed in a hazardous area "1, 2, 21, 22" and mine undergrounds only in Ex d (or other according to the applicable rules). In zone "2", based on the II 3G Ex nA IIC T4 (device category 3), it can be installed also on other rules described below in the environment of explosive mixtures with temperature class T1, T2, T3, T4 (with ignition temperature $T \geq 135^\circ C$).

In the case of explosion group I (underground mines) after switching off the power supply, the device can be removed from the flameproof enclosure without time delay, unless placed on the cover's housing "Do not open the housing within 10 min. after turning off the power." In the case of using the device in the group II gaseous or group III dust explosion group, the device cannot be removed from the flameproof enclosure without a time delay and on the outside of the enclosure the warning sign should be placed: "Do not open the casing within 10 min after turning off the power.".

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 safest to install the device in zone 2, both inside and outside of the building, in an explosion proof enclosure (eg with an "Ex nA", "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 9, 10, 11, 12, 13, 14, 15, 16, 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 $0.25 \div 2.5 \text{ mm}^2$,
 - 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 crushed 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).
- 8) If an explosive atmosphere is present or can occur, non-intrinsically safe terminals numbers 9, 10, 11, 12, 13, 14, 15, 16 must not be connected to live cables. When the device is powered, you can disconnect / connect disconnectable connector blocks but do not disconnect / connect non-intrinsically safe circuits. If an explosive atmosphere is present or can occur during service work, disconnect all non-intrinsically safe connector blocks or disconnect these circuits in the safe area. If there is no explosive atmosphere during service work, the above-mentioned principles from point 8 are not required.

Separator's housing is made of self-extinguishing plastic (poliamid PA 6.6) and can be mounted on TS35 rail. The housing and terminals are IP20 made.

Outer connections should be connected using cables with $\varnothing \leq 2.5$ mm.

ATEX compliance – directive 214/34/UE: PN-EN 60079-0:2013, PN-EN 60079-11:2012, PN-EN 60079-15:2010, PN-EN 50303:2004.

Operation condition :

Ambient temperature - for storage	- -30 ÷ +70°C
Ambient temperature - operation	- -25 ÷ +70°C
Relative humidity	- max 90% and no condensation
Ambient atmosphere	- no dust and aggressive gases
Working position	- any