SBEx-2 BINARY SEPARATOR

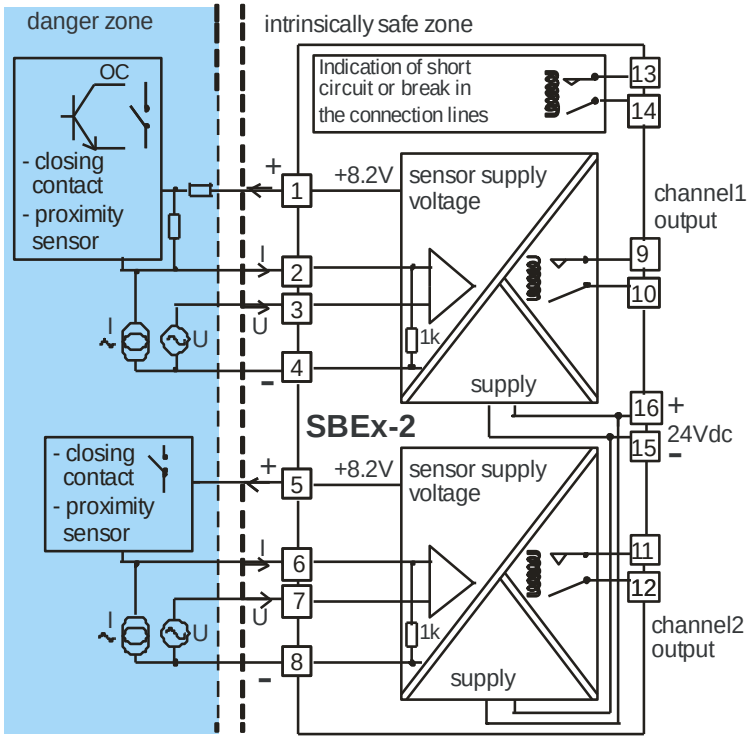
ATEX

1 OR 2 CHANNELS IN ONE HOUSING.

- accompanying device of group I of category (M1), group II and III category (1),
- two channels in one rail housing (TS35, width 22.5mm),
- level "ia" intrinsically safe input circuits – compliance with ATEX,
- EC-Type Examination Certificate: KDB 04ATEX061
FEATURE: I (M1) [Ex ia] I; II (1) G [Ex ia] IIC; II (1) D [Ex ia] IIIC
Protection level IP20 Operating temperature range -25..+70°C

- ***inputs for proximity sensors, contacts, voltage, current and NAMUR 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 circuit can operate with any device, with intrinsically safe circuit of protection level ia or ib, that is installed in explosive hazardous area of group I and zones "0, 1, 2, 20, 21, 22" of group II of any mixture, including e.g. proximity sensor, turbine flow sensor, contact, OC etc.
- Output circuits, signaling circuit and supply circuit can operate with any non-intrinsically safe devices circuits of voltage Um=253V e.g. supplied from the 230Vac network.
- Separator can be installed in a room that is safe in terms of explosion and protected against access of persons not trained in maintenance and operating of the separator.
- Separator installed in a hazardous area can have a flameproof housing. Separator can be removed from the housing shortly after power in group I is turned off, because it does not contain any energy storage elements and do not become too hot. A 10 minutes delay is necessary in group II and III (gases and dusts).



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: $6k\Omega > R > 4k\Omega$.

Order example:

Binary separator, two channels, channel 1 – standard current input for proximity sensor 1.2/2.1mA, channel 2 – voltage input of 2.5V switching level and 0.5V hysteresis width:
SBEx-2/14mA/I-S/U-(2.5; 0.5V)/; Channel1 and ALARM-PK; Channel2-OPTO-B

Application:

Separator can be used to transfer the voltage from contacts or open-collector transistor or any signal to the galvanically separated side. It is adapted to operate with NAMUR type proximity sensors that switch the current between 1.2/2.1 mA (DIN 19234).
Separator has also two types of inputs:
U type – voltage input (e.g. 0/24 V),
I type – current input, e.g. signal from proximity sensor, contact or transistor.
There is a possibility to adjust the input switching voltage or input switching current and hysteresis width. These parameters should be given in the ordering code. Shaping circuit with hysteresis allows you to work with the fast and slow rising signal slopes.

Ordering code:

SBEx-1 or 2 - -	binary separator, 1 or 2 channels	
SBEx-1/5,3mA	SBEx-2/5,3mA	max Io=5,3mA
SBEx-1/14mA	SBEx-2/14mA	max Io=14,5mA
SBEx-1/21mA	SBEx-2/21mA	max Io=21mA
SBEx-1/30mA	SBEx-2/30mA	max Io=30,4mA
SBEx-1/47mA	SBEx-2/47mA	max Io=47,4mA

Channel 1 - --	channel 1 parameters
S - --------	standard input parameters
(X; H) --	input parameters X – switching level, H – hysteresis width
Tor 2 -	channel 1 parameters
S - --	standard input parameters
(X; H)-	input parameters X – switching level, H – hysteresis width

Desired voltage value U on contacts "1" and "5" from range 0÷10,5V should be described.
Output type should be described as well: relays ⇒ PK; optorelays ⇒ OPTO-A or OPTO-B.

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The voltage between contacts 1 - 4 and between 5 - 8 is **typically** 8.2V (**0÷10,5V after agreement**).
In the case, when the separator is driver from an "open-collector" transistor, contact 1 and 5 should be connected with the collector.
Any converter's output, that measures a big variation of some physical value, can be a source of the current signal. Voltage impulses can be provided e.g. by the generator.
Depending on the user needs, the switching thresholds and hysteresis should be specified in the order separately for each channel.
Exceeding the input signal value of
(switching level + hysteresis)
results in shorting the output relay contact and turning on the green LED. If the red "ALARM" LED turns on, it means the connection line is broken (shorted or opened) – relay contact will be shorted in such case. User can reverse the phase of operation of all relays and LEDs by using the switches on the side wall of the housing (switcher 1 – ALARM; switcher 2 - TOR 1; switcher 3 – TOR 2).
Separator signalizes if connection lines are opened or shorted in cooperation with NAMUR type sensors e.g. two-wire inductive proximity sensors of type PCIN by SELS. In such case the red "ALARM" LED is turned on and the contacts connected to terminals "13", "14" become shorted (inner relay signalizing a failure). It is a common signalization for both channels – the user should check, which channel is concerned by the alarm. By using the switch that is placed on the side wall of the housing of the transducer, the phase of the relay and the red LED trigger can be changed.
"ALARM" LED is always turned on (green or red) and it means that there is 24Vdc power supply connected to the separator.
Note: When working with the contact or transistor, a 20÷25kΩ resistor should be mounted in series, and 0,5÷1 kΩ resistor in parallel, to the sensor terminals (in hazardous area), to make the "sensor channel short/open signalization" work properly (terminals 1-2, channel 1 ⇒ check the figure on page no. 1).

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

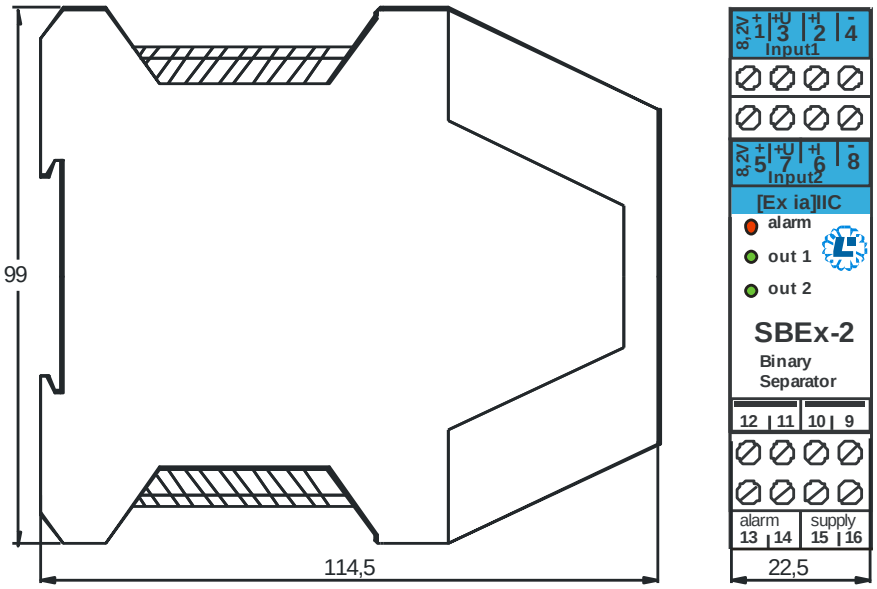
Input signals type	- Proximity sensor, contact or transistor switch, - current, - voltage.
Default switching thresholds:	
- current input and contact	- 1.45 / 1.85 mA
- voltage input	- 4.0 / 5.6 V
Maximal input voltage	- U < 30V
Maximal input current	- I < 100 mA
Input resistance - current	- typically 500 Ω
- voltage	- 75 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 < 500Ω not shorted R > 700Ω
Sensor's supply voltage	- typically 8.2V±5% after agreement 0÷10,5 V
Input - relay contact	
- switching time	- typically 10 ms
- switching frequency	- 10Hz (max 20Hz)
- 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 – OC output	- 350V, 0,1A, 800Hz, r=30Ω
Separator supply voltage	- 20 ÷ 27V DC / max 55 mA

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

Electrical isolation	- all circuits are mutually separated
Isolation test voltage	- 1,5 kV

Standard S parameters:

Current input I	- 1.2 / 2.1mA – separator is then adjusted to work with **NAMUR proximity sensor e.g. type PCIN by SELS**
For contact	- R>10kΩ / R<2kΩ
Voltage input U	- U<4.0V / U>5.6V



Separator can be made in wall housing with 220V/50Hz power supply.

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1. Safety parameters given separately for terminals "1-2; 1-4; 5-6; 5-8" and separately for terminals "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 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 input supplying circuit: "channel 1" – terminals "1-2", "1-3", "1-4" and "channel 2" – terminals "5-6", "5-7", "5-8" with "ia" protection level:

Terminals "1-2" or "1-4" are used in channel 1 (respectively terminals "5-6" or "5-8" in channel 2).

Clustered parameters Co, Lo.

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

Version	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-2/5,3mA	0÷10,5	5,3	15,8	218	9	2,2	50	20	5	3,8	2,7	0,65
SBEx-2/14mA		13,9	41,6	6,5	3,2	0,81				3,3	2,5	0,61
SBEx-2/21mA		20,4	61,1	4,5	2,2	0,56				3,1	2,5	0,58
SBEx-2/30mA		29,4	88,1	3,1	1,5	0,39				2,9	2,3	0,55
SBEx-2/47mA		46,8	140,4	2,0	1,0	0,25	20			3,2	2,1	0,5
Circuits characteristic is trapezoidal.												

Distributed parameters Lo, Co.

Distributed values Co, Lo for connection cable should be taken according to the table beside.
Connection cable parameters L/R can be taken from the table above.

Version	Lo [mH]			Co [µF]		
	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2/5,3mA	100	100	100	75	16,8	2,41
SBEx-2/14mA						
SBEx-2/21mA						
SBEx-2/30mA			52			
SBEx-2/47mA		87	20			
Circuits characteristic is trapezoidal.						

b) Passive measurement inputs.

- Intrinsically safe input circuit: **"channel 1" - terminals "2-4", "3-4"** and **"channel2" - terminals "6-8", "7-8"** with "ia" protection level.
  In channel 1 are used terminals "2-4" or "3-4" (similar in channel 2 terminals "6-8" or "7-8").

Values Lo, Co for clustered and distributed parameters.

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

Version	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-2/5,3mA	6,51	0,32	0,97	292	146	36	100	50	20	9,1	6,2	1,5
SBEx-2/14mA												
SBEx-2/21mA												
SBEx-2/30mA												
SBEx-2/47mA												
Circuits characteristic is linear.												

- Intrinsically safe input circuits parameters: "**channel1" – terminals "2,-4", "3-4"** and **"channel2" – terminals "6-8", "7-8"** with "ia" protection level:
  Ui=30V, Ii=any, Pi=any, Li ≅ 0, Ci ≅ 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 input circuits: “channel1” – terminals “1, 2, 3, 4” and “channel2” – 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 referred to clustered values Co, Lo can also be applied to cables.

Version	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-2/5,3mA	6,5÷10,5	5,91	17,74	16	8	2	50	20	5	3,7	2,8	0,64
SBEx-2/14mA		14,5	43,6	6,5	3,2	0,81				3,3	2,5	0,61
SBEx-2/21mA		21,0	63,1	4,5	2,2	0,56				3,1		0,58
SBEx-2/30mA		30,4	90,1	3,1	1,5	0,39				2,9	2,3	0,55
SBEx-2/47mA		47,4	142,3	2,0	1,0	0,25	20			3,2	2,1	0,5
Circuits characteristic is trapezoidal. Data refer to clustered values Lo and Co can also be applied to cables.												

Distributed parameters Lo, Co.

Distributed values Co, Lo for connection cable should be taken according to the table beside.
Connection cable parameters L/R can be taken from the table above.

Version	Lo [mH]			Co [µF]		
	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2/5,3mA	100	100	100	75	16,8	2,41
SBEx-2/14mA						
SBEx-2/21mA						
SBEx-2/30mA			49			
SBEx-2/47mA		85	20			
Circuits characteristic is trapezoidal.						

b) Intrinsically safe input circuits parameters: “channel1” - terminals “2,-4”, “3-4” and “channel2” – 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) Intrinsically safe, connected with each other serially both input circuits: “channel1” – terminals “1, 2, 3 and 4” and “channel2” – 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 referred to clustered values Co, Lo can also be applied to cables.

Version	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-2/5,3mA	13÷21	5,91	35,5	8	4	1	10	10	2	1,1	0,74	0,14
SBEx-2/14mA		14,5	87,2	3,2	1,6	0,4				1,0	0,91	0,13
SBEx-2/21mA		21,0	126,2	2,2	1,1	0,28		5			0,79	0,13
SBEx-2/30mA		30,4	180,2	1,5	0,79	0,19			10	0,97	0,77	0,12
SBEx-2/47mA		47,4	284,6	0,97	0,48	0,12			5	0,92	0,74	0,11
Circuits characteristic is trapezoidal.												

Distributed parameters Lo, Co.

Distributed values Co, Lo for connection cable should be taken according to the table beside.
Connection cable parameters L/R can be taken from the table above.

Version	Lo [mH]			Co [µF]		
	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2/5,3mA	100	100	100	4,78	1,27	0,188
SBEx-2/14mA						
SBEx-2/21mA			89			
SBEx-2/30mA			39			
SBEx-2/47mA		72	14			
Circuits characteristic is trapezoidal.						

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b) Intrinsically safe input circuits parameters: "channel1" - terminals "2,-4", "3-4" and "channel2" - 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) Intrinsically safe, connected with each other parallely both input circuits: "channel1" – terminals "1, 2, 3 and 4" and "channel2" – 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 referred to clustered values Co, Lo can also be applied to cables.

Version	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-2/5,3mA	6,5÷10,5	11,82	35,5	8	4	1	20	20	5	3,8	2,6	0,62
SBEx-2/14mA		29	87,2	3,2	1,6	0,4				3,5	2,4	0,56
SBEx-2/21mA		42	126,2	2,2	1,1	0,28				3,3	2,2	0,52
SBEx-2/30mA		60,8	180,2	1,5	0,79	0,19				2,9	1,9	0,45
SBEx-2/47mA		94,8	284,6	0,97	0,48	0,12			4,8	2,4	1,4	0,33
Circuits characteristic is trapezoidal.												

Distributed parameters Lo, Co.

Distributed values Co, Lo for connection cable should be taken according to the table beside.
Connection cable parameters L/R can be taken from the table above.

Version	Lo [mH]			Co [µF]		
	I and IIA	IIB	IIC	I and IIA	IIB	IIC
SBEx-2/5,3mA	100	100	100	75	16,8	2,41
SBEx-2/14mA			54			
SBEx-2/21mA			25			
SBEx-2/30mA	78	51	12			
SBEx-2/47mA	32	21	4,8			
Circuits characteristic is trapezoidal.						

b) Intrinsically safe input circuits parameters: "channel1" – terminals "2,-4", "3-4" and "channel2" - 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:

"channel1 output" – terminals "9-10"; "channel2 output" – terminals "11-12"; "alarm" – terminals "13-14" and "supply 24V" – terminals "15-16": Um=253V

Application condition:

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.

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 diameter 0,5 ÷ 2.5 mm^2.

ATEX compliance - directive 94/9/WE: PN-EN 60079-0:2009, PN-EN 60079-11:2012, PN-EN 50303:2004.

Operation condition:

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