

SP.1SC-2SC2D

Signal splitter and incremental converter for sine-cosine encoders

Product features:

- Encoder inputs SIN+, SIN-, COS+, COS-, REF+, REF- with 1 Vpp format
- Two sine-cosine output channels with the same signal format
- Two incremental outputs, each with differential signal format A, /A, B, /B, 0, /0, individually adjustable to either TTL/RS422 level or HTL (10 to 30 V) level
- Suitable for input frequencies up to 500 kHz
- 5 V or 24 V encoder supply (switchable)
- 17 to 30 VDC power supply

Version:	Description:
Index 1	2018-01

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1. Safety Instructions and Responsibility

1.1 General Safety Instructions

This operation manual is a significant component of the unit and includes important rules and hints about the installation, function and usage. Non-observance can result in damage and/or impairment of the functions to the unit or the machine or even in injury to persons using the equipment!

Please read the following instructions carefully before operating the device and observe all safety and warning instructions! Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use these manual. The unit must be installed, connected and put into operation by a qualified electrician.

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation and operation. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.

In addition the manufacturer reserve the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.

The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

During installation or maintenance all general and also all country- and application-specific safety rules and standards must be observed.

If the device is used in processes, where a failure or faulty operation could damage the system or injure persons, appropriate precautions to avoid such consequences must be taken.

1.2 Use according to the intended purpose

The unit is intended exclusively for use in industrial machines, constructions and systems. Non-conforming usage does not correspond to the provisions and lies within the sole responsibility of the user. The manufacturer is not liable for damages which has arisen through unsuitable and improper use.

Please note that device may only be installed in proper form and used in a technically perfect condition - in accordance to the technical specifications (see chapter [6](#)). The device is not suitable for operation in explosion-proof areas or areas which are excluded by the EN 61010-1 standard.

1.3 Installation

The device is only allowed to be installed and operated within the permissible temperature range. Please ensure an adequate ventilation and avoid all direct contact between the device and hot or aggressive gases and liquids.

Before installation or maintenance, the unit must be disconnected from all voltage-sources. Further it must be ensured that no danger can arise by touching the disconnected voltage-sources.

Devices which are supplied by AC-voltages, must be connected exclusively by switches, respectively circuit-breakers with the low voltage network. The switch or circuit-breaker must be placed as near as possible to the device and further indicated as separator.

Incoming as well as outgoing wires and wires for extra low voltages (ELV) must be separated from dangerous electrical cables (SELV circuits) by using a double resp. increased isolation.

All selected wires and isolations must be conform to the provided voltage- and temperature-ranges. Further all country- and application-specific standards, which are relevant for structure, form and quality of the wires, must be ensured. Indications about the permissible wire cross-sections for wiring are described in the technical specifications (see chapter [6](#)).

Before first start-up it must be ensured that all connections and wires are firmly seated and secured in the screw terminals. All (inclusively unused) terminals must be fastened by turning the relevant screws clockwise up to the stop.

Overvoltages at the connections must be limited to values in accordance to the overvoltage category II.

For placement, wiring, environmental conditions as well as shielding and earthing/grounding of the supply lines the general standards of industrial automation industry and the specific shielding instructions of the manufacturer are valid. Please find all respective hints and rules on www.kuebler.com/download.html --> “[General EMC Rules for Wiring, Screening and Earthing]”.

1.4 Cleaning, Maintenance and Service Notes

To clean the front of the unit please use only a slightly damp (not wet!), soft cloth. For the rear no cleaning is necessary. For an unscheduled, individual cleaning of the rear the maintenance staff or assembler is self-responsible.

During normal operation no maintenance is necessary. In case of unexpected problems, failures or malfunctions the device must be shipped for back to the manufacturer for checking, adjustment and reparation (if necessary). Unauthorized opening and repairing can have negative effects or failures to the protection-measures of the unit.

2. Application

The SP.1SC-2SC2D encoder splitter has been designed for clean and trouble-free distribution of the output signals of sine-cosine type encoders to several target units. Since on the output site the unit provides both, sine-cosine outputs and incremental outputs, it is suitable for use with target units with either sine or incremental inputs.

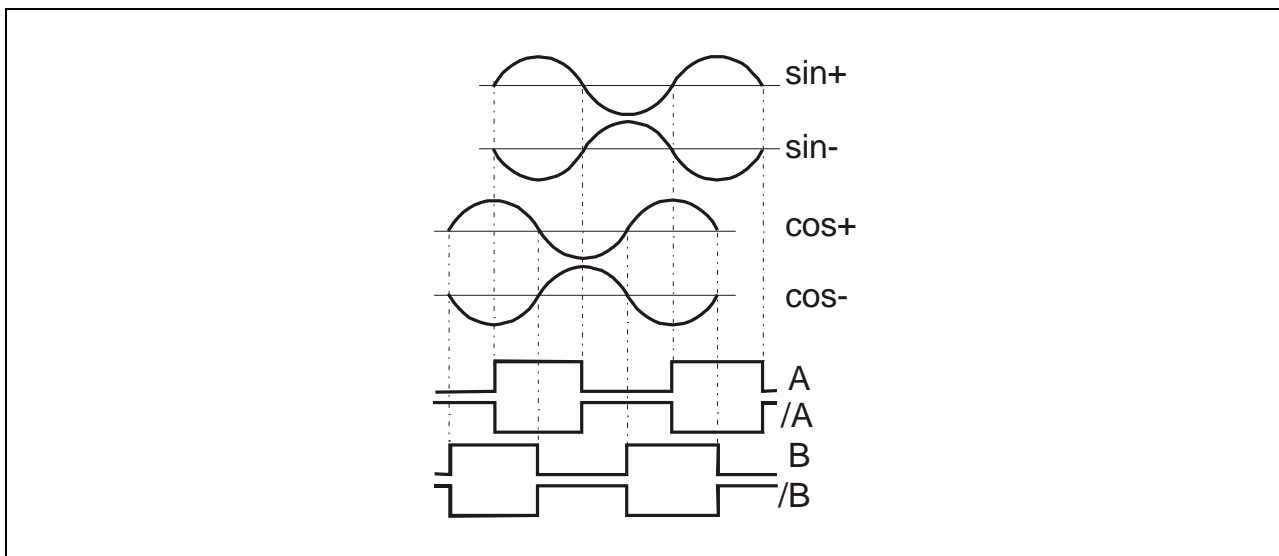
On both sine output channels the same signal format is available as on the input site, including a reference impulse (if available on the input site). All sine-cosine signals use the differential 1 V_{pp} format which is most common with industrial sine-cosine encoders.



Current signals according to the 11 μ A standard are not supported by this unit.

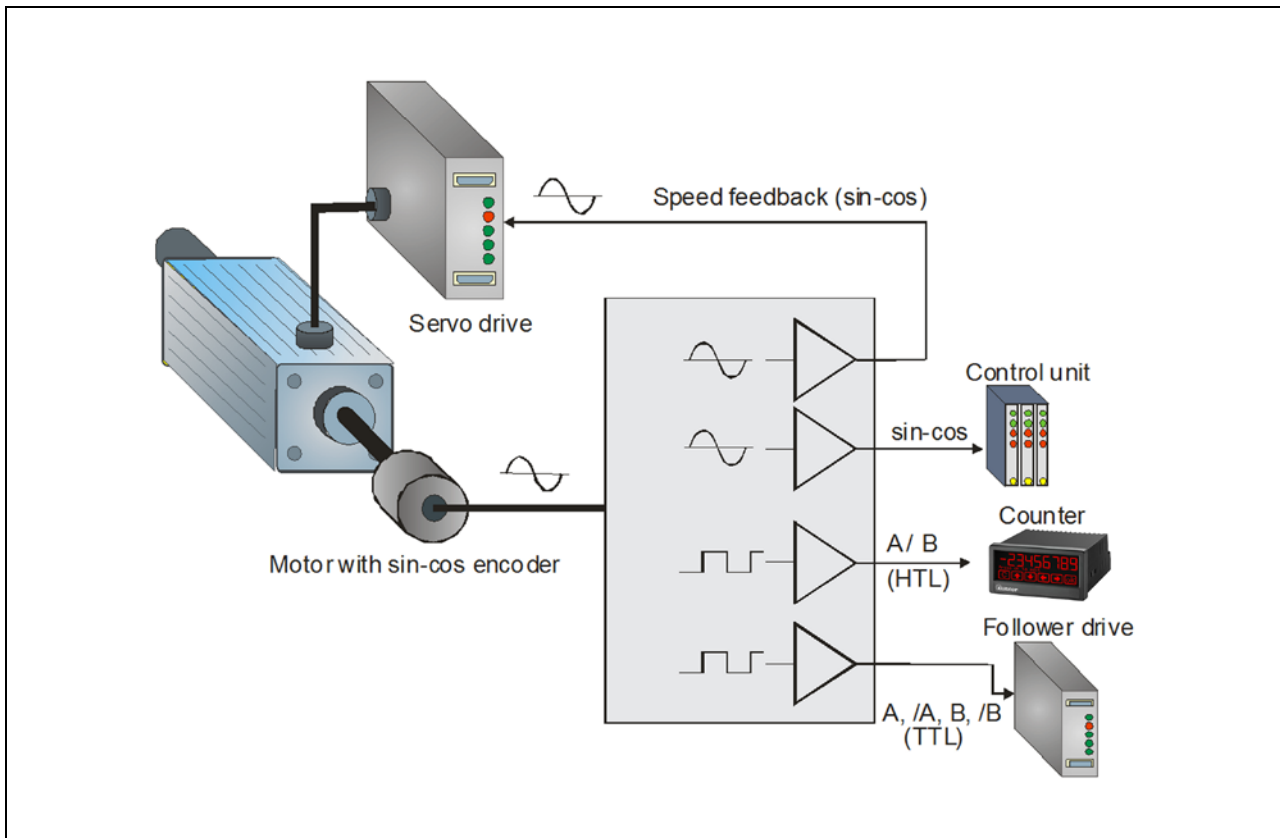
The two incremental output channels at the same time supply square wave signals, namely one impulse per each sine period and one index pulse per each reference signal on the input side. At any time the differential signals A, /A, B, /B, 0 /0 are available and the output level is settable to either TTL (5 V) or HTL (10 ... 30 V) level, separately for each output channel.

The diagram below explains the correlation between sine signals and incremental signals.



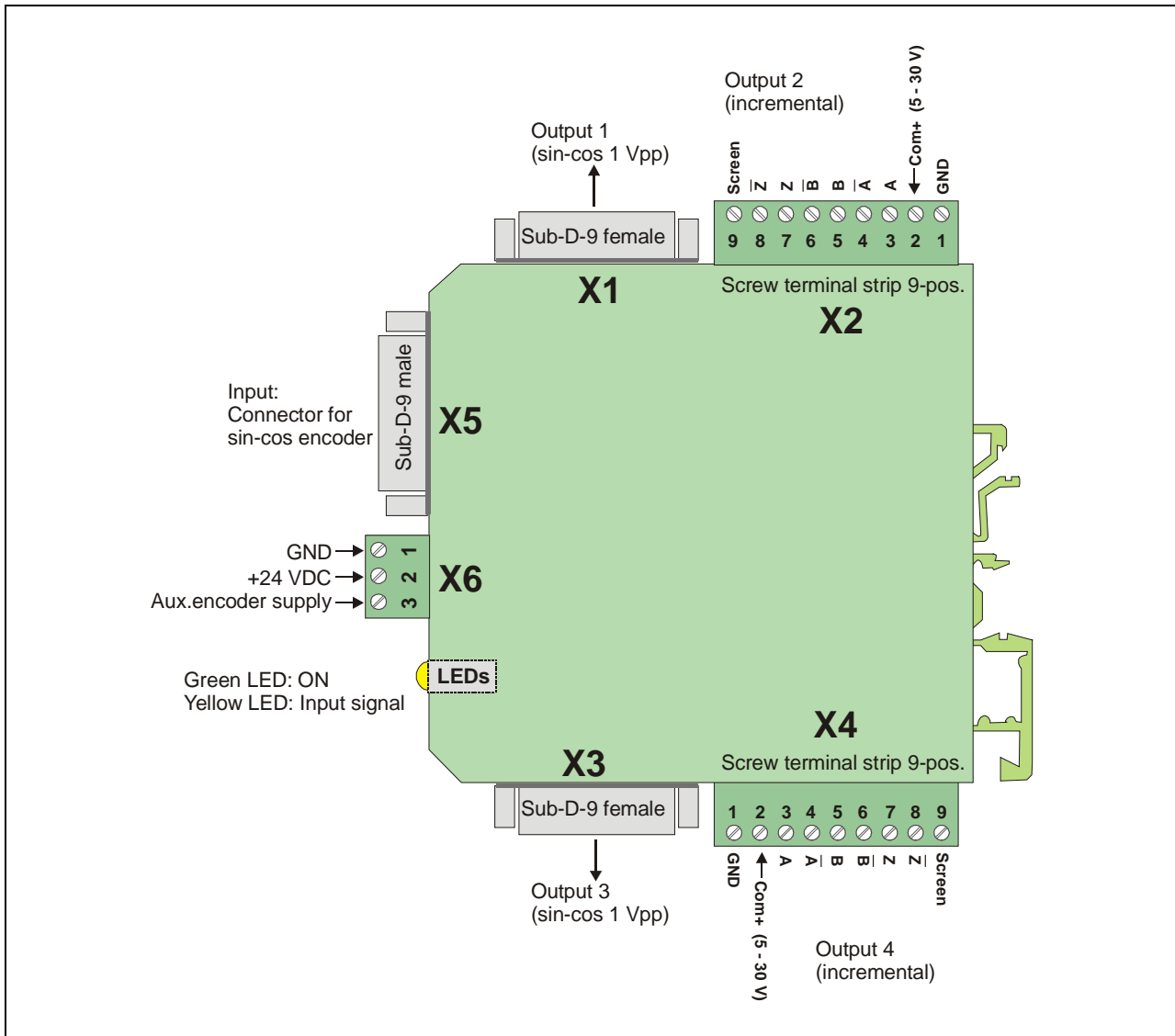
For interpolation of the sine waves to a higher number of incremental impulses (e.g. 50 increments per sine period) please refer to our Sine-Cosine Interpolator type SK.1SC-1D.

2.1. Typical application example of the SP.1SC-2SC2D signal splitter:



3. Connection Diagram

For wiring of the sinusoidal signals the unit provides 3 SUB-D-9 connectors (X1, X3, and X5). For all other connections 3 screw terminal strips are available (X2, X4, and X6).



3.1. Power Supply (X6)

The unit operates from a DC power from 17 to 30 volts which must be applied to the front terminals X6/1 (-) and X6/2 (+).

With unloaded state the current consumption is about 70 mA (encoder supply line and output channels unconnected). Terminal X6/3 selects the level of the auxiliary encoder supply output (5 V or 24 V).

More details are explained under section [3.2](#) "Connection of the SinCos Encoder (X5)".

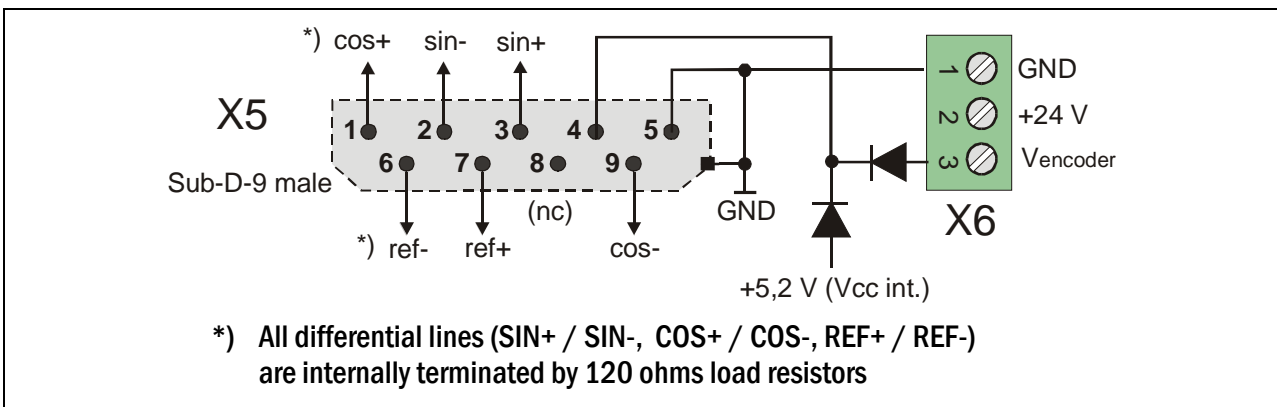
3.2. Connection of the SinCos Encoder (X5)

The encoder can be connected via the front SUB-D-9 connector marked X5 (male connector on unit side, female connector on the encoder cable). Only encoders with differential sine-cosine signals of 1 Vpp can be used (0.8 Vpp - 1.2 Vpp).

At any time the signals SIN+ / SIN- and COS+ / COS- must be available. Where an additional reference marker pulse is used, also the signals REF+ / REF- must be applied.

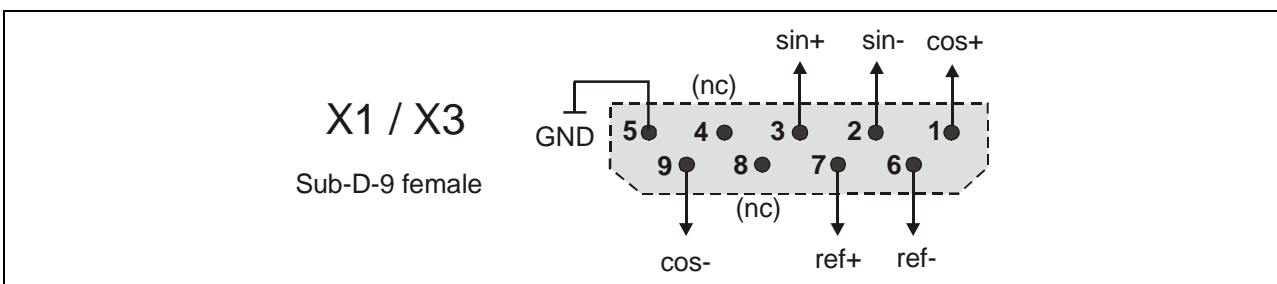
Pins 4 (+) and 5 (-) of the SUB-D-connector provide an auxiliary power output for the encoder supply. When terminal 3 of the front X6 connector is unconnected, the aux. output voltage is automatically about 5.2 volts (max. 150 mA). Where the encoder requires another supply voltage (e.g. 24 volts), an appropriate voltage can be applied remotely to terminal X6/3.

Please note that the metallic housing of the SUB-D input connector is internally connected to the common GND potential of the unit.



3.3. The Sine-Cosine Outputs (X1 und X3)

These two SUB-D-outputs provide an image of the sine-cosine input signals, however with a fixed offset voltage of 2.5 volts with respect to GND. This allows a clean and trouble-free distribution of the input signal to two target units.

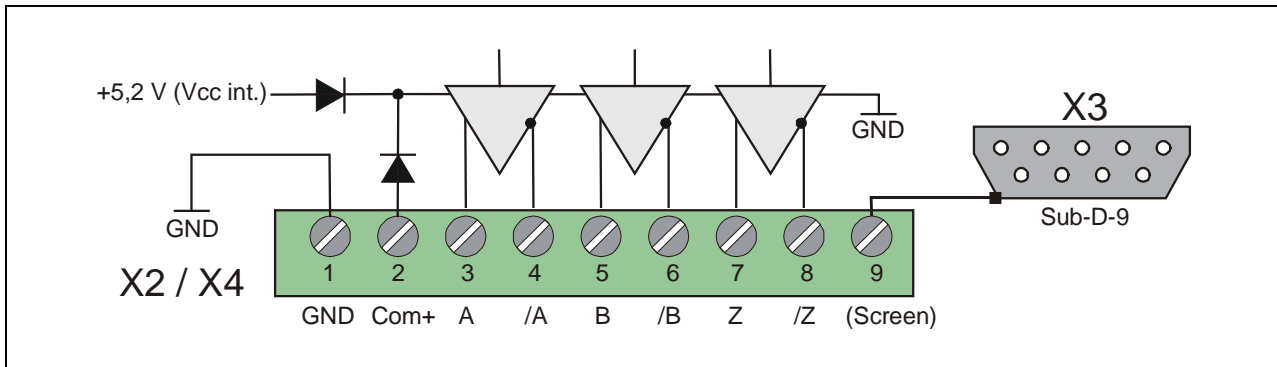


- It is mandatory to use cables with pairwise twisted wires for all sinusoidal signals SIN+ / SIN-, COS+ / COS- and REF+ / REF-.
- For signal transmission the target unit must provide terminating resistors at the end of the signal line (in each case 120 ohms between signal+ and signal-).
- Since on the inputs the unit already uses in-built termination resistors, no further measures must be taken on the encoder side.

3.4. The Incremental Outputs (X2 und X4)

On the terminal strips X2 and X4 the encoder information is available with a differential square wave format. All incremental outputs use push-pull drivers. When position 2 (Com+) of the corresponding terminal strip is unconnected, the output level is automatically adapted to TTL / RS422 format.

As soon as terminal position 2 receives any external voltage $> 5.5 \text{ V} / < 30 \text{ V}$, automatically this voltage will determine the output swing. Consequently each of the two incremental outputs can operate with its own specific TTL or HTL level.



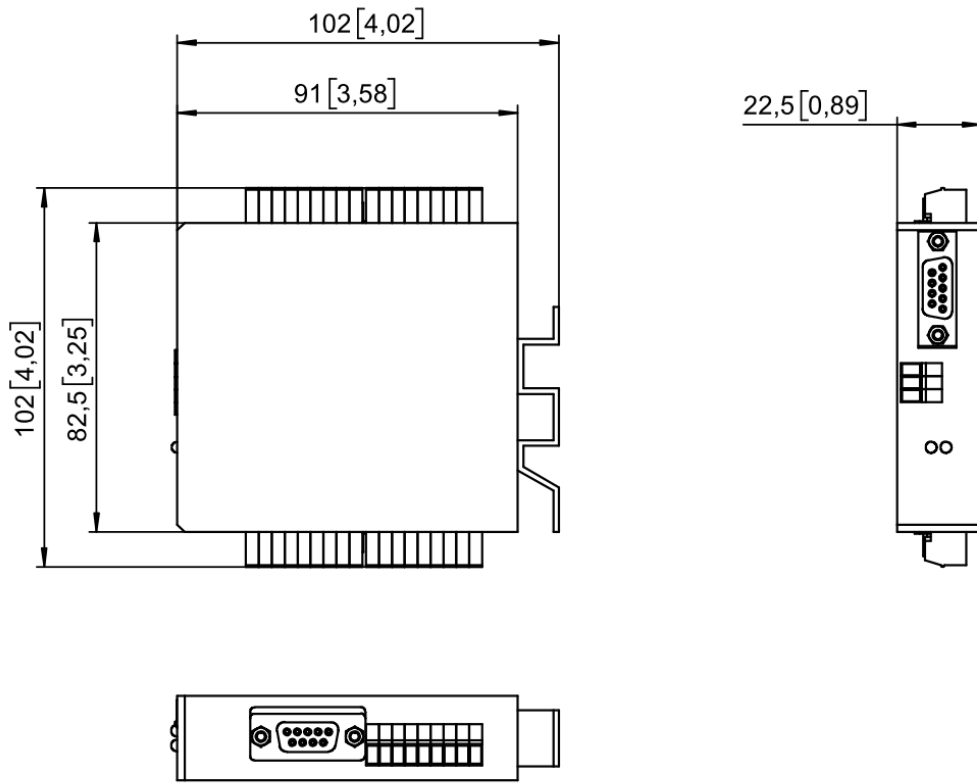
- Positions 9 of the terminal strips X2 and X4 are in each case galvanically connected to the metal housing of the adjacent SUB-D connector (located on the same side of the housing).
- It is recommendable to connect the cable shield directly to the metal housing of the associated counterpart connector, and to wire terminal position 9 to earth or ground potential. This ensures that the cable shield is earthed / grounded correctly.

4. Front LEDs

- The green LED is lit whenever the power supply of the unit is on.
- The yellow LED indicates the presence of encoder input signals. With slow motion, the LED will blink with every input impulse. With higher speeds the blinking will pass over into a continuous glowing with reduced brightness.

5. Dimensions

Dimensions in mm [inch]



6. Technical Specifications

Power supply:	Input voltage: Protective circuit: Consumption: Connections:	17 ... 30 VDC (Ripple \leq 10 % at 24 VDC) polarity protection ca. 70 mA (unloaded) screw terminal, 1.5 mm ² / AWG 16
Encoder supply:	Output voltage: Output current: Connections:	5.2 VDC (internally generated) or 5 ... 30 VDC (external connection) max. 150 mA SUB-D connector (male), 9-pin
SinCos inputs:	Amplitude: Offset: Channels: Frequency: Terminating resistors: Connections:	0.8 ... 1.2 Vpp 2 ... 3 VDC SIN+, SIN-, COS+, COS-, REF+, REF- max. 500 kHz 120 Ohm (integrated) SUB-D connector (male), 9-pin
SinCos outputs:	Number of outputs: Amplitude: Offset: Channels: Terminating resistors: Connections:	2 0.8 ... 1.2 Vpp ca. 2.5 VDC SIN+, SIN-, COS+, COS-, REF+, REF- 120 Ohm (must be equipped with the target device) SUB-D connector (female), 9-pin
Incremental outputs:	Number of outputs: Signal levels: Channels: Output current: Output logic: Signal running time: Protection: Connections:	2 RS422 / TTL or HTL (max. 30 V) A, /A, B, /B, 0, /0 max. 30 mA (per channel) push-pull ca. 200 ns short circuit proof screw terminal, 1.5 mm ² / AWG 16
Housing:	Material: Mounting: Dimensions (w x h x d): Protection class: Weight:	plastic 35 mm top hat rail (according to EN 60715) 22.5 x 102 x 102 mm / 0.886 x 4.016 x 4.016 inch IP20 ca. 100 g
Ambient temperature:	Operation: Storage:	0 °C ... +45 °C / +32 ... +113 °F (not condensing) -25 °C ... +70 °C / -13 ... +158 °F (not condensing)
Failure rate:	MTBF in years:	70.5 a (long-term usage at 60 °C / 140 °F)
Conformity & standards:	EMC 2014/30/EU: Guideline 2011/65/EU:	EN 61000-6-2, EN 61000-6-3, EN 61000-3-4 RoHS-conform

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