

# SINEAX I 503 / SINEAX U 504

## Transducer for AC current or AC voltage

### Application

The transducers SINEAX I 503/U 504 (Figs. 1 and 2) are designed to convert a sinusoidal AC current or voltage into a **load independent** DC signal proportional to the measured value. This output signal can operate several receiving instruments, such as indicators, recorders, alarm units etc., simultaneously. These can be both local to the measuring point (e.g. at the site) and also remote from it (e.g. at the central control station).

### Features / Benefits

- Narrow housing, 35 mm / Saves space and therefore costs
- Provision for either snapping the transducer onto top-hat rails or securing it with screws to a wall or panel
- Manufactured in SMD technology / Results in reduced costs
- Also available with output signal 4...20 mA in 2-wire connection
- Laser trimmed / Virtually no accuracy variation between units
- The device fulfils the protection requirements of the EMC guidelines (89/336/EWG). The device bears the CE symbol for EMC
- Self-powered / Less wiring expense
- Low power consumption / Smaller CT's and VT's can be used
- Standard version as per Germanischer Lloyd

### Layout and mode of operation

The transducer consists of the transformer W, the rectifier unit G and the amplifier V (Fig. 3). The measured variable I/U AC is isolated from the electronics by the transformer W, and is rectified and smoothed in G. The output amplifier V amplifies the resultant signal and converts it into the load-independent DC output signal A.

The version with live zero output (Fig. 4) has a 4 mA constant current source to provide the zero setting. In the case of a 2-wire connection the output increases from the zero setting of 4 mA with an increase in measured value.

The constant current source needs a supply voltage H between 12 and 30 V DC, which may be supply typically from the main installation, the receiving equipment or a separate power pack (SINEAX B 811).



Fig. 1. SINEAX I 503 transducer in housing E8 clipped onto a top-hat rail.



Fig. 2. SINEAX U 504 transducer in housing E8 screw hole mounting brackets pulled out.

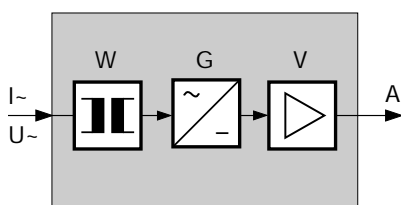


Fig. 3. Block diagram for transducer with unipolar output.

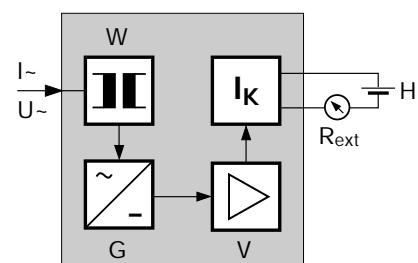


Fig. 4. Block diagram for transducer with live-zero output and 2-wire connection.

# SINEAX I 503 / SINEAX U 504

## Transducer for AC current or AC voltage

### Technical Data

#### General

Measured quantity: AC current or AC voltage sinusoidal  
Arithmetical mean measured, calibration to rms with sine wave form

Measuring principle: Rectifier method

#### Measuring input $\rightarrow$ I resp. U

Nominal frequency  $f_N$ : 50 or 60 Hz

Nominal input current  $I_N$   
(measuring range end value)

① ③ : 1 / 1.2 / 5 or 6 A

Nominal input voltage  $U_N$

② ③ :  $100/\sqrt{3}$  /  $110/\sqrt{3}$  /  $120/\sqrt{3}$  / 100 /  
110 / 116.66 / 120 / 125 / 133.33 /  
150 / 250 / 400 or 500 V

Own consumption at nominal frequency 50 Hz:

Full output value $I_{AN}$ [mA]	SINEAX I 503 [VA]	SINEAX U 504 [VA]
1	0.8	0.8
5	1.8	1.2
10	2.2	1.5
20	2.5	1.8

Overload capacity:

Measured quantity	Number of applications	Duration of one application	Interval between two successive applications
$1.5 \times I_N$	continuously	---	---
$2 \times I_N$	10	10 s	10 s
$10 \times I_N$	5	3 s	5 min.
$40 \times I_N$	1	1 s	---
$1.5 \times U_N$	continuously	---	---
$2 \times U_N$	10	10 s	10 s
$4 \times U_N$	1	2 s	---

#### Measuring output A $\rightarrow$

Output variables: Load-independent DC current  $I_A$   
or  
DC voltage output  $U_A$  (not superimposed)

Load-independent DC current  $I_A$ :

Standard ranges of  $I_A$  ④  
0...1 / 0...5 / 0...10 or 0...20 mA

Burden voltage 15 V

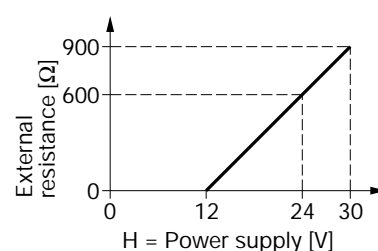
External resistance

$$R_{\text{ext max.}} [\text{k}\Omega] = \frac{15 \text{ V}}{I_{AN} [\text{mA}]}$$

$I_{AN}$  = Full output value

#### With 2-wire connection

Standard ranges of  $I_A$  4...20 mA  
External resistance  $R_{\text{ext}}$  dependent on power supply H (12...30 V DC)



$$R_{\text{ext max.}} [\text{k}\Omega] = \frac{H [\text{V}] - 12 \text{ V}}{20 \text{ mA}}$$

DC voltage output  $U_A$   
not superimposed:

Standard range of  $U_A$  ⑤  
0...10 V

External resistance  $\geq 200 \text{ k}\Omega/\text{V}$

Current limit under overload:

$\leq 1.5 \times I_{AN}$  for current output  
approx. 30 mA for voltage output

Voltage limit under  $R_{\text{ext}} = \infty$ :  $< 24 \text{ V}$

Output current ripple:  $\leq 1\%$  p.p.

Response time:  $< 300 \text{ ms}$

#### Accuracy (acc. to DIN/IEC 688-1)

Reference value: Input end value

Basic accuracy: Class 0.5

#### Reference conditions:

Ambient temperature:  $23 \text{ }^\circ\text{C}, \pm 5 \text{ K}$

Input: 0 to 100% for current measurement  
20 to 100% for voltage measurement

Frequency:  $f_N \pm 2\%$

Distortion factor:  $< 0.5\%$

External resistance:  $0 - R_{\text{ext max.}}$

#### Influence effects (maxima):

Included in basic error

Linearity error:  $\pm 0.3\%$

Frequency  $f_N \pm 2\%$ :  $\pm 0.3\%$

Dependence on external resistance  $\Delta R_{\text{ext max.}}$ :  $\pm 0.1\%$

Distortion factor ( $K < 0.5\%$ ):  $\pm 0.2\%$

① to ⑤ see section "Special features"

### Additional errors

Temperature influence (-25...+55 °C)	± 0.5% / 10 K
Frequency influence 45 – 200 Hz	± 0.5%
Stray field influence 0.5 mT	± 0.2%
Distortion factor influence (K < 10%)	± 0.4 · K (%)
Influence of range exceeding at $1.2 \times I_N$ resp. $U_N$	± 0.25%
Influence of common-mode voltage 220 V, 50 Hz or 10 V, 1 MHz	± 0.2%

### Power supply H

DC voltage:	12 – 30 V (only for 2-wire connection and out- put 4...20 mA)
-------------	---

### Installation data

Mechanical design:	Housing type E8 Dimensions see section "Dimensional drawings"
Material of housing:	Lexan 940 (polycarbonate), Flammability Class V-0 acc. to UL 94, self-extinguishing, non-dripping, free of halogen
Mounting:	For snapping onto top-hat rail (35 × 15 mm or 35 × 7.5 mm) acc. to EN 50 022 or directly onto a wall or panel using the pull-out screw hole brackets
Mounting position:	Any

Electrical connections: Screw-type terminals with indirect  
wire pressure, for max.  $2 \times 2.5 \text{ mm}^2$   
or  $1 \times 6 \text{ mm}^2$

Weight: Approx. 0.4 kg

### Regulations

Impulse withstand voltage  
acc. to IEC 255-4 Cl. III: 5 kV, 1.2/50  $\mu\text{s}$ , 0.5 Ws  
Common-mode and differential-  
mode between any terminals

Electrical standards: Acc. to DIN 57 410

Housing protection: IP 40 acc. to EN 60529  
Terminals IP 20

Insulation group acc. to  
DIN 57 110 b: A (instrument)  
C (terminals)

Test voltage: 4 kV / 50 Hz / 1 min.

### Environmental conditions

Climatic rating (6) :	Climate class 3Z acc. to VDI/VDE 3540
Operating temperature:	- 25 to + 55 °C
Storage temperature:	- 40 to + 70 °C
Relative humidity of annual mean:	≤ 75% standard climatic rating ≤ 90% enhanced climatic rating
Permissible vibrations:	2 g acc. to EN 60 068-2-6
Shock:	3 × 50 g 3 shocks each in 6 directions

(6) see section "Special features"

## Table 1: Electromagnetic compatibility

Reference was made to the general standards EN 50 081-2 and EN 50 082-2

Conducted interference from the instrument	EN 55 011	Group 1, Class A
HF radiation from complete instrument	EN 55 011	Group 1, Class A
Electrostatic discharge	IEC 1000-4-2	Direct: ± 8 kV air Indirect: ± 4 kV contact
HF field influence on instrument	IEC 1000-4-3	80 MHz ... 1000 MHz: 10 V/m, 80% AM 1 kHz (Frequencies ITU, 3 V/m)
Transient burst via connections	IEC 1000-4-4	± 2 kV, 5/50 ns, 5 kHz, > 2 min. capacitively coupled
HF interference via connections	IEC 1000-4-6	0.15 to 80 MHz: 10 V, 80% AM 1 kHz (Frequencies ITU, 3 V)

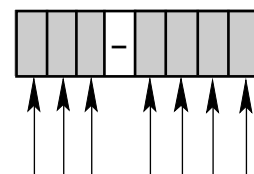
The device fulfils the protection requirements of the EMC guidelines (89/336/EWG). The device bears the CE symbol for EMC.

# SINEAX I 503 / SINEAX U 504

## Transducer for AC current or AC voltage

**Table 2: Specification and ordering information** (see also Table 3: "Standard versions")

Order Code			
Features, Selection	*SCODE	no-go	
Transducer for AC current			5 0 3
Transducer for AC voltage			5 0 4
1. Mechanical design 3) Carrying rail housing E8			. . . . . 3 . . . .
2. Nominal frequency 1) 50 / 60 Hz			. . . . . 1 . . . .
3. Measuring range (measuring input)			
1) 0...1 A			. . . . . 1 . . . .
2) 0...1,2 A			. . . . . 2 . . . .
3) 0...5 A			. . . . . 3 . . . .
4) 0...6 A			. . . . . 4 . . . .
9) Non-standard [A]			. . . . . 9 . . . .
A) 0...100/√3 V			. . . . . A . . . .
B) 0...110/√3 V			. . . . . B . . . .
C) 0...120/√3 V			. . . . . C . . . .
D) 0...100 V			. . . . . D . . . .
E) 0...110 V			. . . . . E . . . .
F) 0...116.66 V			. . . . . F . . . .
G) 0...120 V			. . . . . G . . . .
H) 0...125 V			. . . . . H . . . .
J) 0...133.33 V			. . . . . J . . . .
K) 0...150 V			. . . . . K . . . .
L) 0...250 V			. . . . . L . . . .
M) 0...400 V			. . . . . M . . . .
N) 0...500 V			. . . . . N . . . .
Z) Non-standard [V]			. . . . . Z . . . .
Line 9: 0... 0.5 to 0...10 A ①			
Line Z: 0...20.00 to 0...660 V ②			
4. Output signal (measuring output A)			
1) 0...10 V, R <sub>ext</sub> ≥ 200 kΩ/V			. . . . . 1 . . . .
9) Non-standard [V]			. . . . . 9 . . . .
A) 0... 1 mA, R <sub>ext</sub> ≤ 15 kΩ			. . . . . A . . . .
B) 0... 5 mA, R <sub>ext</sub> ≤ 3 kΩ			. . . . . B . . . .
C) 0...10 mA, R <sub>ext</sub> ≤ 1.5 kΩ			. . . . . C . . . .
D) 0...20 mA, R <sub>ext</sub> ≤ 750 Ω			. . . . . D . . . .
E) 4...20 mA, 2-wire connection, R <sub>ext</sub> dependent on power supply			. . . . . E . . . .
Z) Non-standard [mA]			. . . . . Z . . . .
Line 9: 0...0.060 to 0...< 10 V ⑤			
Line Z: 0...> 1.000 to 0...< 20 mA ④			
Line E: Power supply 12...30 V DC			



① ② ④ and ⑤ see section "Special features"

Order Code																				
Features, Selection											*SCODE	no-go								
<b>5. Special features</b>																				
0) Without											Y									
1) With																				
Without special features (line 0): Order code complete.																				
With special features (line 1): The features to be omitted must be marked hereafter with / (slant line) in the order code until reaching the required feature																				
<b>6. Measuring range adjustable</b> (3)																				
A) Admissible alteration of full scale output, variable sensitivity approx. ± 10%													Y							
<b>7. Climatic rating</b> (6)																				
A) Improved climatic rating													Y							

\* Lines with letter(s) under "no-go" cannot be combined with preceding lines having the same letter under "SCODE".

(3) and (6) see section "Special features"

**Table 3: Standard versions**

The following 2 transducer versions are available as standard versions. It is only necessary to quote the Order No.:

Order Code *)	Housing	Nominal frequency	Measuring range	Output signal	Order No.
503-311D	Housing <b>E8</b>	50 / 60 Hz	0 ... 1 A	0 ... 20 mA	970 708
503-313D			0 ... 5 A	0 ... 20 mA	970 724

\*) See section "Specification and ordering information"

The complete Order Code 503 – .... and/or a description according to the section "Specification and ordering information" should be stated for other versions.

**Special features**

Nature of special features			
<b>Measuring range</b>			
① Ranges between 0...0.5 and 0...10 A, besides the standard ranges 0...1 / 0...1.2 / 0...5 and 0...6 A			
② Ranges between 0...20 and 0...660 V*, besides the standard ranges 0...100/√3 / 0...110/√3 / 0...120/√3 / 0...100 / 0...110 / 0...116.66 / 0...120 / 0...125 / 0...133.33 / 0...150 / 0...250 / 0...400 and 0...500 V			
* Restriction: Overload capacity for nominal input voltages U <sub>N</sub> > 500 V			
Measured quantity	Number of application	Duration of one application	Interval between two successive applications
1.5x500 V	continuously	---	---
2 x500 V	10	10 s	10 s
4 x500 V	1	2 s	---

Nature of special features	
<b>Measuring range adjustable</b>	
③ (Admissible alteration of full scale output, variable sensitivity, adjustable with potentiometer)	
Range adjustable 0.9...1.1· I <sub>N</sub> resp. U <sub>N</sub> (± 10%)	

# SINEAX I 503 / SINEAX U 504

## Transducer for AC current or AC voltage

Nature of special features
<b>Output signal</b>
④ Load-independent DC current $I_A$ Ranges between 0...1 and 0...20 mA, besides the standard ranges 0...1 / 0...5 / 0...10 and 0...20 mA
⑤ Non-impressed DC voltage $U_A$ Ranges between 0...60 mV and 0...10 V, besides the standard ranges 0...10 V

Nature of special features
<b>Climatic rating</b>
⑥ Climate class 3Z acc. to VDI/VDE 3540, but temperature continuously -25 to +55 °C. Relative humidity ≤ 90% annual mean

### Electrical connections

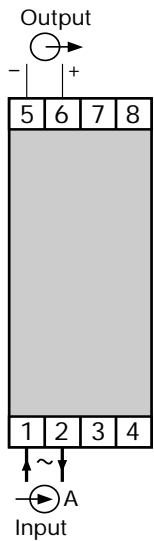


Fig. 5. SINEAX I 503, for measuring AC current.



Fig. 6. SINEAX U 504, for measuring AC voltage.



Fig. 7. SINEAX I 503-3.. E as 2-wire converter with 4...20 mA output.



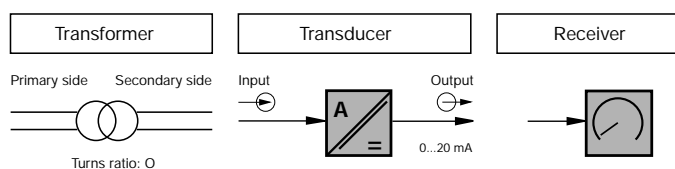
Fig. 8. SINEAX U 504-3.. E as 2-wire converter with 4...20 mA output.

### Selection aid for primary measuring ranges

A few different transducer measuring ranges are sufficient to cover a large number of applications.

When selecting primary measuring ranges from one of the following tables, a corresponding standard range results for the transformer input, and any receiving equipment connected may have a standard scale.

#### Current transformer



#### Examples for current measuring

Details of transformer	O	Measuring range of the transducer	Scaling for receiving equipment
75/1 A	75	0...1 A 0...1.2 A	0... 75 A 0... 90 A
200/1 A	200	0...1 A 0...1.2 A	0... 200 A 0... 240 A
75/5 A	15	0...5 A 0...6 A	0... 75 A 0... 90 A
200/5 A	40	0...5 A 0...6 A	0... 200 A 0... 240 A

**Table 4: Determining the primary measuring ranges for SINEAX I 503**

Measuring range I: 0...1 A  
 Measuring range II: 0...1.2 A

Current transformer [A]	Transformation ratio	Measuring range of the transducer	Primary measuring ranges [A]
20 : 1	20	I	20
		II	24
25 : 1	25	I	25
		II	30
30 : 1	30	I	30
		II	36
40 : 1	40	I	40
		II	48
50 : 1	50	I	50
		II	60
60 : 1	60	I	60
		II	72
75 : 1	75	I	75
		II	90
80 : 1	80	I	80
		II	96
100 : 1	100	I	100
		II	120
120 : 1	120	I	120
		II	144
150 : 1	150	I	150
		II	180
200 : 1	200	I	200
		II	240
250 : 1	250	I	250
		II	300
300 : 1	300	I	300
		II	360
400 : 1	400	I	400
		II	480
500 : 1	500	I	500
		II	600
600 : 1	600	I	600
		II	720
750 : 1	750	I	750
		II	900
800 : 1	800	I	800
		II	960
1000 : 1	1000	I	1000
		II	1200
1200 : 1	1200	I	1200
		II	1440
1500 : 1	1500	I	1500
		II	1800
2000 : 1	2000	I	2000
		II	2400
2500 : 1	2500	I	2500
		II	3000
3000 : 1	3000	I	3000
		II	3600
4000 : 1	4000	I	4000
		II	4800
5000 : 1	5000	I	5000
		II	6000
6000 : 1	6000	I	6000
		II	7200

**Continuation of Table 4:**

Measuring range I: 0...5 A  
 Measuring range II: 0...6 A

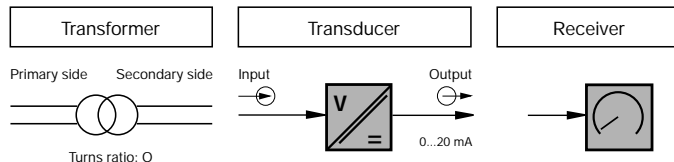
Current transformer [A]	Transformation ratio	Measuring range of the transducer	Primary measuring ranges [A]
20 : 5	4	I	20
		II	24
25 : 5	5	I	25
		II	30
30 : 5	6	I	30
		II	36
40 : 5	8	I	40
		II	48
50 : 5	10	I	50
		II	60
60 : 5	12	I	60
		II	72
75 : 5	15	I	75
		II	90
80 : 5	16	I	80
		II	96
100 : 5	20	I	100
		II	120
120 : 5	24	I	120
		II	144
150 : 5	30	I	150
		II	180
200 : 5	40	I	200
		II	240
250 : 5	50	I	250
		II	300
300 : 5	60	I	300
		II	360
400 : 5	80	I	400
		II	480
500 : 5	100	I	500
		II	600
600 : 5	120	I	600
		II	720
750 : 5	150	I	750
		II	900
800 : 5	160	I	800
		II	960
1000 : 5	200	I	1000
		II	1200
1200 : 5	240	I	1200
		II	1440
1500 : 5	300	I	1500
		II	1800
2000 : 5	400	I	2000
		II	2400
2500 : 5	500	I	2500
		II	3000
3000 : 5	600	I	3000
		II	3600
4000 : 5	800	I	4000
		II	4800
5000 : 5	1000	I	5000
		II	6000
6000 : 5	1200	I	6000
		II	7200

# SINEAX I 503 / SINEAX U 504

## Transducer for AC current or AC voltage

### Voltage transducer

For measuring voltages via voltage transformers, 95% of the practical applications can be covered with 7 different measuring ranges.



#### Example 1:

Transformer data	O	Factor	Measuring range of the transducer	Scaling for receiving equipment
6 600 V/110 V	60	×1 ×1 ×6 ×5 ×4 ×3 ×2	0...100 V 0...110 V 0...116.66 V 0...120 V 0...125 V 0...133.33 V 0...150 V	0...6 000 V $\cong$ 0...6 kV 0...6 600 V $\cong$ 0...6.6 kV 0...7 000 V $\cong$ 0...7 kV 0...7 200 V $\cong$ 0...7.2 kV 0...7 500 V $\cong$ 0...7.5 kV 0...8 000 V $\cong$ 0...8 kV 0...9 000 V $\cong$ 0...9 kV
All factors are included in the turn ratio 60. Consequently a reasonable end point for scaling the receiving equipment is obtained with all transducers.				

#### Example 2:

Transformer data	O	Factor	Measuring range of the transducer	Scaling for receiving equipment
22 000 V/110 V	200	×1 ×1 <del>×6</del> ×5 ×4 <del>×3</del> ×2	0...100 V 0...110 V <del>0...116.66 V</del> 0...120 V 0...125 V <del>0...133.33 V</del> 0...150 V	0...20 000 V $\cong$ 0...20 kV 0...22 000 V $\cong$ 0...22 kV <del>0...33 332 V</del> 0...24 000 V $\cong$ 0...24 kV 0...25 000 V $\cong$ 0...25 kV <del>0...26 666 V</del> 0...30 000 V $\cong$ 0...30 kV
Factors crossed through are not included as possibilities in the turns ratio 200. If they are a difficult end value results for the scaling of the receiving equipment.				

**Table 5: Determine the primary measuring ranges for SINEAX U 504**

Measuring range of the transducer 0...X (Volt)			Voltage transformer: Primary voltage [kV]									
			3.00 3.30	5.00	6.00 6.60	10 11	12.00 13.20	15.00	20.00 22.00	25.00	30.00 33.00	35.00
			Transformation ratio									
Factor	X (Volt)	Unit	30	50	60	100	120	150	200	250	300	350
			Primary measuring ranges									
×1	100.00		3.0	5.0	6.0	10.0	12.0	15.0	20.0	25.0	30.0	35.0
×1	110.00		3.3	5.5	6.6	11.0	---	---	22.0	---	33.0	---
×6	116.66	kV	3.5	---	7.0	---	14.0	17.5	---	---	35.0	---
×5	120.00		3.6	6.0	7.2	12.0	---	18.0	24.0	30.0	36.0	42.0
×4	125.00		---	---	7.5	12.5	15.0	---	25.0	---	---	---
×3	133.33		4.0	---	8.0	---	16.0	20.0	---	---	40.0	---
×2	150.00		4.5	7.5	9.0	15.0	18.0	---	30.0	---	45.0	---



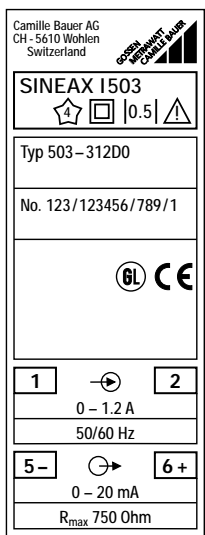
Continuation of Table 5:

Measuring range of the transducer 0...X (Volt)			Voltage transformer: Primary voltage [kV]									
			45	50	60 66	100 110	120 132	150	200 220	275	330	380
			Transformation ratio									
			450	500	600	1000	1200	1500	2000	2750	3000	3800
Factor	X (Volt)	Unit	Primary measuring ranges									
×1	100.00	kV	45	50	60	100	120	150	200	275	300	380
×1	110.00		---	55	66	110	132	165	220	---	330	---
×6	116.66		---	---	70	---	140	175	---	---	350	---
×5	120.00		54	60	72	120	144	180	240	330	360	---
×4	125.00		---	---	75	125	150	---	250	---	375	475
×3	133.33		60	---	80	---	160	200	---	---	400	---
×2	150.00		---	75	90	150	180	225	300	---	450	570

Standard scale values for panel instruments:

1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and decimal multiples of these.

### Type label (Fig. 9)



\_\_\_\_\_ Type designation  
 \_\_\_\_\_ Works No.  
 \_\_\_\_\_ Test mark  
 \_\_\_\_\_ Input Measuring range  
 \_\_\_\_\_ Measured quantity  
 \_\_\_\_\_ Nominal frequency  
 \_\_\_\_\_ Output Output signal  
 \_\_\_\_\_ External resistance

### Standard accessories

1 Operating Instructions in three languages: German, French, English

Fig. 9

# SINEAX I 503 / SINEAX U 504

## Transducer for AC current or AC voltage

### Dimensional drawings

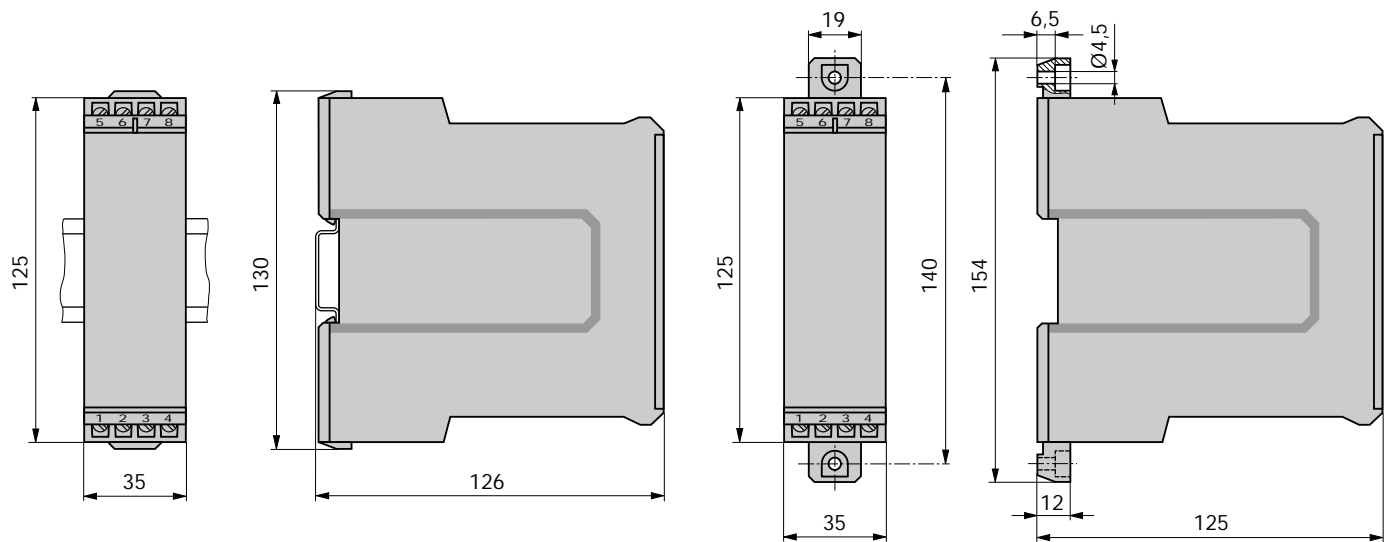


Fig. 10. Transducer in housing E8 clipped onto a top-hat rail (35 × 15 mm or 35 × 7.5 mm acc. to EN 50 022).

Fig. 11. Transducer in housing E8 with the screw hole brackets pulled out for wall mounting.



# SINEAX I 503 / SINEAX U 504

## Transducer for AC current or AC voltage

---

---

Printed in Switzerland • Subject to change without notice • Edition 12.96 • Data sheet No I 503 / U 504 Le

Camille Bauer Ltd.

Aargauerstrasse 7  
CH-5610 Wohlen/Switzerland  
Phone +41 56 618 21 11  
Fax +41 56 618 24 58  
Telex 827 901 cbm ch

