SINEAX U 554
Transducer for AC Voltage with Different Characteristics

CAMILLE BAUER

With power supply
RMS value measurement
Carrying rail housing P13/70

CE

*Fig. 1. Transducer SINEAX U 554 in housing **P13/70** clipped onto a top-hat rail.*

Application

The transducer **SINEAX U 554** (Fig. 1) converts a sinusoidal or a distorted AC voltage into a **load independent** DC current or a **load independent** DC voltage proportional to the measured value.

Depending on the version, part of the measuring range of interest may be amplified at the beginning or end. The section of no or minor interest is suppressed. A live zero output signal is possible with all versions (see Fig. 3 and 4).

The transducer fulfils all the important requirements and regulations concerning electromagnetic compatibility **EMC** and **Safety** (IEC 1010 resp. EN 61 010). It was developed and is manufactured and tested in strict accordance with the **quality assurance standard** ISO 9001.

Features / Benefits

- **Measuring input: AC voltage, sine or distorted wave forms, RMS value measurement**

Measured variable	Measuring range limits
AC voltage	0 to 20 to 0 to 690 V

- **Measuring output: Unipolar and live-zero output variables**
- **Measuring principle: Logarithmic method**
- **DC, AC-power pack with wide power supply tolerance**

Mode of operation

Input signal U~ is galvanically separated from the mains network using a transformer.

The following mathematical expression is then formed using a root-mean-square value computer

$$U_{eff} = \left| \sqrt{\frac{1}{T}\int_0^T u^2\,dt} \right|$$

Following filtration by means of an active filter, the transformation properties of the measuring transducer are determined in the succeeding characteristics circuit.

The output amplifier transforms the measuring signal into an impressed output signal A.

The electronic components are supplied with voltage H from the mains supply unit H.

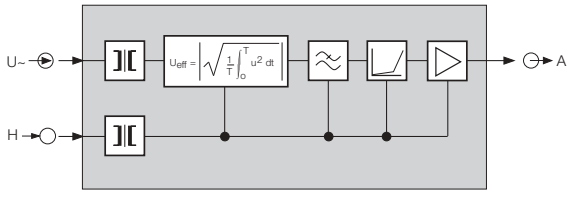

Fig. 2. Block diagram.

Technical data

General

Measured quantity:	AC voltage Sine or distorted wave form RMS value measurement
Measuring principle:	Logarithmic method

Measuring input E

Nominal frequency f_N:	50/60 or 400 Hz
Nominal input voltage U_N (measuring range end value):	0 to 20 to 0 to 690 V
Own consumption:	≤ 1 VA with input end value
Overload capacity:	

Measured quantity U_N	Number of applications	Duration of one application	Interval between two successive applications
1.2 · U_N[1]	---	continuously	---
2 · U_N[1]	10	1 s	10 s

[1] *But max. 264 V with power supply from measuring input*

Measuring output A

Load-independent DC current:	0 to 1 to 0 to 20 mA resp. live-zero 0.2 to 1 to 4 to 20 mA

SINEAX U 554
Transducer for AC Voltage with Different Characteristics

Burden voltage: 15 V

External resistance: R_{ext} max. [kΩ] = $\frac{15\ V}{I_{AN}\ [mA]}$

I_{AN} = Output current end value

Load-independent DC voltage: 0 to 1 to 0 to 10 V
resp. live-zero
0.2 to 1 to 2 to 10 V

External resistance: R_{ext} min. [kΩ] ≥ $\frac{U_A\ [V]}{4\ mA}$

Residual ripple in output current: ≤ 1.5 · I_{AN} at current output
Approx. 10 mA at voltage output

Voltage limit under $R_{ext} = \infty$: ≤ 25 V

Residual ripple in output current:
≤ 1% p.p. at setting time 300 ms
≤ 5% p.p. at setting time 50 ms and c ≤ 2.5
≤ 5% p.p. + c x 0.5% at setting time 50 ms and c > 2.5

Setting time: 50 ms or 300 ms

Output characteristics

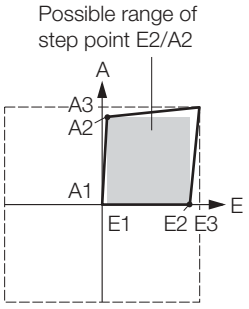

Fig. 3. Characteristic A:
E1 = 0
0.1 x E3 ≤ E2 ≤ 0.9 x E3
A1 = 0
A1 ≤ A2 ≤ 0.9 x A3

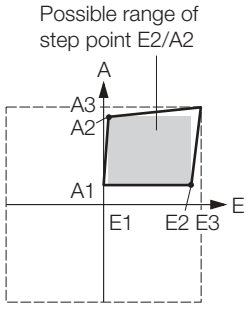

Fig. 4. Characteristic B:
E1 = 0
0.1 x E3 ≤ E2 ≤ 0.9 x E3
A1 = 0.2 x A3
A1 ≤ A2 ≤ 0.9 x A3

Power supply H →◯

Nominal voltage U_N	Rated operating range
AC 24 V	22 to 26 V
AC 110 V	99 to 121 V
AC 115 V	103 to 127 V
AC 120 V	108 to 132 V
AC 230 V	207 to 253 V
AC 400 V	360 to 440 V

Rated operating range of frequency: 45 to **50 to 60** to 65 Hz

Power consumption: ≤ 3 VA at H = U_N

DC, AC-power pack (DC or 40 to 400 Hz)

Table 1: Rated voltages and permissible variations

Nominal voltage U_N	Permissible variation
85 to 230 V DC, AC	DC – 15 to + 33% AC ± 15%
24 to 60 V DC, AC	

Option: Connected to the low tension terminal side 12 and 13
24 V AC or 24 to 60 V DC

Power consumption: ≤ 2 W resp. ≤ 4 VA

Accuracy (acc. to EN 60 688)

Reference value: Output end value

Basic accuracy: Class 0.5 with setting time 300 ms
Class 0.5 x c with setting time 50 ms

Factor c: $c = \frac{E3}{E2}$
with main value magnification in initial range

$c = \frac{1}{1 - E2/E3}$
with main value magnification in end range

Reference conditions:

Ambient temperature: 15 to 30 °C

Input variable: Rated operating range

Frequency: f_N ± 2 Hz

Curve shape: Sine-wave

Crest factor: $\sqrt{2}$

Power supply: In rated range

Output burden: Current: 0.5 · R_{ext} max.
Voltage: 2 · R_{ext} min.

Warm-up time: ≤ 5 min.

Influence effects (maxima):

Setting time 300 ms	c = 1	
Setting time 50 ms	c acc. to calculation	
Frequency influence	40 to 400 Hz,	± 0.3% x c
	30 to 1000 Hz,	± 0.5% x c
Crest factor	1 to 2.5	± 0.2% x c
	> 2.5 to 6	± 0.5% x c

Influence quantity	Rated operating range	Permitted effect as factor of precision class
Ambient temperature	– 10 to **15 to 30** to 40°C	1
	10 to **15 to 30** to 55°C	3

SINEAX U 554
Transducer for AC Voltage with Different Characteristics

Safety

Protection class:	II (protection isolated, EN 61 010)
Housing protection:	IP 40, housing (test wire, EN 60 529) IP 20, terminals (test finger, EN 60 529)
Contamination level:	2
Overvoltage category:	III
Rated insulation voltage (versus earth):	400 V, input 230 V, power supply 40 V, output
Test voltage:	50 Hz, 1 min. acc. to EN 61 010-1 3700 resp. 5550 V, input versus all other circuits as well as outer surface 3700 V, power supply versus output as well as outer surface 490 V, output versus outer surface

Installation data

Mechanical design:	Housing **P13/70**
Material of housing:	Lexan 940 (polycarbonate), flammability Class V-0 acc. to UL 94, self-extinguishing, non-dripping, free of halogen
Mounting:	For rail mounting
Mounting position:	Any
Weight:	Approx. 0.3 kg

Connecting terminals

Connection element:	Screw-type terminals with indirect wire pressure
Permissible cross section of the connection leads:	≤ 4.0 mm² single wire or 2 × 2.5 mm² fine wire

Environmental conditions

Operating temperature:	– 10 to + 55 °C
Storage temperature:	– 40 to +70 °C
Relative humidity of annual mean:	≤ 75%

Ambient tests

EN 60 068-2-6:	Vibration
Acceleration:	± 2 g
Frequency range:	10 to 150 to 10 Hz, rate of frequency sweep: 1 octave / minute
Number of cycles:	10, in each of the three axes
EN 60 068-2-27:	Shock
Acceleration:	3 x 50 g 3 shocks each in 6 directions
EN 60 068-2-1/-2/-3:	Cold, dry heat, damp heat
IEC 1000-4-2/-3/-4/-5/-6 EN 55 011:	Electromagnetic compatibility

Table 2: Specification and ordering informations

Description	Blocking code	no-go with blocking code	Article No./ Feature
Transducer for AC voltage with different characteristics **Order Code 554 - 4xxx xxxx xx**			554 -
Features, Selection			
1. Mechanical design Housing P13/70 for rail mounting			4
2. Nominal input frequency Nominal frequency 50/60 Hz			1
Nominal frequency 400 Hz			3
3. Input voltage, final value Final value E3 [V] ≥ 20 V to ≤ 690 V* With power supply from measuring input min. 24 V / max. 230 V, see feature 8. * > 400 V for connection between 2 phases in 3-phase system only			Z
4. Input voltage, step point Step point E2 [V] E2, permissible values: 0.1 · E3 to 0.9 · E3			Z

SINEAX U 554
Transducer for AC Voltage with Different Characteristics

Description	Blocking code	no-go with blocking code	Article No./ Feature
Transducer for AC voltage with different characteristics			554 -
Features, Selection			
5. Output signal, initial value			
Initial value A1: 0 (standard)	A		1
Initial value A1: 20% of final value A3 (live-zero)	B		2
6. Output signal, final value			
Final value A3: 1 mA			1
Final value A3: 5 mA			2
Final value A3: 10 mA			3
Final value A3: 20 mA			4
Non-standard [mA] _____ > 1 to < 20 mA			9
Final value A3: 10 V			A
Non-standard [V] _____ ≥ 1 to < 10 V			Z
7. Output signal, step point			
Without step point (A2 = A1)			0
Standard step point, A2: [mA, V] _____ A2, permissible values: > 0 to 0.9 · A3		B	A
Live-zero step point, A2: [mA, V] _____ A2, permissible values: > 0.2 · A3 to 0.9 · A3		A	B
Specify step point A2 in mA or V, acc. to selection of A3 in feature 6			
8. Power supply			
AC 24 V (22 to 26 V)			1
AC 110 V (99 to 121 V)			2
AC 115 V (104 to 126 V)			3
AC 120 V (108 to 132 V)			4
AC 230 V (207 to 253 V)			5
AC 400 V (360 to 440 V)			6
24 to 60 V DC, AC			A
85 to 230 V DC, AC			B
Power supply from measuring input (≥ 24 to 60 V AC)			C
Power supply from measuring input (≥ 85 to 230 V AC)			D
Uh: 24 V AC / 24 to 60 V DC, low terminal side			E
9. Setting time			
Setting time 0.3 s			1
Setting time 50 ms			2
10. Test certificate			
Without test certificate			0
Test certificate in German			D
Test certificate in English			E

Electrical connections

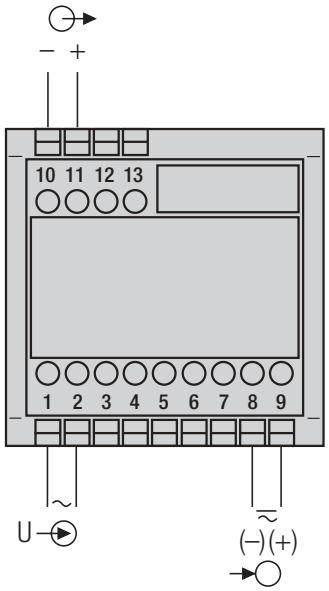

Fig. 5. Power supply connected to terminals 8 and 9.

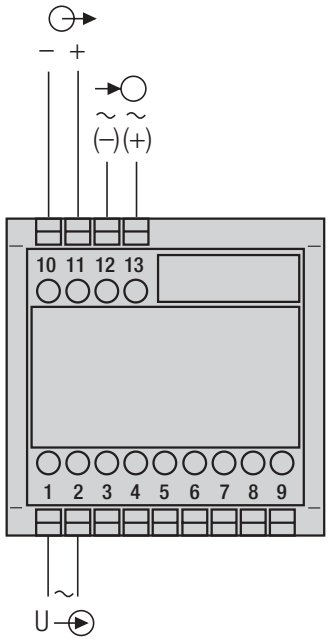

Fig. 7. Power supply connected to the low tension terminal side 12 and 13.

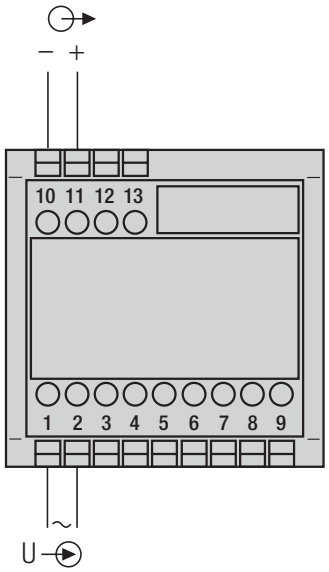

Fig. 6. Power supply internal from voltage measuring input, No power supply connection needed.

= Measuring input
= Measuring output
= Power supply

SINEAX U 554
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Dimensional drawing

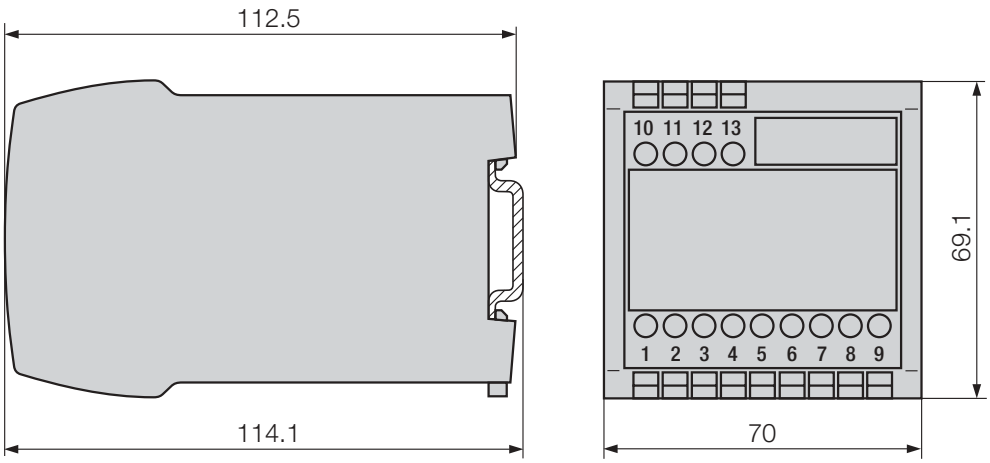

*Fig. 8. SINEAX U 554 in housing **P13/70** clipped onto a top-hat rail (35 × 15 mm or 35 × 7.5 mm, acc. to EN 50 022).*

Standard accessories

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

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Camille Bauer LTD
Aargauerstrasse 7
CH-5610 Wohlen/Switzerland
Phone +41 56 618 21 11
Fax +41 56 618 24 58
e-mail: info@camillebauer.com
http://www.camillebauer.com

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Member of GMC Instruments Group