

VariTrans P 43000 TRMS

AC/DC high voltage transducers for true rms measurement of input currents ranging from $I_{in} = 100 \text{ mA AC}$ to $I_{in} = 5 \text{ A AC}$

In the case of insufficient insulation, high voltages and harsh ambient conditions may overload the galvanic isolation. This can result in false measurement values or even personal injury or damage to the equipment. These risks have to be eliminated safely and over the long term by suitably designed high voltage transducers.

The Solution

The VariTrans P 43000 TRMS high voltage transducers have been specially conceived for measurements of bipolar currents ranging from milliamps to amps. They reliably isolate high potentials at the input circuit. Thanks to the true rms conversion in the transducer, even distorted input signals are captured correctly and output as so-called true rms values.

The isolating distances are designed for high working voltages up to 3600 V AC/DC and test voltages up to 15 kV. Protection against electric shock is achieved through protective separation up to 1800 V AC/DC across input and output and power supply according to EN 61140.

The Housing

A new 45 mm wide modular housing is used for the VariTrans P 43000 TRMS high voltage transducers. It is snapped onto a standard DIN rail. The front panels of the adjustable models provide a rotary encoder switch for selecting the ranges.

The Advantages

The VariTrans P 43000 TRMS are available for any input currents from 100 mA AC to 5 A AC. Analog DC signals are available at the output: 0 ... 20 mA, 0 ... 10 V and 4 ... 20 mA. The true rms conversion is performed with high precision up to a crest factor of 5. It operates over a frequency range of 16.7 Hz to 1000 Hz. 16 input/output signal combinations can easily be selected with a rotary encoder switch on the front of the device. There is no need for a complicated on-site adjustment with screwdriver, calibrator and multimeter. Drift problems due to unstable trimming components – e.g., potentiometers – are avoided. Thanks to the easy scalability of the range selection, the devices can easily be customized to individual customer solutions. Up to 16 customized signal combinations can be implemented in one device and configured optimally for the respective application.

The Task

In electrical systems, alternating currents from 100 mA to 5 A need to be recorded, galvanically isolated and converted into standard 0...20 mA, 0...10 V or 4 ... 20 mA output signals. The DC output signal should reflect the rms values of the input voltage.

The Problems

The alternating currents which are used are not always sinusoidal, but sometimes distorted. But typical AC/DC transducers are only designed for sinusoidal sources. With input signals which are not sinusoidal, they exhibit – sometimes considerable – errors in forming the rms value, which can be severe enough to render the measurement values unusable. Therefore true rms measurement is required for signals which are non-sinusoidal and/or are distorted.

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VariTrans P 43000 TRMS

The integrated 20 to 253 V AC/DC VariPower broad-range power supply offers maximum flexibility. 253 V AC/DC. This ensures trouble-free operation with alternating or direct voltages everywhere in the world and provides for maximum safety even in unstable power supply networks. Installation is also safe and easy. Incorrect connection of the supply voltage is practically impossible. Expensive standstill times and repair work during commissioning are avoided. Vacuum encapsulation provides maximum protection against aggressive environmental influences, shock and vibrations and ensures that the high insulation strength required for working voltages up to 3600 V AC/DC is maintained over the long term. The isolation system meets the safety requirements of EN 61010-1.

The Technology

In this device series, Knick relies on the newly developed TransShield technology, which compared to conventional designs enables very compact high-voltage transformers with low leakage. Thanks to the resulting space advantage, the P 43000 D1 TRMS AC/DC high voltage transducers can be installed in an only 45 mm wide modular housing. Another major advantage offered by this technology: High transient overvoltages (common-mode interference) are reliably isolated and cause hardly any measurement errors at the output. To guarantee the specified isolation capabilities, 100 % of the devices are subjected to routine testing with 15 kV AC (fixed-range models) or 10 kV AC (switchable models).

Circuit design and device construction ensure excellent transmission characteristics, which are reflected in zero stability, linearity, long-term stability and immunity to interference.



Facts and Features

- **Universal usability:**
 - AC input 60 mV~ up to 3600 V~ as well as 100 mA~ up to 5 A~
 - DC output 0 (4) ... 20 mA, 0 ... 10 V
- **New TransShield technology** enables extremely compact modular housings
- **Working voltages up to 3600 V AC/DC**
- **Protection against electric shock** with protective separation up to 1800 V AC/DC according to EN 61140
- **Test voltages up to 15 kV AC**
- **Excellent transmission properties:**
 - Gain error
Crest factor ≤ 3 < 0.5 %
 - Gain error
Crest factor 3 ... 5 < 1 %
 - Response time T_{90} < 150 ms
- **Virtually no influence from common-mode voltages:** CMRR approx. 150 dB
- **Tremendous flexibility provided by**
 - calibrated switching of up to 16 input/output ranges
 - up to 16 customer-specific measuring ranges
 - VariPower 20 V to 253 V AC/DC broad-range power supply
- **Reliable function even with unstable supply**
- **No damage in the case of erroneous power connection**
- **Switchable models** minimize required device variants and save stockkeeping costs
- **Robust** thanks to vacuum encapsulation
- **Mechanically stable** for operation on ships, rail vehicles and land crafts
- **5-year warranty**



Product line

Device	AC input	Output TRMS value	Working voltage	Test voltage	Order no.
VariTrans P 43000 TRMS Switchable input and output	0.1 A ... 5 A AC, 1 to 16 ranges to customer requirements ¹⁾	0 ... 20 mA, 4 ... 20 mA and / or 0 ... 10 V, 1 to 16 ranges to customer requirements ¹⁾	≤ 2.2 kV AC/DC	10 kV AC	P 43000 D2 TRMS-nnnn
VariTrans P 43100 TRMS Input and output with fixed settings	0.1 A ... 5 A AC, to customer requirements ¹⁾	0 ... 20 mA, 4 ... 20 mA or 0 ... 10 V to customer requirements ¹⁾	≤ 3.6 kV AC/DC	15 kV AC	P 43100 D2 TRMS-nnnn

"Specific Test Report" included in shipment

Power supply

20 ... 253 V AC/DC

¹⁾ Please specify the desired setting on the order

VariTrans P 43000 TRMS

Specifications

Input data

Input	P 43000 D2 TRMS-nnnn	0.1 A ... 5 A AC, 1 to 16 ranges to customer requirements, calibrated switching
	P 43100 D2 TRMS-nnnn	0.1 A ... 5 A AC; fixed setting to customer requirements
Rated frequency	50/60 Hz	
Frequency range	40 ... 1000 Hz (frequency \leq 40 Hz upon request)	
Input resistance	< 0.6 ohms	
Input capacitance	Approx. 1 nF	
Overload capacity	20 % full scale (max. crest factor 8)	

Output data

Output	P 43000 Dx TRMS-nnnn	0 ... 20 mA, 4 ... 20 mA and/or 0 ... 10 V to customer requirements, switchable
	P 43100 Dx TRMS-nnnn	0 ... 20 mA, 4 ... 20 mA or 0 ... 10 V to customer requirements, fixed setting
Offset	Up to ± 100 % by default	
Load	with output current	≤ 12 V (600 ohms at 20 mA)
	with output voltage	≤ 10 mA (1000 ohms at 10 V)
Residual ripple	< 10 mV _{eff}	

Transmission behavior

Gain error	< 0.5 % full scale Gain error for sinusoidal input signals (crest factor $\sqrt{2}$) over the frequency range of 45 ... 65 Hz	
Response time t_{90}	< 150 msec rising < 300 msec falling	
Influencing effects (additional error)	Frequency 40 ... 1000 Hz	< 1 % meas. val. (typ. 0.5 %)
	Crest factor 1 ... 3 (non-sinusoidal signals)	< 0.5 % meas. val.
	Crest factor < 3 ... 5	< 1 % meas. val.
Common-mode rejection ratio	CMRR DC: approx. 150 dB	AC 50 Hz: approx. 120 dB CMRR: Common-Mode Rejection Ratio = differential voltage gain : common-mode voltage gain
Temperature influence	< 50 ppm/K full scale Reference temperature for TC specifications = 23 °C, the average TC is specified	

Power supply

Power supply	20 ... 253 V AC/DC, AC 48 ... 62 Hz, approx. 2 VA; DC 1.2 W
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Specifications *(continued)*

Isolation

Galvanic isolation	3-port isolation between input, output, and power supply	
Test voltage	Calibrated switching	10 kV AC across input and output / power supply
	Fixed setting (model P 43100 D2 TRMS-nnnn)	15 kV AC across input and output / power supply
	All models 4 kV AC across output and power supply	
Working voltage (basic insulation) according to EN 61010-1	Calibrated switching	Up to 2200 V AC/DC across input, output, and power supply with overvoltage category III and pollution degree 2 (fast transients: 13.5 kV)
	Fixed setting (model P 43100 D2 TRMS-nnnn)	Up to 3600 V AC/DC across input, output, and power supply with overvoltage category III and pollution degree 2 (fast transients: 20 kV)
Rated isolation voltage according to EN 50124-1	Calibrated switching	Up to 2200 V AC/DC across input, output, and power supply with overvoltage category III and pollution degree 2
	Fixed setting (model P 43100 D2 TRMS-nnnn)	Up to 3600 V AC/DC across input, output, and power supply with overvoltage category III and pollution degree 2
Protection against electric shock	Calibrated switching	Protective separation according to EN 61140 through reinforced insulation according to EN 61010-1. Working voltages with overvoltage category III and pollution degree 2: – up to 1100 V AC/DC across input, output, and power supply – up to 300 V AC/DC across output and power supply
	Fixed setting (model P 43100 D2 TRMS-nnnn)	Protective separation to EN 61140 by reinforced insulation according to EN 61010-1. Working voltages with overvoltage category III and pollution degree 2: – up to 1800 V AC/DC across input, output and power supply – up to 300 V AC/DC across output and power supply

For applications with high working voltages, take measures to prevent accidental contact and make sure that there is sufficient distance or insulation between adjacent devices.

Standards and approvals

EMC	Product family standard:	EN 61326
	Emitted interference:	Class B
	Immunity to interference:	Industry
	Slight deviations are possible during interference.	
RoHS conformity	According to directive 2011/65/EU	

VariTrans P 43000 TRMS

Specifications (continued)

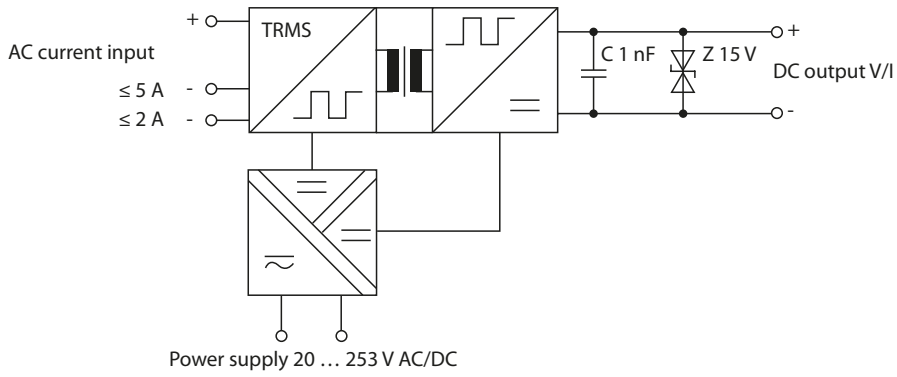
Further data

Ambient temperature	Operation: -10 ... +70 °C Operation with restricted specifications (upon request) -40 ... +85 °C Transport and storage: -40 ... +85 °C
Ambient conditions	Indoor use ¹⁾ ; relative humidity 5 ... 95 %, no condensation; max. altitude 2000 m (air pressure: 790 ... 1060 hPa) ²⁾
Design	Modular housing D2 housing width 45 mm with screw terminals See dimension drawings for further measurements
Connection	M 3.5 connecting screws with self-releasing terminal housing Conductor cross section max. 1 x 4 mm ² solid or 1 x 2.5 mm ² stranded with ferrule, min. 1 x 0.5 mm ² solid or stranded with ferrule
Tightening torque	0.6 Nm
Ingress protection	Housing: IP 40, terminals: IP 20
Mounting	With snap-on mounting for 35 mm DIN rail according to EN 60715
Weight	Approx. 350 g

¹⁾ Closed, weather-protected operating areas (stationary operation), water or wind-driven precipitation (rain, snow, hail, etc.) excluded

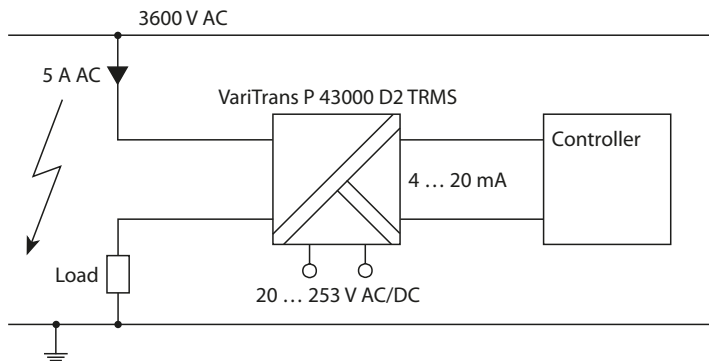
²⁾ Lower air pressure reduces the allowable working voltages.

Block Diagram



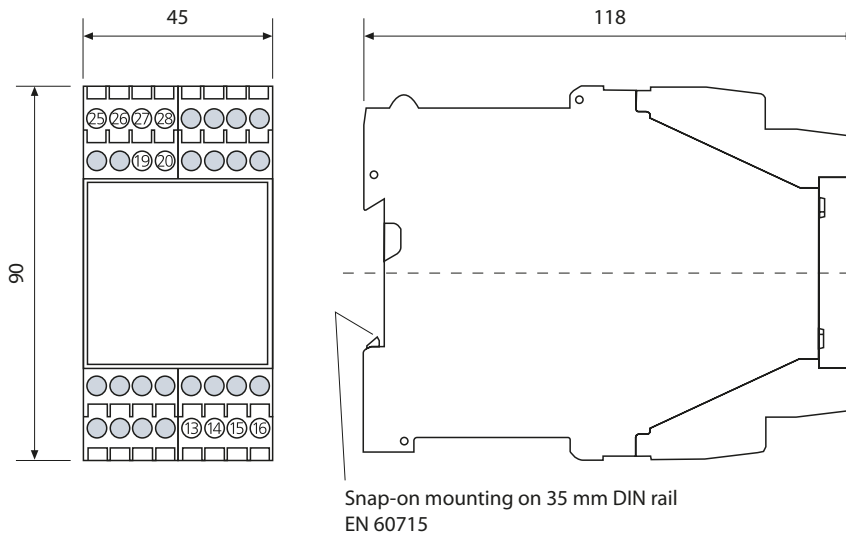
Typical Application

Direct current measurement with a high input potential



VariTrans P 43000 TRMS

Dimension Drawing and Terminal Assignments



Terminal assignments

1 ... 5 A input

13	nc
14	Input \pm current
15	Input 0 current (≤ 5 A)
16	Input 0 current (≤ 2 A)

19	Power supply AC/DC
20	Power supply AC/DC

25	Output + current/voltage
26	Output + voltage
27	Output - current
28	Output - voltage

0.1 ... 5 A input

13	+0.1 A ... +1 A
14	+2 A ... +5 A
15	-2 A ... -5 A
16	-0.1 A ... -1 A

19	Power supply AC/DC
20	Power supply AC/DC

25	Output + current/voltage
26	Output + voltage
27	Output - current
28	Output - voltage

M 3.5 connecting screws with self-releasing terminal housing
Conductor cross-section max. 1 x 4 mm² solid or 1 x 2.5 mm² stranded with ferrule, min. 1 x 0.5 mm² solid or stranded with ferrule

For voltage output, place jumper across terminals 25 and 26
Do not use a jumper for current output (remove pre-installed jumper).

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