

VariTrans P 42000 TRMS

AC/DC high voltage transducers for true rms measurement
Input voltages up to $V_{in} = 3600 \text{ V AC}$

The Task

In electrical systems, alternating currents from 10 V to 3600 V 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 voltages 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.

The Solution

The VariTrans P 42000 TRMS high voltage transducers have been specially conceived for measuring high voltages up to 3600 V AC/DC. 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 or 67.5 mm wide modular housing (depending on the input voltage level) is used for the VariTrans P 42000 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 42000 TRMS are available for any input voltages from 10 V AC to 3600 V 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.

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VariTrans P 42000 TRMS

The integrated 20 to 253 V AC/DC VariPower broad-range power supply offers maximum flexibility. 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 savings, a just 67.5 mm wide modular housing is sufficient for input voltages up to 3600 V AC/DC (up to 1200 V in a 45 mm 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 42000 TRMS Switchable input and output	10 V ... 1200 V AC 1 to 16 ranges to customer requirements (limited range spread) 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 42000 D2 TRMS-nnnn
	1200 mV ... 2200 V AC 1 to 16 ranges to customer requirements (limited range spread) 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 42000 D3 TRMS-nnnn
VariTrans P 42100 TRMS Input and output with fixed settings	10 V ... 1200 V 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 42100 D2 TRMS-nnnn
	1200 V ... 3600 V 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 42100 D3 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 42000 TRMS

Specifications

Input data

Input	P 42000 D2 TRMS-nnnn	10 V ... 1200 V AC; 1 to 16 ranges with calibrated switching, to customer requirements
	P 42000 D3 TRMS-nnnn	1200 V ... 2200 V AC; 1 to 16 ranges with calibrated switching, to customer requirements
	P 42100 D2 TRMS-nnnn	10 V ... 1200 V AC; fixed setting to customer requirements
	P 42100 D3 TRMS-nnnn	1200 V ... 3600 V AC; fixed setting to customer requirements
Rated frequency	50/60 Hz	
Frequency range	40 ... 1000 Hz (frequency \leq 40 Hz upon request)	
Input resistance	Range 10 V ... 100 V AC	approx. 1 Mohm
	Range 100 V ... 500 V AC	approx. 3.6 Mohms
	Range 500 V ... 1200 V AC	approx. 7.2 Mohms
	Range 1200 V ... 3600 V AC	approx. 14 Mohms
Input capacitance	Approx. 1 nF	
Overload capacity	D2: 20 % full scale (max. crest factor 8), max. crest voltage \leq 2000 V	
	D3: 20 % full scale or $<$ 3900 V AC (max. crest factor 8), max. crest voltage $<$ 5500 V	

Output data

Output	P 42000 Dx TRMS-nnnn	0 ... 20 mA, 4 ... 20 mA and/or 0 ... 10 V to customer requirements, switchable
	P 42100 Dx TRMS-nnnn	0 ... 20 mA, 4 ... 20 mA or 0 ... 10 V to customer requirements, fixed setting
Offset	Up to \pm 100 % by default	
Load	With output current	\leq 12 V (600 ohms at 20 mA)
	With output voltage	\leq 10 mA (1000 ohms at 10 V)
Residual ripple	$<$ 10 mV _{rms}	

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	$<$ 100 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 42100 Dx 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 42100 Dx 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 42100 Dx 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 42100 Dx 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	

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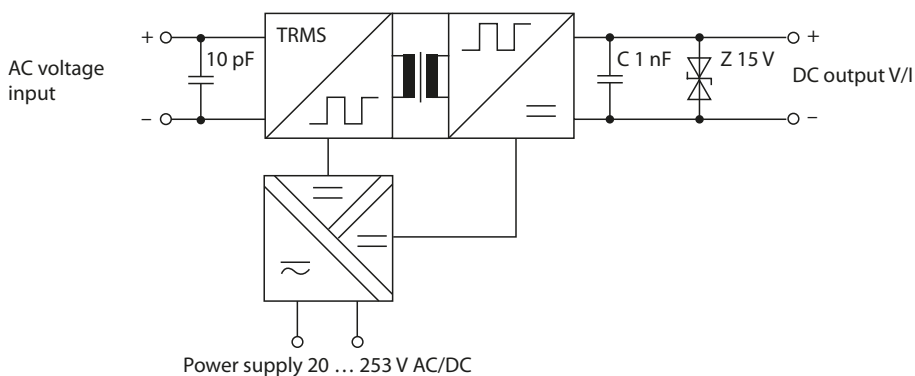
Specifications (continued)

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 D3 housing width 67.5 mm 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	Type D2 approx. 350 g, type D3 approx. 500 g

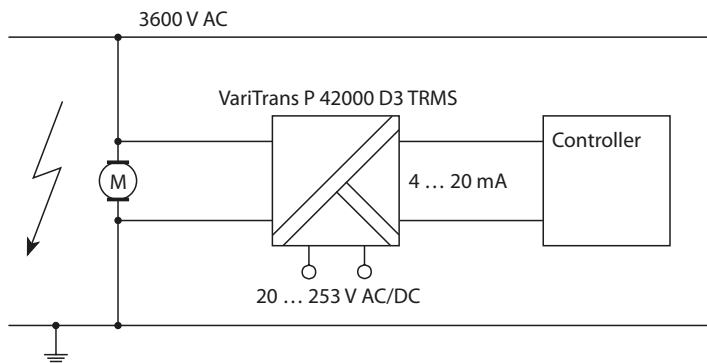
¹⁾ Closed, weather-protected operating areas (stationary operation), water or wind-driven precipitation (rain, snow, hail, etc.) excluded
²⁾ Lower air pressure reduces the allowable working voltages.

Block Diagram

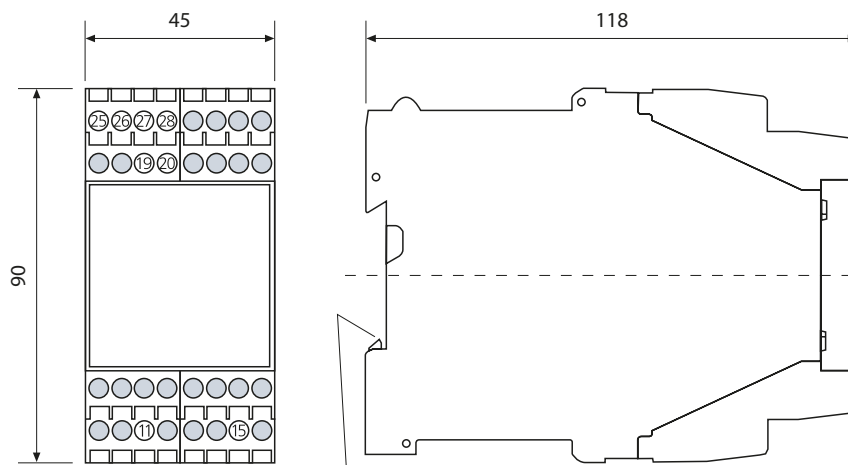


Typical Application

Direct measurement of supply voltage



Dimension Drawing and Terminal Assignments



Type D2

Snap-on mounting on 35 mm DIN rail to EN 60715

Terminal assignments

11 Input	0 voltage
15 Input	+ voltage ≤ 1200 V AC
19 Power supply	AC/DC
20 Power supply	AC/DC
25 DC output	+ current/voltage
26 DC output	+ voltage
27 DC output	- current
28 DC output	- voltage

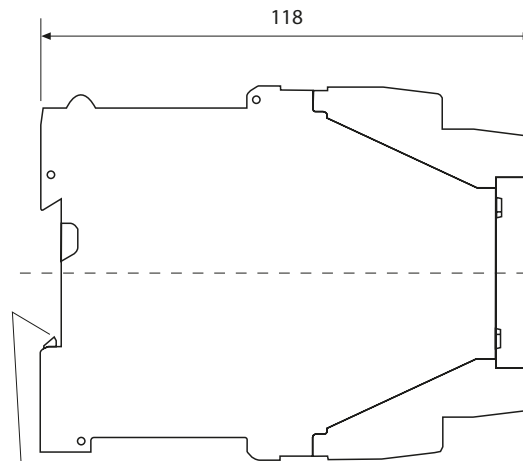
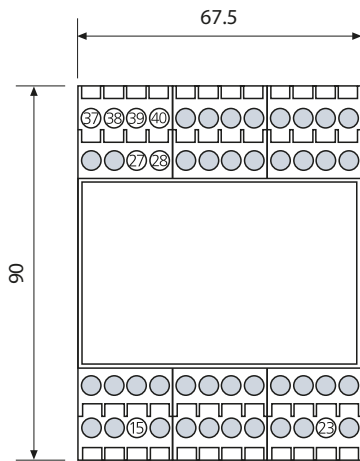
M 3.5 connecting screws with self-releasing terminal housing
 Conductor cross-section max. 1×4 mm² solid or 1×2.5 mm² stranded with ferrule, min. 1×0.5 mm² solid or stranded with ferrule

For voltage output, place jumper across terminals 25 and 26.

All dimensions in mm

VariTrans P 42000 TRMS

Dimension Drawing and Terminal Assignments (continued)



Snap-on mounting on 35 mm DIN rail to EN 60715

Type D3

Terminal assignments

15 Input	0 voltage	
23 Input	+ voltage ≤ 3600 V AC	
27 Power supply	AC/DC	
28 Power supply	AC/DC	
37 DC output	+ current/voltage	}
38 DC output	+ voltage	
39 DC output	- current	
40 DC output	- voltage	

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

For voltage output, place jumper across terminals 37 and 38.
 Do not use a jumper for current output (remove pre-installed jumper).

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