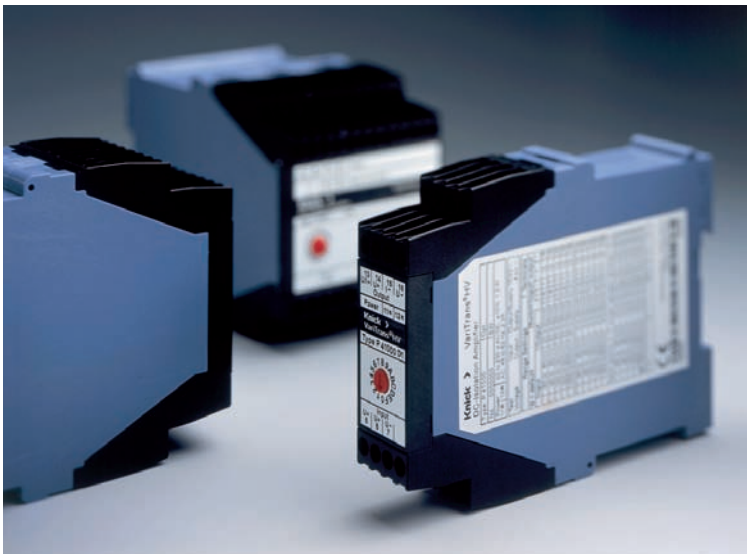
Knick

VariTrans® P 41000

Universal high-voltage isolators.
Input signals from
V_{in} = ±60 mV up to
V_{in} = ±100 V.



The Task

In high-voltage systems unipolar or bipolar voltage signals ranging from 60 mV to 100 V, e.g. voltages across shunt resistors, must be galvanically isolated and converted to standard ±20 mA, ±10 V, or 4 ... 20 mA output signals.

The Problems

In the case of insufficient insulation the high voltages and harsh ambient conditions may impair the galvanic isolation. This can result in false signals or even personal injury or damage to the equipment. These risks have to be securely eliminated in the long term through isolation amplifiers that are specially suited for high-voltage applications.

The Solution

The VariTrans® P 41000 isolation amplifiers have been specially conceived for measurements of bipolar voltages from millivolts to volts. They reliably isolate high potentials at the input circuit.

The isolating distances are designed to withstand permanent voltages up to 3600 V AC/DC and fast transients up to 20 kV. Protection against electric shock is achieved through Safe Isolation to EN 61140 from input to output and power supply.

The Housing

For the VariTrans® P 41000 high-voltage isolation amplifiers a new 22.5 mm wide modular housing is used. It is snapped on a standard DIN rail. The front panels of the adjustable models provide a rotary coding switch for selecting the ranges.

The Advantages

The VariTrans® P 41000 are available for any input voltages from ±60 mV to ±100 V. Analog unipolar and bipolar (standard) signals are available at the output: ±20 mA, ±10 V, and 4 ... 20 mA standard signals.

16 input/output signal combinations can easily be selected with a rotary coding switch on the front of the device. Tedious on-site adjustment using a screwdriver, calibrator, and multimeter is no longer required. Drift problems due to instable trimming components (e. g. potentiometers) are avoided. Thanks to the easy scalability of the range selection, the devices can be flexibly suited to the individual needs of the application. Up to 16 customized signal combinations can be implemented in one device. The integrated 20 to 253 V AC/DC VariPower® broad-range power supply offers highest flexibility. This ensures trouble-free operation with alternating or direct voltages everywhere in the world and provides for maximum safety even in unstable power

High-Voltage Isolators / Isolation Amplifiers for Shunt Applications

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supply networks. Installation is safe and easy: Erroneous connection of mains supply is practically impossible. Expensive standstill times and repair work during the commissioning are prevented.

Vacuum encapsulation provides maximum long-term protection against aggressive environmental influences, shock, and vibrations and ensures the high disruptive strength required for working voltages up to 3600 V AC/DC. The isolation system meets the safety requirements of EN 61010-1 and EN 50124-1 (railway applications: insulation coordination).

The Technology

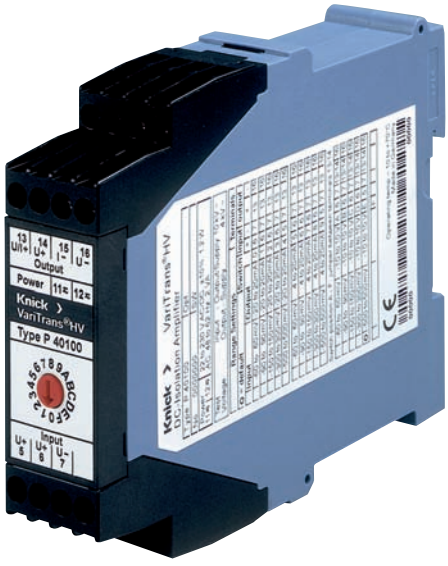
In this series, Knick relies on the newly developed TransShield® technology which compared to conventional designs enables very compact high-voltage transformers with low leakage. Thanks to the resulting space advantage, the P 41000 shunt isolators can be installed in an only 22.5 mm wide modular housing.

Another substantial advantage of 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, the devices are subjected to routine testing with 15 kV AC (fixed-range models) or 10 kV AC (switchable models) on a 100 % basis.
Circuit design and device construction ensure excellent transmission characteristics, which are reflected in zero stability, linearity, long-term stability, frequency response, and immunity to interference. A cutoff frequency >5 kHz and rise time <0.1 ms guarantee distortion-free signal conversion. The output signal follows fast changes in the input signal almost without delay.

Warranty
5 years!

Defects occurring within 5 years from delivery are remedied free of charge at our works (carriage and insurance paid by sender).



Modular Housings

VariTrans® P 41000

The Facts

Universal high-voltage isolators
for conversion of voltages, e. g. in shunt applications, from ±60 mV up to ±100 V to impressed ±20mA, ±10 V, or 4 ... 20 mA output signals.

New TransShield® technology
enables extremely compact modular housings

Working voltages up to 3600 V AC/DC

Protection against electric shock
through Safe Isolation up to 1800 V AC/DC according to EN 61140

Test voltages up to 15 kV AC

Excellent transmission properties:
– Gain error < 0.1 %
– Cutoff frequency >5 kHz (low-pass filtering possible)
– Rise time T90 < 0.1 ms

Virtually no influence from common-mode voltages:
CMRR > 150 dB

High immunity to transient interferences:
T-CMRR > 115 dB

Very high flexibility due to
– calibrated selection of up to 16 input/output ranges (up to 2200 V working voltage)
– up to 16 customer-specific ranges
– 20 V to 253 V AC/DC broad-range power supply unit

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

Suitable for DC railway systems
up to 3000 V DC

Mechanically stable
for operation on ships, rail vehicles and land crafts

5-year warranty

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Product Line

Devices	Input	Output	Order No. Working voltage ≤2.2 kV AC/DC Test voltage 10 kV AC	Order No. Working voltage ≤3.6 kV AC/DC Test voltage 15 kV AC
VariTrans® P 41000 Input and output adjustable	±60 / 90 / 150 / 300 / 500 mV / 10 V[1], switchable	±10 V, ±20 mA and 4 ... 20 mA, switchable	P 41000 D1	–
VariTrans® P 41000 with fixed settings	±60 mV	±20 mA	P 41056 D1	P 41156 D1
	±60 mV	4 ... 20 mA	P 41059 D1	P 41159 D1
	0 ... 60 mV	4 ... 20 mA	P 41057 D1	P 41157 D1
	±60 mV	±10 V	P 41058 D1	P 41158 D1
	±90 mV	±20 mA	P 41046 D1	P 41146 D1
	±90 mV	4 ... 20 mA	P 41049 D1	P 41149 D1
	0 ... 90 mV	4 ... 20 mA	P 41047 D1	P 41147 D1
	±90 mV	±10 V	P 41048 D1	P 41148 D1
	±150 mV	±20 mA	P 41066 D1	P 41166 D1
	±150 mV	4 ... 20 mA	P 41069 D1	P 41169 D1
	0 ... 150 mV	4 ... 20 mA	P 41067 D1	P 41167 D1
	±150 mV	±10 V	P 41068 D1	P 41168 D1
	±300 mV	±20 mA	P 41076 D1	P 41176 D1
	±300 mV	4 ... 20 mA	P 41079 D1	P 41179 D1
	0 ... 300 mV	4 ... 20 mA	P 41077 D1	P 41177 D1
	±300 mV	±10 V	P 41078 D1	P 41178 D1
	±500 mV	±20 mA	P 41086 D1	P 41186 D1
	±500 mV	4 ... 20 mA	P 41089 D1	P 41189 D1
	0 ... 500 mV	4 ... 20 mA	P 41087 D1	P 41187 D1
	±500 mV	±10 V	P 41088 D1	P 41188 D1
	±1 V	±20 mA	P 41096 D1	P 41196 D1
	±1 V	4 ... 20 mA	P 41099 D1	P 41199 D1
	0 ... 1 V	4 ... 20 mA	P 41097 D1	P 41197 D1
	±1 V	±10 V	P 41098 D1	P 41198 D1
	±10 V	±20 mA	P 41036 D1	P 41136 D1
	±10 V	±10 V	P 41038 D1	P 41138 D1
VariTrans® P 41000 with customer-specific settings	±60 mV ... 100 V one or more ranges to customer requirement[2]	±10 V, ±20 mA, 4 ... 20 mA, one or more ranges to customer requ.[2]	P 41000 D1-nnnn	–
	±60 mV ... 100 V, fixed to customer requirement[2]	±10 V, ±20 mA, 4 ... 20 mA, fixed, to customer requ.[2]	P 41000 D1-nnnn	P 41100 D1-nnnn

Power supply

20 ... 253 V AC/DC

1) Input ±10 V switchable only with output ±10 V
2) Please specify desired setting when ordering

VariTrans® P 41000

Specifications

Input data

Inputs	P 41000 D1	±60 mV, ±90 mV, ±150 mV, ±300 mV, ±500 mV, ±10 V, (bipolar)	Calibrated selection, factory setting: ±10 V
	P 41000 D1-nnnn	60 mV to 100 V, unipolar/bipolar	1 to 16 switchable calibrated ranges to customer requirements
	P 41100 D1-nnnn	60 mV to 100 V, unipolar/bipolar	Fixed settings, to customer requirements
Input resistance	Range ≤ 0.5 V	Approx. 100 kohms	
	Range > 0.5 V	> 2 Mohms	
Input capacitance	Range ≤ 0.5 V	Approx. 10 nF	
	Range > 0.5 V	Approx. 1 nF	
Overload	Range ≤ 10 V	Limited by 36 V suppressor diode, permitted continuous current = 20 mA	
	Range > 10 V	Limited by 150 V suppressor diode, permitted continuous current = 3 mA	

Output data

Outputs 1 and 2	P 41000 D1	20 mA, 10 V, unipolar/bipolar and 4 ... 20 mA	Calibrated selection, factory setting: ±10 V
	P 41000 D1-nnnn	20 mA, 10 V, unipolar/bipolar and/or 4 ... 20 mA	Calibrated selection, to customer requirements
	P 41100 D1-nnnn	20 mA, 10 V, unipolar/bipolar or 4 ... 20 mA	Fixed settings, to customer requirements
Offset	Factory setting up to ±150 %		
Load	With output current ≤ 12 V (600 ohms at 20 mA) With output voltage ≤ 10 mA (1000 ohms at 10 V)		
Offset	< 20 µA or 10 mV		
Residual ripple	< 10 mV_{rms}		

Transmission behavior

Gain error	< 0.1 % meas. val.		
Cutoff frequency (–3 dB)	> 5 kHz; optional factory setting: < 10 Hz		
Common mode rejection ratio	Input range ≤ 1 V	CMRR[1)]	Approx. 150 dB (DC/AC: 50 Hz)
		T-CMRR[2)]	Approx. 115 dB (1000 V, tr = 1 µs)
	Input range > 1 V	CMRR[1)]	DC: approx. 150 dB AC 50 Hz: approx. 120 dB
Temperature coefficient[3)]	< 0.005 %/K		

1) Common-Mode Rejection Ratio = $\frac{\text{Differential voltage gain}}{\text{Common-mode voltage gain}}$

2) Transient Common-Mode Rejection Ratio = $\frac{\text{Differential DC gain}}{\text{Common-mode transient peak value gain}}$

3) Reference temperature for TC specifications 23 °C, average TC is specified

High-Voltage Isolators / Isolation Amplifiers for Shunt Applications

Specifications *(continued)*

Power supply

Power supply	20 ... 253 V AC/DC	AC 48 ... 62 Hz, approx. 2 VA; DC approx. 0.9 W

Isolation

Galvanic isolation	3-port isolation between input, output and power supply	
Test voltage	Calibrated selection	10 kV AC input against output and power supply
	Fixed settings (Model P411xxD1)	15 kV AC input against output and power supply
	All models	4 kV AC output against power supply
Working voltage (basic insulation) to EN 61010-1	Calibrated selection	Up to 2200 V AC/DC across input, output, and power supply with overvoltage category III and pollution degree 2 (fast transients: max. 13.5 kV)
	Fixed settings (Model P411xxD1)	Up to 3600 V AC/DC across input, output, and power supply with overvoltage category III and pollution degree 2 (fast transients: max. 20 kV)
Rated isolation voltage to EN 50124-1	Calibrated selection	Up to 2200 V AC/DC across input, output, and power supply with overvoltage category III and pollution degree 2
	Fixed settings (Model P411xxD1)	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 selection	Safe Isolation according to EN 61140 by reinforced insulation in accordance with EN 61010-1 Working voltages with overvoltage category III and pollution degree 2: – up to 1100 V AC/DC across input and output/ power supply – up to 300 V AC/DC across output and power supply
	Fixed settings (Model P411xxD1)	Safe Isolation according to EN 61140 by reinforced insulation in accordance with EN 61010-1 Working voltages with overvoltage category III and pollution degree 2: – up to 1800 V AC/DC across input and output/ power supply – up to 300 V AC/DC across output and power supply
For applications with high working voltages, you should ensure there is sufficient spacing or isolation from neighboring devices and protection against electric shocks.		

Standards and approvals

EMC[4)]	Product standard:	EN 61326
	Emitted interference:	Class B
	Immunity to interference:	Industry

4) Slight deviations are possible while there is interference

VariTrans® P 41000

Specifications *(continued)*

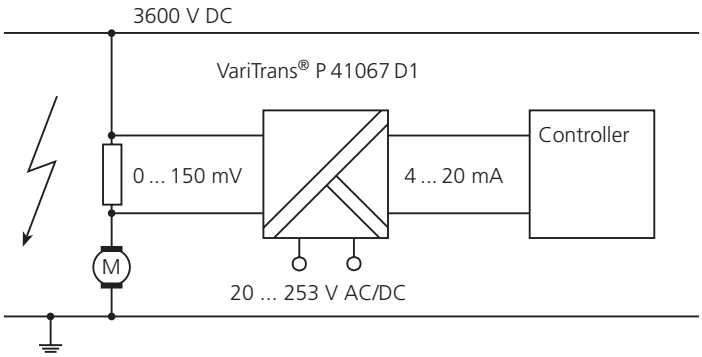
Other data

MTBF[5]	Approx. 96 years	
Ambient temperature[6]	Operation:	–10 ... +70 °C
	Transport and storage:	–40 ... +85 °C
Design	Modular housing	Housing width D1: 22.5 mm
	With screw terminals	See dimension drawings for further measurements
Ingress protection	Housing IP 40, terminals IP 20	
Mounting	With snap-on mounting for 35 mm top hat rail according to EN 60715	
Weight	Approx. 180 g	

5) Mean Time Between Failures – MTBF – according to EN 61709 (SN 29500). Conditions: stationary operation in well-kept rooms, average ambient temperature 40 °C, no ventilation, continuous operation
6) Extended temperature range –25 ... +85 °C on request

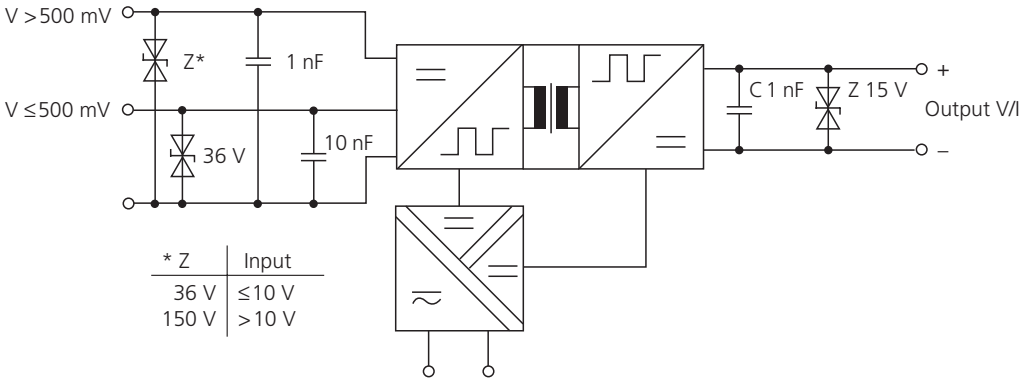
Application Example

Current measurement via shunt resistor

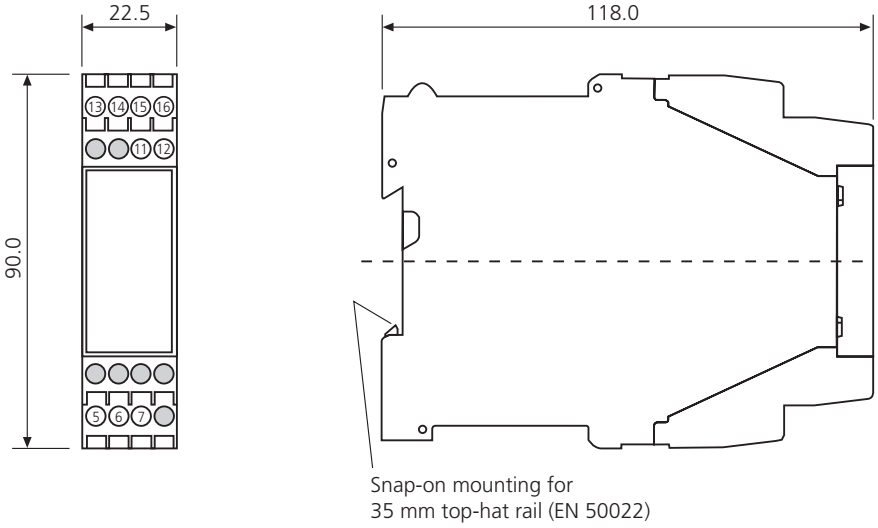


High-Voltage Isolators / Isolation Amplifiers for Shunt Applications

Block Diagram



Dimension Drawings and Terminal Assignments



Terminal assignments:

5 Voltage input + (>1 V ... 100 V)
6 Voltage input + (60 ... 1000 mV)
7 Input –

11 Power supply AC/DC
12 Power supply AC/DC

13 Current output +
14 Voltage output +
15 Current output –
16 Voltage output –

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 wire with ferrule,
min. 1 x 0.5 mm² solid or stranded wire with ferrule

For switchable models and voltage output:
Place jumper across terminals 13 and 14

All dimensions in mm!