Knick

High-Precision Devices
for the Railway Industry

The Knick Group has been a proven partner of the international railway industry for more than 50 years.

Why Knick?

Signal conditioners and transducers from Knick deliver the signals required for downstream processes – always interference-free and with high precision. The precise, robust Knick devices meet the special normative and functional requirements of the railway industry.

To us, precision also means that each individual product characteristic is perfectly tailored to the respective measurement task. After all, without this prerequisite, the overall system cannot carry out its function reliably.

Knick: Core Competencies

- Galvanic isolation
- U – Voltage measurement
- I – Current measurement
- V – Speed signal processing
- ϑ – High-voltage temperature measurement

Voltage measurement in DC substations
For 750 V DC, 1,500 V DC and 3,000 V DC systems
Basic insulation up to 3,600 V AC/DC
Test voltage up to 15 kV AC
More on page 6

Current measurement in DC substations
For up to 20 kA with shunt resistors from ±30 mV
Basic insulation up to 3,600 V AC/DC
Test voltage up to 15 kV AC
More on page 6

Temperature measurement in traction power supply units and DC substations
With the Pt100 resistance thermometer (RTD)
Basic insulation up to 6,600 V AC/DC
Test voltage up to 15 kV AC
More on page 11

Voltage measurement in rolling stock
Up to ±4,500 V DC/±3,000 V AC
Basic insulation up to 4,800 V AC/DC
Test voltage up to 20 kV AC
More on page 12

Current measurement in rolling stock
For up to 20 kA with shunt resistors from ±30 mV
Basic insulation up to 4,800 V AC/DC
Test voltage up to 18 kV AC
More on page 14

Speed signals in rolling stock
Speed signal doubling, adjustment, and isolation
Basic insulation up to 1,000 V AC/DC
Test voltage up to 5 kV AC
More on page 16

Knick Group

International Railway Technology

Reliability for your rail systems – Made in Germany.

Knick is a reliable partner and has been known for its high technical level and continuous drive toward innovation for a long time. One in every four Knick employees works in research and development.

Based on many years of experience in developing interface technology for many sectors, including the generation and storage of power and steel processing, Knick offers outstanding quality engineered down to the last detail, a high level of product reliability, and a long service life.

Alongside its company headquarters in Berlin, Germany, Knick has subsidiaries in the USA, China, Korea, Switzerland, and France, and is represented by a partner network in 39 other countries.

The Knick service team will be happy to provide you with further details on transmitters for rolling stock and infrastructure.

Phone: +49 30 80191-0
Email: info@knick.de

Knick Group

Sales partners

High-Isolation Transmitters for Voltage, Current, Temperature, and Speed Signals

For Applications in Rolling Stock and Along the Line

Knick Elektronische Messgeräte GmbH & Co. KG – a family-run company with high quality standards.

Knick has set the benchmark in the sector with an unusually high MTBF (mean time between failures) of 2,165 years for DC high voltage transducers, which was determined based on real field data.

The more than 250 employees at Knick headquarters in Berlin and in the international subsidiaries also uphold this quality standard for all the other railway industry products.

On this basis, Knick delivers forward-looking measuring technology that increases both efficiency and safety in rail transport – both on the rails and in the DC traction power supply. With devices for precisely measuring current, voltage and temperature, as well as for isolating signal conversion in the railway industry, Knick impresses with:

THE ART OF MEASURING

Precision and Reliability – Made in Germany

Pioneering Spirit
Setting new standards with know-how and technology – This is our mission

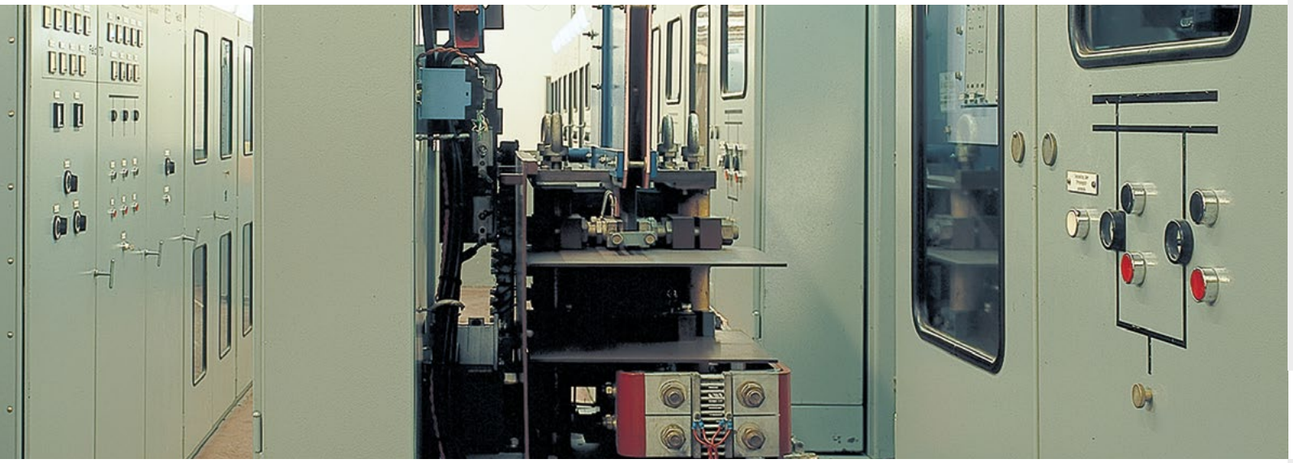
Performance
Optimal solutions for complex conditions – Challenges are our motivation

Precision
Sophisticated technology and meticulous verification – Accuracy is our standard

Premium Quality
First-class materials and reliability – Outstanding products are our pride

Reliable Market Leader:
The P40000 Series

Voltage, Current, and Temperature Measurement in the DC Traction Power Supply

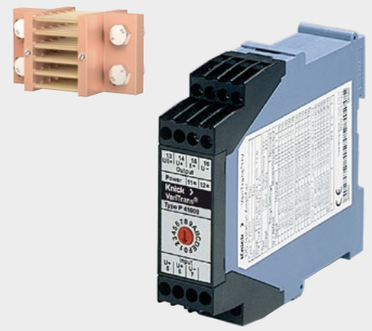


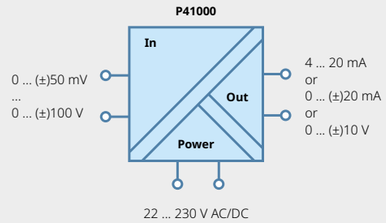
For decades, Knick has provided transmitters with galvanic isolation for the reliable and precise measurement of voltage and current in DC substations. Today, the company is a global market leader in this sector. This is why Knick is also the first contact for suppliers and operators of DC substations in terms of mastering technical challenges like the options for wear monitoring for predictive maintenance.

DC substations have ratings up to the upper single-digit MW range. Both substations and the grid sections they supply must be effectively protected against short circuits. The protective mechanism must reliably interrupt high currents and limit the power flowing into the short circuit.

The protective device must measure current and voltage in order to execute algorithms for detecting short circuits. This requires high voltage transducers that measure quickly and precisely, and are able to withstand high loads. They must tolerate voltages in the 750 to 3,000 V DC range along with temporary surges like the ones generated in energy recovery for braking trains.

In these high voltage applications, protection for humans and devices is of vital importance. Therefore, the high galvanic isolation of Knick devices is a key aspect when selecting the most suitable transmitter. The P41000 and P42000 universal high voltage transducers have proven themselves in DC substations for traction power supply worldwide.



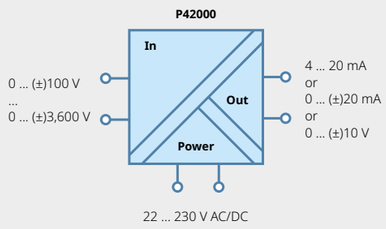


P41000 – Current Measurement via Shunt Resistor

Universal high voltage transducer in a compact, modular enclosure for current measurement via shunt resistor. High measurement accuracy without long-term drift.

Application:

Bi-directional current measurement for
- Controllers and protection relays
- Circuit breaker panels (incomer and negative return panels, negative return feeder)
- Line feeder outputs (line feeder and bypass feeder panels)
- Voltage limiters
- Frame leakage protection
- Line feeder testing

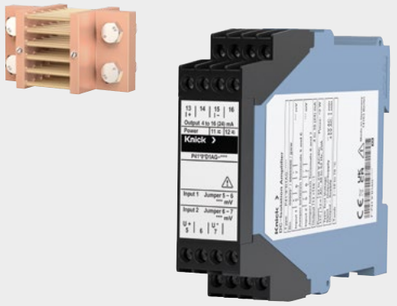


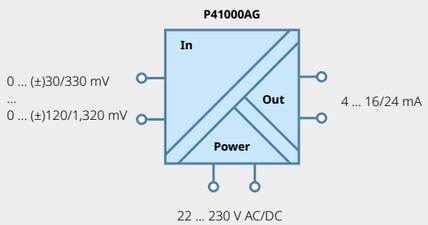
P42000 – Voltage Measurement

Universal high voltage transducer for direct high voltage measurement. High measurement accuracy without long-term drift.

Application:

Unipolar and bipolar voltage measurement for
- Controllers and protection relays
- Circuit breaker panels (incomer and negative return panels, negative return feeder)
- Line feeder outputs (line feeder and bypass feeder panels)
- Voltage limiters
- Monitoring stray current
- Frame leakage protection





New

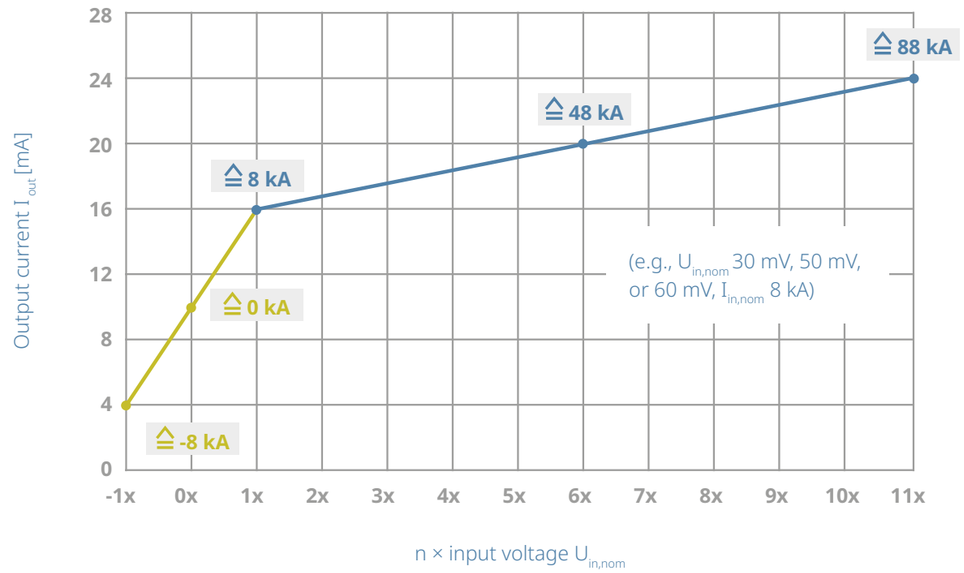
P41000AG – Current and Overcurrent Measurement via Shunt Resistor

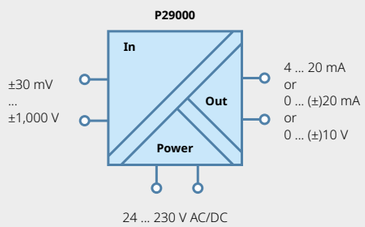
Two in one: Adaptive gain for rated current and overcurrent measurement. High level of accuracy in the rated current range and adequate accuracy up to 11 times the rated current. The first of its type in the market.

Application:

- Bi-directional current measurement at the circuit breaker for detecting short-circuit currents through protection relays
- Wear monitoring at high-speed circuit breakers for predictive maintenance

P41000AG Transfer Characteristic



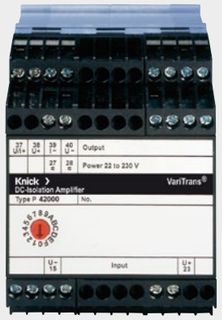


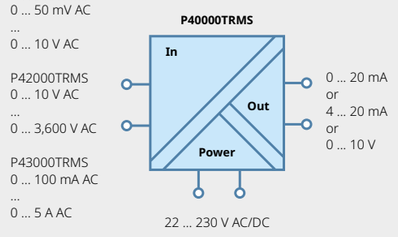
P29000– Voltage and Current Measurement via Shunt Resistor

High voltage transducer for reliable current and voltage measurement with moderate requirements for galvanic isolation.

Application:

- Bi-directional current measurement
- Unipolar and bipolar voltage measurement
- Streamlines alternative for environments with “low” voltage





P40000TRMS – AC Voltage and Current TRMS Measurement

AC current high voltage transducer/signal conditioner for True-RMS measurement of voltages and current from 16.7 Hz to 400 Hz. A DC signal is available at the output for a programmable logic controller, for example. It is designed for an isolation of 3,600 V and a test voltage of 15,000 V. In accordance with the EN 50124 standard.

Application:

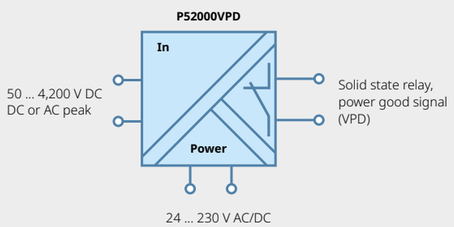
- AC voltage and current monitoring in substations, workshops, and test benches

P52000VPD – Voltage Detection

P52000VPD is a product designed to detect voltages between 50 and 4,200 V. The input signal is compared to a threshold value. If the input voltage exceeds the set threshold value, a floating solid state relay opens and signals that voltage is present at the input.

Application:

High voltage detection
- In the traction power supply
- In rolling stock
- For operating motorized switch disconnectors (MODs)
- For monitoring conductor rails and overhead lines

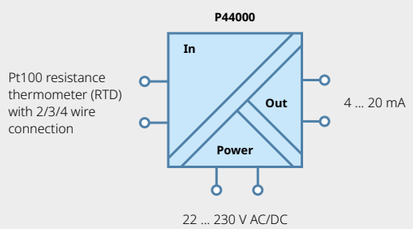


P44000 – Temperature Measurement

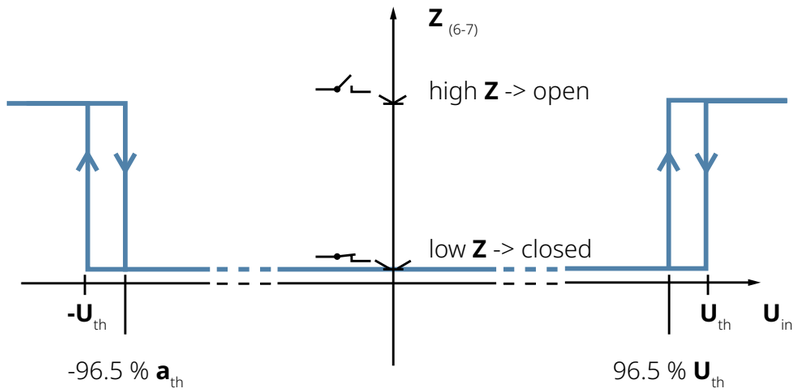
Measurement of up to 300 °C with a Pt100 resistance thermometer (RTD). Low measurement errors of normally 0.5 K and short T90 delay time of 100 ms. Up to 6,600 V AC/DC basic insulation.

Application:

- Temperature monitoring of Thyristors, diodes, and IGBTs in rectifiers and inverters
- Busbars in substations
- Heat sinks



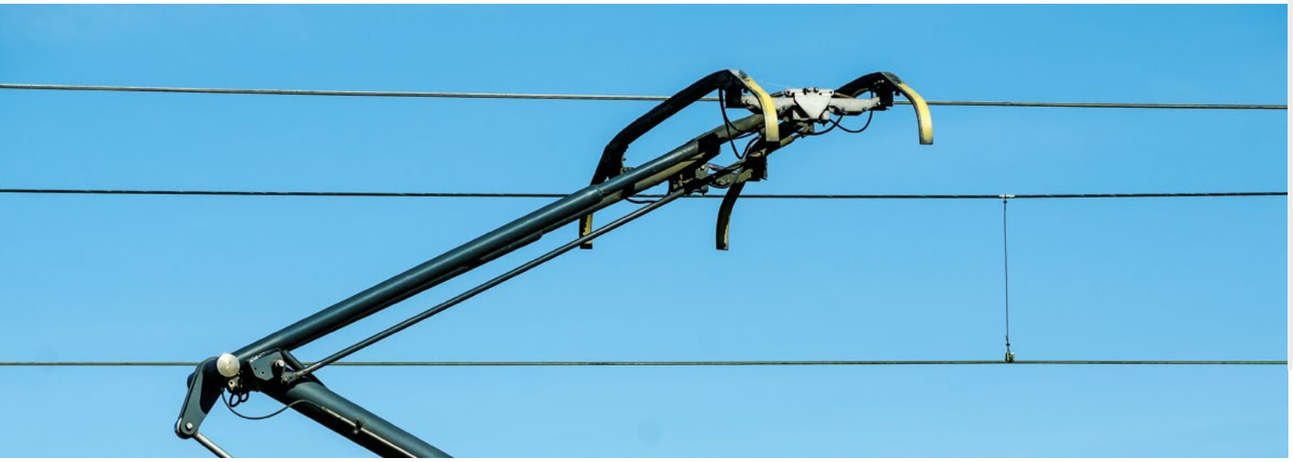
Relay Output Switching Characteristics



The Perfect Solution for any Voltage Range and the Requirements of Rail Standards

The Space-Saving High Voltage Transducer for Rolling Stock: P45000

High Voltage and Current Measurement for Rolling Stock



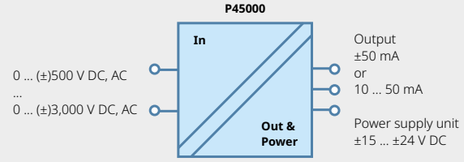
The signal conditioners in the P45000 series are designed to measure the high direct and alternating voltages in heavy-duty vehicles: rolling stock in particular. Monitoring and controlling traction motors and monitoring the DC link voltage in traction converters or auxiliary power converters are just some of the possible applications.

The voltage measuring input is highly isolated from the output circuit and auxiliary power supply. The current output is compatible with the inputs of commercial controllers. The enclosure offers very flexible mounting options: it can be bolted to a surface in the vertical (upright) or horizontal position, or snapped onto a 35 mm DIN rail. Multiple devices can even be stacked and mounted, making them ideal for use when space is at a premium.

For the first time, applications with requirements for functional safety can be properly carried out. The high voltage transducer is certified for use in SIL 2 systems and in redundant operation for SIL 3. With it, for example, dangerously high voltages can be reliably detected.

EN 50155

SIL 2/3 IEC 61508



New

P45000 – Flexible High Voltage Measurement

High voltage transducer optimized for use in all rolling stock operated with direct and alternating current, including diesel-electric units. The small size supports the miniaturization of drive and power supply systems. All mechanical and electrical interfaces meet industry standards.

Application:

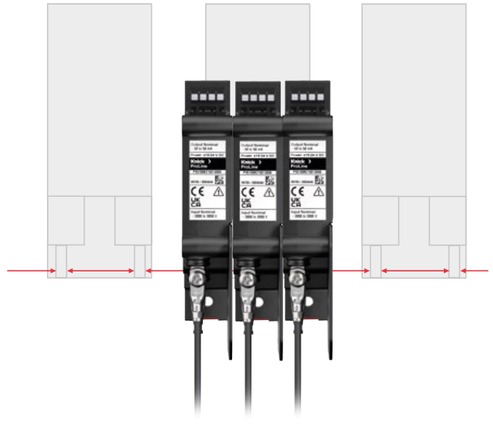
Unipolar and bipolar voltage measurement in
- Traction converters
- Auxiliary power converters

Can be ordered for any input voltage range

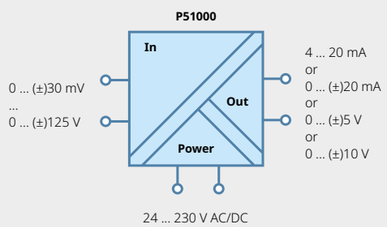
The Compact Specialist

Space-Saving Installation with P45000 Compared to Conventional Voltage Converters

- Functional safety in accordance with SIL 2/3 – the world's first SIL high voltage transducer
- Can be stacked for a compact footprint
- Flexible mounting options: 35 mm DIN rail, horizontal or vertical on surfaces



Gray: Arrangement of conventional transmitters with the required mounting distances.

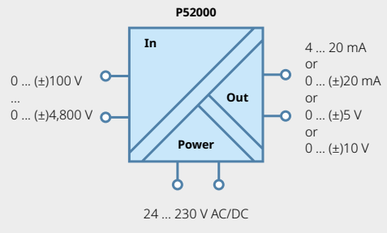


P51000 – Current Measurement via Shunt Resistor

Overload-proof current measurement via shunt resistor from amperes to kiloamperes. Even strong electromagnetic fields do not impact the measurement result. This enables high-precision current measurement.

Application:

Bi-directional current measurement for
- Pantographs and current collectors
- Distribution boards
- Energy measurement in accordance with EN 50463 (P51000E)



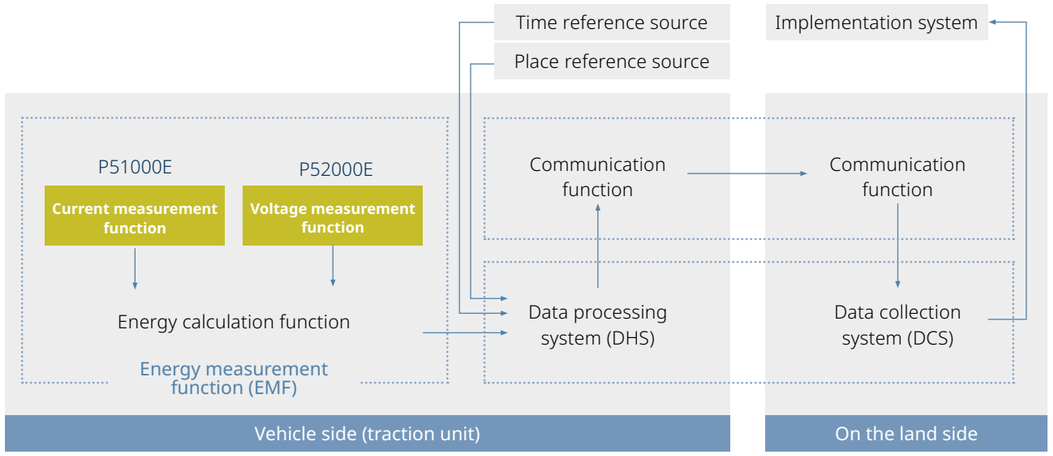
P52000 – Voltage Measurement

High voltage transducer with a robust design. High voltage contacts and connections are covered. There is no danger of reciprocal effects with other components. If multiple devices are being arranged, no additional distance between connections is required: P52000 – absolute safety guaranteed.

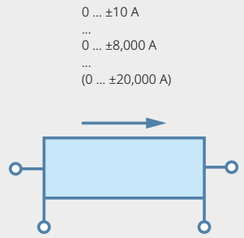
Application:

Unipolar and bipolar voltage measurement for
- Pantographs and current collectors
- Distribution boards
- Energy measurement in accordance with EN 50463 (P52000E)

P51000E and P52000E for Energy Measurement in Accordance with EN 50463



Functional structure of the energy measurement system and data flowchart in accordance with EN 50463



New

Shunt Resistors

Precise resistance with low voltage drop, which is directly proportional to the flowing current. This principle avoids the influence of adjacent cables. Excellent long-term stability. High overload capacity without residual measurement errors. Current peaks do not cause offsets or drift. Available in accuracy classes 0.5 and 0.2. Already available as of 30 mV voltage drop in order to significantly reduce power dissipation and in turn, heat development.

Application:

Bi-directional current measurement in conjunction with a Knick transmitter for
- DC traction power supply
- Rolling stock
- Energy measurement in accordance with EN 50463

Makes It Easier to Retrofit, Saves Costs for New Units

Speed Signal Doubling for Rolling Stock

Many systems in and on rolling stock require information about the current speed. They include brake systems and drive technology – two system that are key for functional safety. This is why the encoders and sensors that deliver speed data must function reliably and precisely.

If additional applications also require speed data, additional rotary encoders are usually attached to the axles of the units. However, space is often at a premium and wiring costs time and money.

With the P16000 series, Knick offers an extremely easy solution. The signal of an existing encoder is decoupled and provided for other applications.

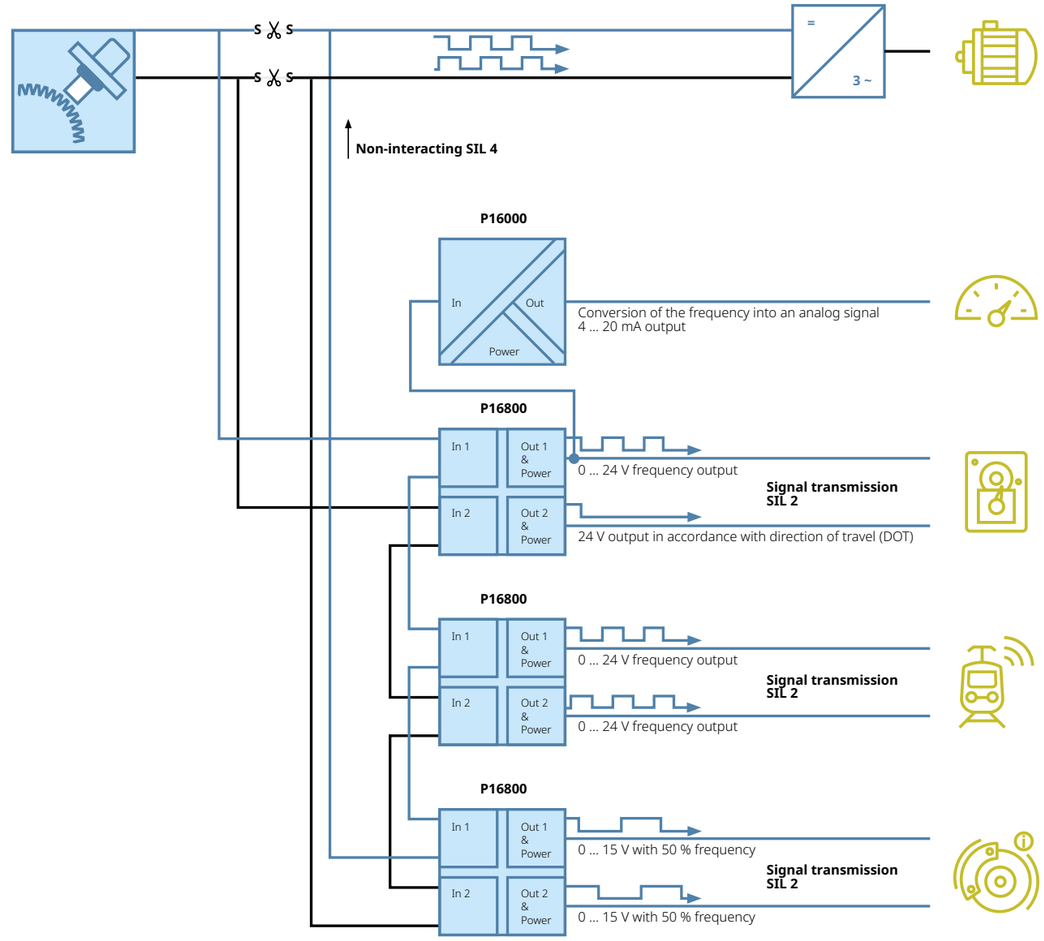
The process is non-interacting in accordance with SIL. The encoder signal is neither falsified nor distorted on its way to the controller.

All conventional signals from rotary encoders with a current or voltage output (also with open collector) can be detected. Any desired output signals can be configured via DIP switch.

P16800 is the perfect solution for retrofitting rolling stock. It helps to quickly and affordably implement the extensive requirements for odometry resulting from implementing standardized train control systems.

Knick

Cost-Reducing Solution Certified for Rolling Stock – Odometry without Additional Sensors



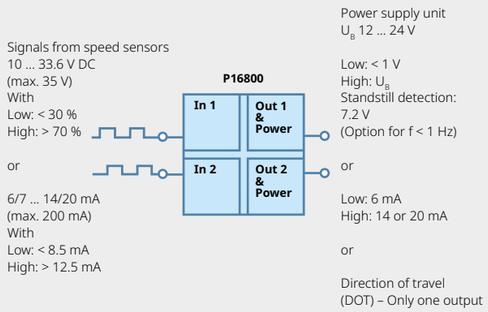
Product Highlight

Cost-Reducing Solution Certified for Rolling Stock

- Creates flexibility for connecting speed sensors to controllers
- Makes it easier to retrofit rolling stock
- Certified functional safety in accordance with SIL 4/SIL 2 (P16800) and SIL 3 (P16000)
- High galvanic isolation and extremely high EMC immunity

P16800

P16000



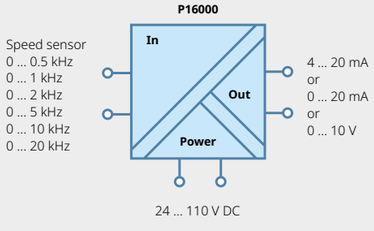
New

P16800 – Universal Speed Signal Doubler SIL 2/SIL 4

Using the P16800 makes it easier to retrofit rolling stock with systems that require speed data or rather, makes this type of retrofit possible in the first place. For new units, the number of speed sensors can be reduced, which in turn reduces procurement and maintenance costs.

Application:

- Savings on speed sensors on rolling stock by simply doubling the encoder signals



P16000 – Pulse Counter SIL 3

Pulse frequency conditioner for decoupling signals from safety-relevant circuits. In accordance with SIL 3, the rotary encoder signal is neither falsified nor distorted.

Application:

- Measurement of pulse frequency for speed indicators in rolling stock

Knick

High Voltage Transducers and Transmitters from Knick

Measuring Range	P16000	P16800	P29000	P40000 series	P45000	P51000 P52000	P44000
Temperatures (Pt100) up to 300 °C							
Voltages up to 4,800 V/Currents up to 20 kA							
Voltages up to 4,500 V							
Voltages up to 3,600 V/Currents up to 20 kA							
Voltages up to 1,000 V/Currents up to 20 kA							
Frequencies up to 25 kHz							
Frequencies up to 20 kHz							
Basic Insulation on AC/DC (Test Voltage)	**300 V (3 kV)**	**1,000 V (8.8 kV)**	**1,000 V (5.4 kV)**	**3,600 V (15 kV)**	**4,800 V (20 kV)**	**4,800 V (18 kV)**	**6,600 V (15 kV)**

Area and Standard		P16000	P16800	P29000	P40000 series	P45000	P51000 P52000	P44000
Use on rolling stock	EN 50155	X	X			X	X	
Fire protection in rolling stock	EN 45545-1, EN 45545-2, EN 45545-5	X	X			X	X	
Insulation coordination – Railway applications	EN 50124-1/IEC 62497-1	X	X		X	X	X	X
Insulation coordination – General industrial applications	UL 347 or UL 61010-1 or EN 50178	X	X	X	X	X	X	X
Protection against electric shock through strengthened isolation	EN 61140 or EN 50178 or EN 50124-1/IEC 62497-1	X	X	X	X	X	X	X
Electrical safety	EN 61010-1	X	X	X	X	X	X	
Reliability	EN 61709 (SN 29500)	X	X	X	X	X	X	X
Environmental conditions	EN 50125-1, EN 50125-3	X	X			X	X	
Resistance to vibration and shock – Railway applications	EN 61373	X	X		X	X	X	
EMC railway applications	EN 50121-1, EN 50121-3-2	X	X			X	X	
EMC railway applications	EN 61326-1	X	X	X	X	X	X	X
Protective measures against electrical hazards	EN 50153					X	X	
Functional safety	EN IEC 61508 or EN 50129	X	X			X		

Knick

Interface Technology

- High voltage transducers
- Isolated standard signal conditioners
- Transmitters
- Signal multipliers
- Indicators

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