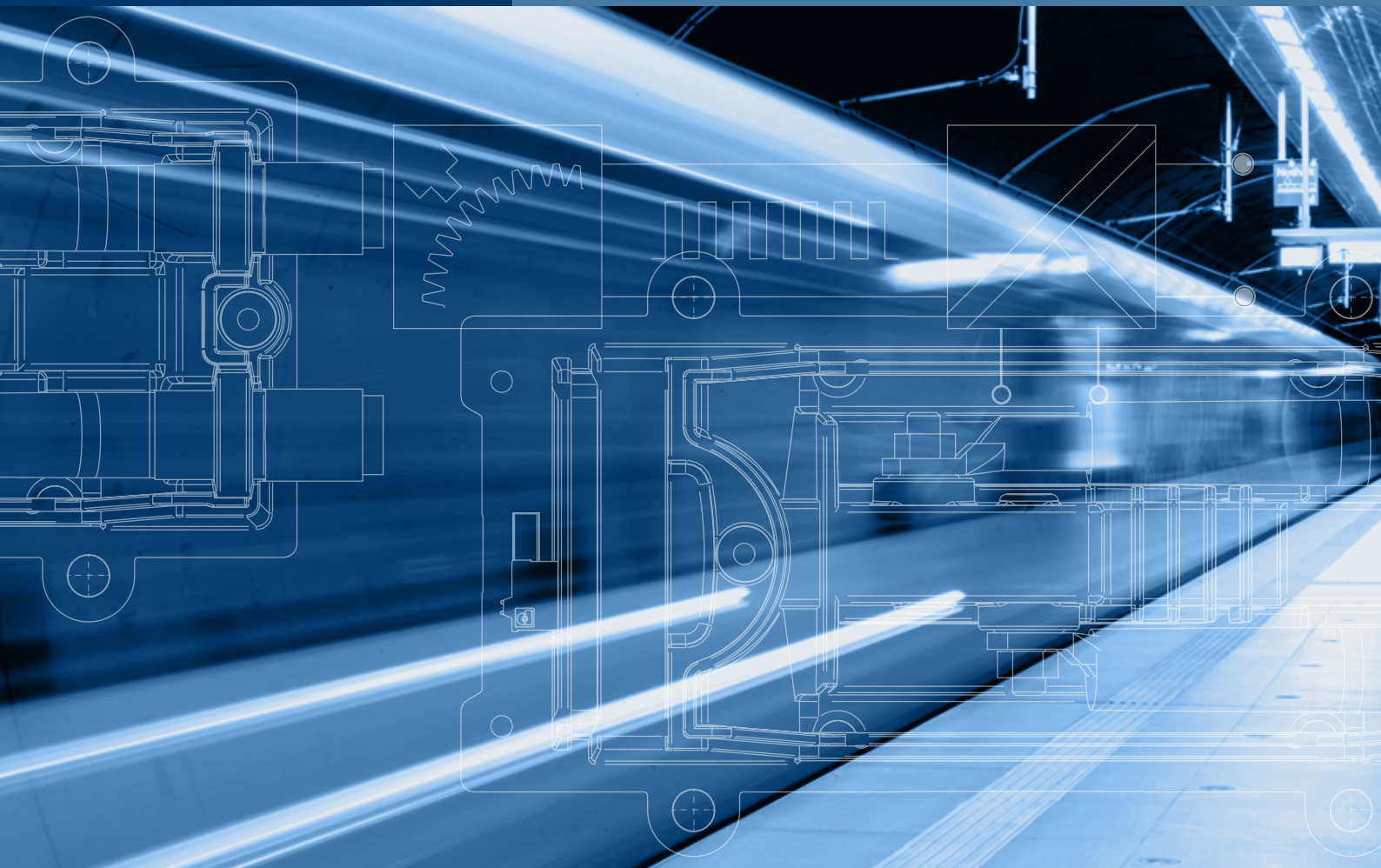
The Art of Measuring. Knick

Reliable
high-voltage and current measurement,
high-precision energy metering,
safe signal isolation

Precision Devices for the Rail Industry



Whether it's infrastructure or rolling stock – we are the high voltage experts. And we know all about current, energy and speed.

For over 40 years, Knick has been a partner of the German and international rail industry. **VariTrans P 40000** high voltage transducers improve traction power supply availability and security.

Used worldwide for many years, these high-precision devices have become an integral part of substations.

The new **ProLine P 50000** and **P 16000** product series are based on this experience. They are especially designed for use on rolling stock – for voltage and current measurement, signal isolation and signal conversion.

Precision and reliability – Made in Germany

Signal conditioners and transmitters from Knick deliver the signals required for downstream processes – interference-free and with high precision at all times.

The precise, robust devices from Knick meet the rail industry's special standards-related and functional requirements.

And to us, precision also means that each individual product property is perfectly tuned to the measurement task. After all, this is the prerequisite for the overall system being able to reliably carry out its function.

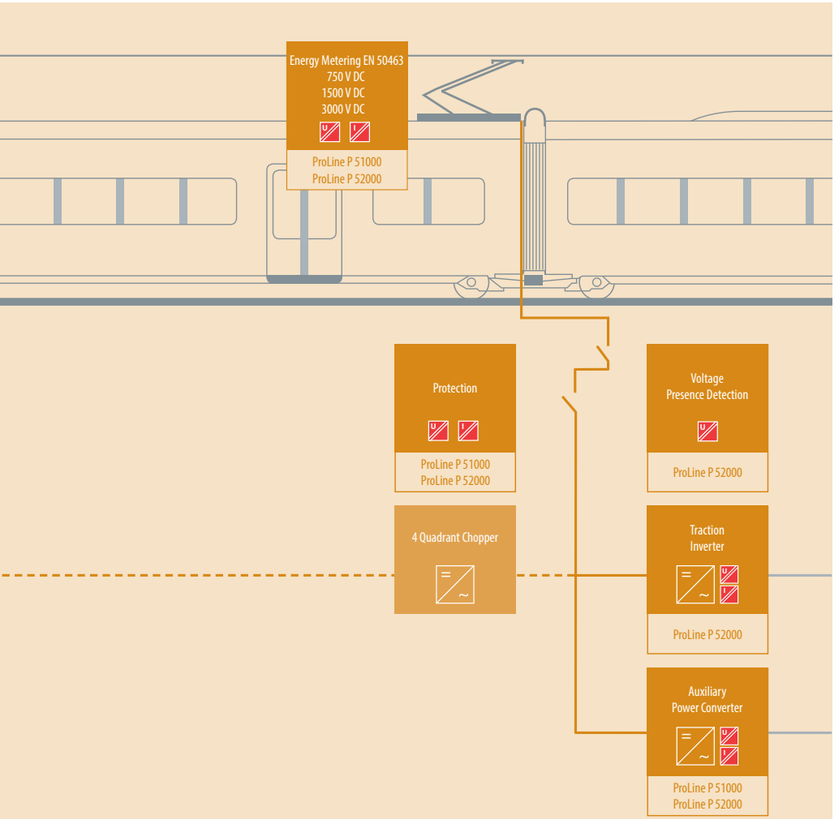
Fulfills these rail-specific standards:

Subject	Standard/Directive
Fire protection (HL 3)	EN 45545-2
Use on rolling stock	EN 50155
Temperature class TX Altitude class AX	EN 50155, EN 50125 -1
Use in traction power substations	EN 50123-1
Reliability	EN 61709 (SN 29500)
Resistance to vibration and mechanical shock (rail applications)	EN 61373
EMC for rail applications and industrial applications	EN 50121-1, EN 50121-3-2, EN 61326-1
Protective measures with regard to electrical hazards	EN 50153
Isolation coordination for rail and industry	EN 50124-1, IEC 62497-1, EN 50123-1, EN 50178, UL 347
Protection against electric shock	EN 61140 or EN 50124-1, IEC 62497, EN 50178

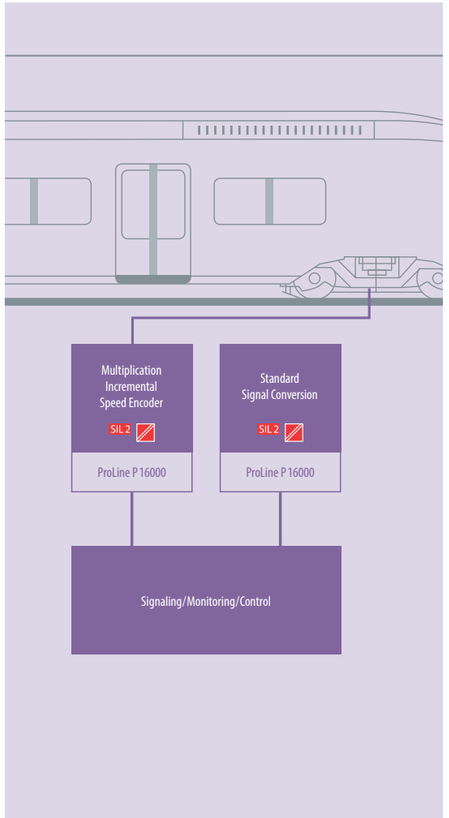
Knick

Fields of Excellence in Rail Technology

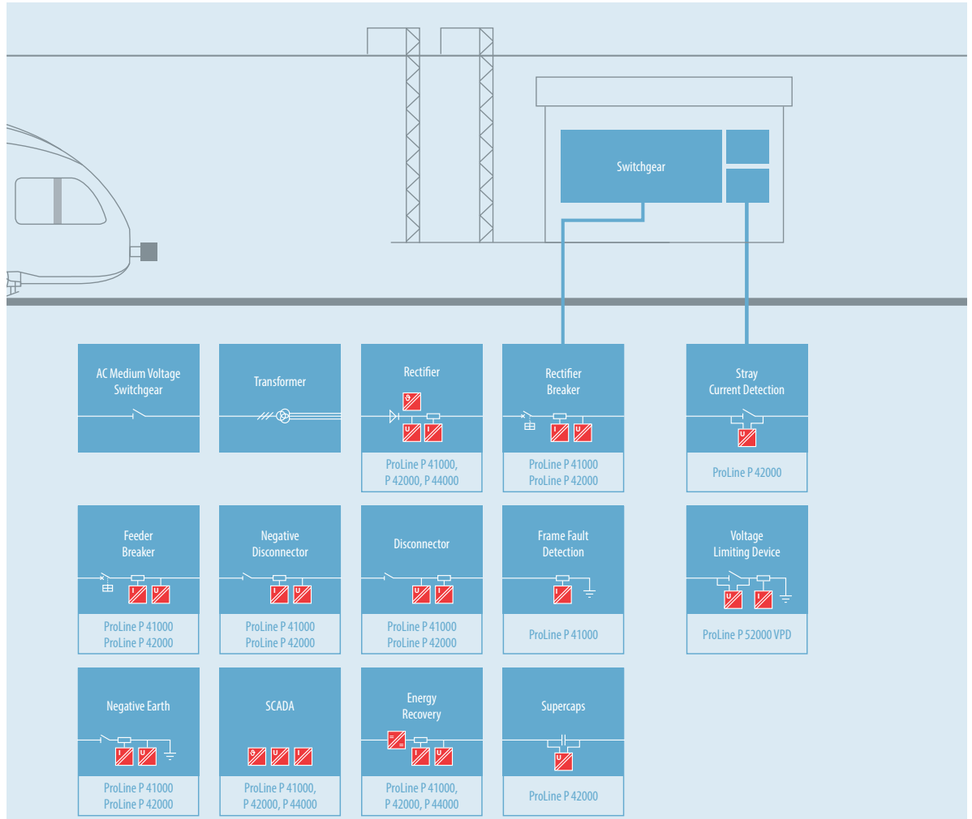
Voltage and Current Measurement Rolling Stock



Signal Isolation Rolling Stock



Voltage and Current Measurement DC Traction Power Supply



- Voltage Measurement
- Current Measurement
- High-Voltage Temperature Measurement
- Galvanic Isolation

Voltage and Current Measurement Rolling Stock

Energy Measurement in Accordance With EN 50463

ProLine P 51000 Current Sensor
ProLine P 52000 Voltage Sensor

- Energy Measurement System

Highly precise and reliable energy detection.

Energy measurement systems for rolling stock must fulfill the EN 50463 standard. But without precise, reliable current and voltage measurement, recorded consumption data is half as useful.

ProLine P 50000 was systematically developed according to EN 50463. In addition, it is immune to all regular interference. The result: consistently high data quality.

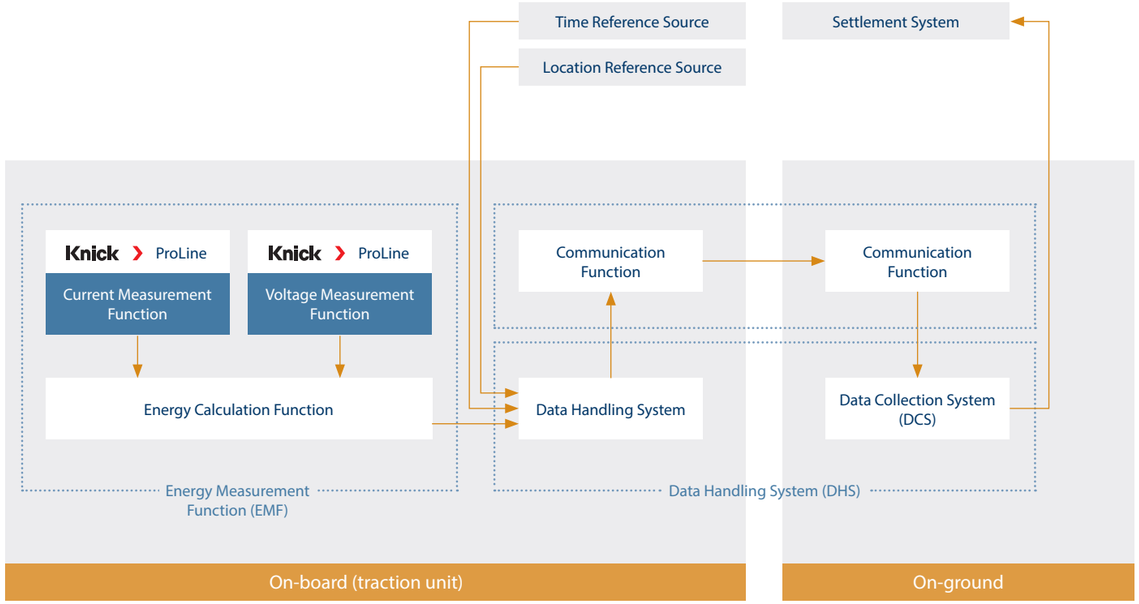
Current measurement with the new **ProLine P 51000** transducer is based on a process that uses a shunt resistor. Even strong electromagnetic fields cannot influence the measurement result. This yields highly precise current detection.

ProLine P 52000 voltage sensors feature a compact design. High-voltage contacts and connections are encapsulated. There is no danger of interaction with other components. When dimensioning, additional space between junction blocks is no longer needed: **ProLine P 52000** functions with complete safety even in very small installation spaces.

Both the current and voltage sensors feed standard signals into the energy measurement system. Special solutions at the inputs of the evaluator unit are not necessary. This means no more dependency on sensor manufacturers.

And Knick sensors continuously monitor themselves. If an error occurs, a message is generated immediately.

Of course **ProLine P 50000** meets the current standards for use on rolling stock – whether it's shock and vibration, EMC, temperature range or fire protection. And galvanic 3-port isolation between input, output, and power supply is also a matter of course.



Functional energy measurement system layout and data flowchart in accordance with EN 50463

High-Voltage and Current Measurement

ProLine P 51000 Current Sensor
ProLine P 52000 Voltage Sensor

- Traction Inverters
- Auxiliary Power Converters
- Protection/ Short Circuit Detection

Rolling Stock and DC Traction Power Supply

ProLine P 52000 VPD High Voltage Presence Detector

- Voltage Limiters
- Circuit Breaker Actuation
- Access Protection
- Track Alive Detection

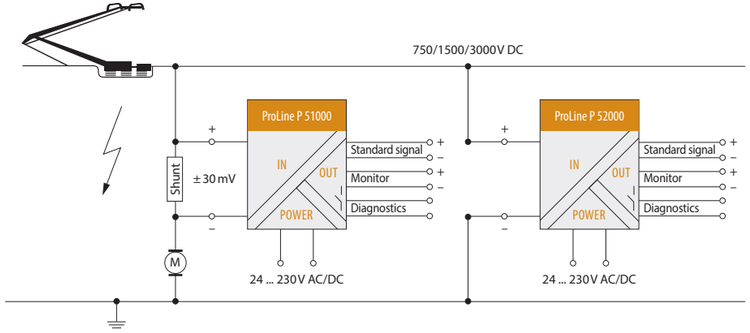
Flexibly measure high voltages and currents.

Components for use in rolling stock must meet the toughest requirements. **ProLine P 50000** sensors are flexible high-voltage transducers in a rugged, compact design. They can be flexibly adapted to the measuring task at hand.

The **P 50000** series is certified in accordance with rail industry standards. Their high availability in mobile applications is ensured by a particularly rugged electrical and mechanical concept designed to deliver safety.

Based on decades of experience in the field of industrial measurement technology and traction power supply, the developers at Knick have specifically designed the new series for use on rail vehicles. This applies to electrical safety (isolation) and fire protection, as well as to EMC and extreme ambient conditions.

The circuit design and device construction of the **ProLine P 50000** series guarantee outstanding output quality. This is characterized by zero stability, linearity, long-term stability, pulse fidelity and immunity to interference. The 3-port isolation between input, output, and power supply prevents measurement errors due to galvanic connections between the output signal and the power supply.



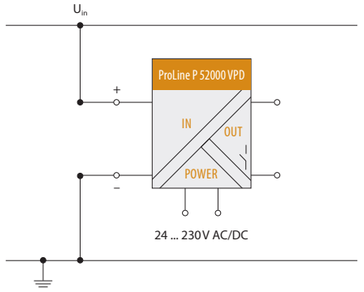
Reliably monitor and report high voltage.

ProLine P 52000 VPD is designed to detect voltages between 50 and 4200 V. The input signal is compared to a threshold value and the resulting binary information is galvanically isolated and transmitted to the output circuit. When the input voltage exceeds the set threshold value, a solid state relay opens, signaling the presence of voltage at the input.

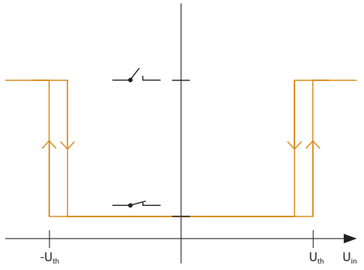
The signal of the solid state relay can control a hardware relay, for example, or be fed into a safety device or controller. The signal levels are based on type 1, EN 61131-2 PLC signal inputs.

Ten default threshold values can be selected using the rotary switches on the front of the device. User-defined values are also provided.

ProLine P 52000 Block Diagram



Solid State Switching Behavior



Signal Isolation
Rolling Stock

Safety Integrity Level
SIL 2
IEC 61508

Knick

ProLine P 16000

- Decoupling of Signals from Safety-Related Circuits
- Doubling of Standard and Impulse Signals

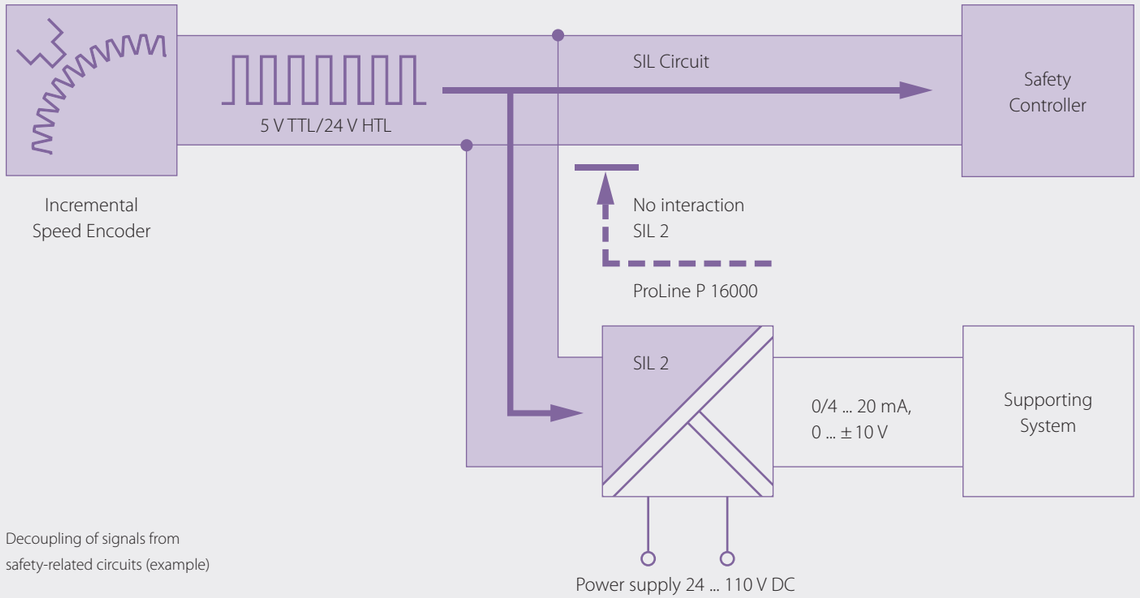
The process can be very easy – and save money and time.

Many systems in and on rolling stock require information on the current speed at any given time. They include brake systems and drive technology, two systems that are key to functional safety. This is why the speed encoders available to the speed signal must function reliably and precisely.

If additional systems need to process speed information, additional speed encoders are usually mounted on the vehicle axles. But space is limited there. And installation and wiring are an investment in money and time.

With the new **P 16000** product line, Knick provides an extremely simple solution. The signal of an existing speed encoder is decoupled and made available for other applications. The process is non-interacting in accordance with safety level SIL 2. The speed encoder signal is neither influenced nor interfered with on its way to the evaluator.

Of course, our **P 16000** sensors meet all of the current standards for use in rolling stock – whether it's shock and vibration, EMC, temperature range or fire protection.



Decoupling of signals from safety-related circuits (example)

Voltage and Current Measurement
DC Traction Power Supply

Play it safe with technology that's been proven 100,000 times over.

Substations for DC power supply have rated powers as high as the upper single-digit MW range. Substations and the grid sections they supply must be effectively safeguarded against short circuits. The protection mechanism must reliably interrupt high levels of current as they occur, limiting the power that flows into the short circuit.

The protective device must measure current and voltage in order to execute algorithms for short-circuit detection. This requires high voltage transducers that measure quickly and precisely while withstanding high loads. They must master voltages between 750 and 3000 V DC, including temporary surges in the case of energy recovery for braking trains, for example.

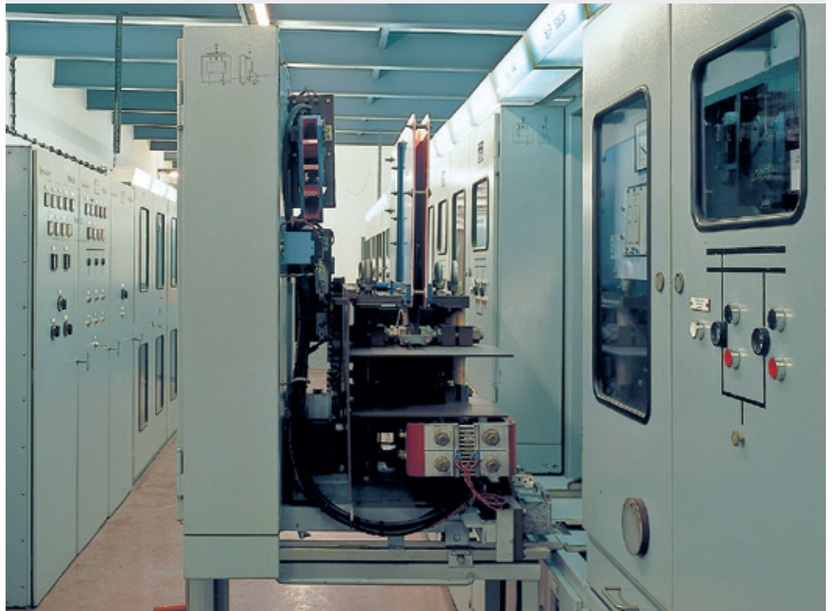
Our high-voltage transducers meet the requirements for measurement and signal processing: **VariTrans P 41000** for current measurement via shunt resistor and **VariTrans P 42000** for direct voltage measurement up to 3000/3600 V DC.

The use of highly insulating solids – including solid casting – ensures reliable galvanic isolation. The circuit design is dimensioned for quick, high-precision signal transmission. The transducers are extremely resistant to external fields and common-mode disturb influence. This avoids false-positive short-circuit detection (traction power supply interruptions without short circuits), which is another significant yet undesirable disruption of operations.

VariTrans P 41000 and **P 42000** have proven their value in DC traction power supply substations worldwide. You'll be playing it safe with the two measuring devices. A comprehensive evaluation of their years of use found that the mean time between two failures (MTBF) is 2,165 years.

VariTrans P 41000 und P 42000

- Protection of DC Substations for Traction Power Systems
- Line Testing, Frame Leakage Protection
- Rectifiers, Circuit Breakers, Surge Arresters
- Energy Recovery, Energy Storage



Knick

Put precision and reliability in your trains.

Knick is a reliable partner that has always been known for achieving high technological levels and constantly striving for innovation. One in four Knick employees works in the Research & Development Department.

Based on its many years of experience in developing interface technology for a spectrum of sectors such as power generation, steel processing, process automation, etc., Knick provides top quality that is mature down to the details and maximum product reliability and service life.

Alongside its headquarters in Berlin, Knick has subsidiaries in the US, Brazil, China, Switzerland and France. Knick is represented by partners in 39 other countries.

The Knick service team would be happy to explain further details on measuring devices for rolling stock and infrastructure.

Phone: +49 30 80191-0

E-mail: info@knick.de

Knick

Interface Technology

Transducers for Railway Applications
High Voltage Transducers
Universal Isolated Signal Conditioners
Isolated Standard Signal Conditioners
Temperature Transmitters

Knick
Elektronische Messgeräte
GmbH & Co. KG

Beuckestrasse 22, 14163 Berlin, Germany
Phone: +49 30 80191-0
Fax: +49 30 80191-200
info@knick.de · www.knick.de

TP-212.000 Bahn EN 1000