The Art of Measuring. Knick

P52000VPD
Voltage Presence Detector

Railway and Industrial Applications Solution
for Monitoring Voltages from 50 to 4200 V

Voltage Presence Detector

ProLine P 52000 VPD

Voltage presence detector for control and safety applications

To protect people and systems, voltage potentials often must be monitored in industrial and railway applications. Continuous monitoring of the absence of voltage in potentially hazardous areas is essential for the safety of people.

To ensure safe system operation, impermissibly high voltage levels must be avoided. Switching operations must not lead to damage in the event of unintentionally large potential differences.

The P52000VPD voltage presence detector, with its continuous monitoring of individually adjustable threshold values and reliable switching outputs, is the ideal solution for these applications.

For applications with up to 4200 V input voltage.

5-year warranty

Possible Use Cases

The P52000VPD voltage presence detector is engineered for the following applications, among others:

Monitoring of the absence of voltage for personal protection
Performance of maintenance work is sometimes in the vicinity of high-voltage systems, such as seen with DC switchgear or overhead lines and 3rd rails. It must be ensured that these systems are voltage-free. P52000VPD monitors and signals the voltage status.

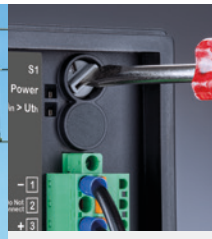
Warning of high voltages in electrical systems
When working on rail vehicles or other electrical equipment, it is sometimes often necessary to keep the DC supply voltage switched on. To warn personnel of the voltage, the P52000VPD can monitor and signal it.

Voltage monitoring for access control to test cells
Access barriers to test cells must not open as long as device under test (DUT) in the cell is live. P52000VPD can monitor DC or low-frequency AC voltages, signal them, and only enable opening when the DUT is de-energized.

Monitoring of the potential difference to limit dangerous voltages
Rail transit platforms can have a significant difference in potential compared to the train on the platform. To protect passengers, the P52000VPD can detect impermissible voltages and cause the platform earth to be short-circuited to the return conductor.

Voltage detection for controlling Motorized Disconnect Switches (MODs)
To interconnect sections of the electrical DC railway supply along the route, it must be ensured that the sections have the same voltage potential. P52000VPD can monitor this and enable the MOD.

Voltage detection for the operation of rolling stock
The main switch on electric rail vehicles may only be closed if the DC contact wire voltage is within the tolerable voltage range. P52000VPD can monitor this and signal it to the train control system.



10 default threshold values can be selected using the rotary switch on the front of the device.

Quick, safe wiring of output and power supply using push-in spring-cage terminals

Function of P52000 VPD

ProLine P 52000 VPD detects the presence of voltage. 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.

The threshold value applies regardless of the sign of the input voltage's absolute value. In other words, the solid state relay will be triggered as soon as the positive threshold value is exceeded or the input voltage is below the negative threshold.

10 default threshold values can be selected using the rotary switch on the front of the device. Units with user-defined values are also available. A switch position can optionally be provided as a test position to trip the solid state relay, e.g., to help simplify installation.

Increased safety due to separate cover for the high-voltage terminals

Why Knick

The P52000VPD complies with all relevant standards and has obtained all necessary railway and industrial certifications, in particular for use on rolling stock. All certifications are verified and confirmed by independent accredited test laboratories. The product can be used by the user in the strictly regulated railway sector without further testing.

The P52000VPD has galvanic isolation between input, output, and power supply (3-port isolation). Thanks to its high isolation and rated voltage, it is capable of switching thresholds up to 4200 V AC/DC.

The unique, sturdy product design ensures reliable operation unaffected by EMC, common mode, and temperature interferences, or harsh conditions such as vibration, high temperature, and humidity.

The integrated broad-range power supply, selectable factory-calibrated switching thresholds, and optional protective covers make installation of the voltage presence detector an easy and safe affair.

Transparent protective cover for output terminals and auxiliary power

Voltage Presence Detector

ProLine P 52000 VPD

Product Line

Basic/reinforced insulation 4800/3600 V, Input ranges
(±)50, 100, 200, 300, 400, 500, 600, 750, 900 VDC, Test R

P52	1	0	0	K	1	1-	MS	0006	R	/	0	1

9 switching thresholds + 1 testing position (solid state relay closed), Power supply 24 ... 230 V AC/DC, with protective covers

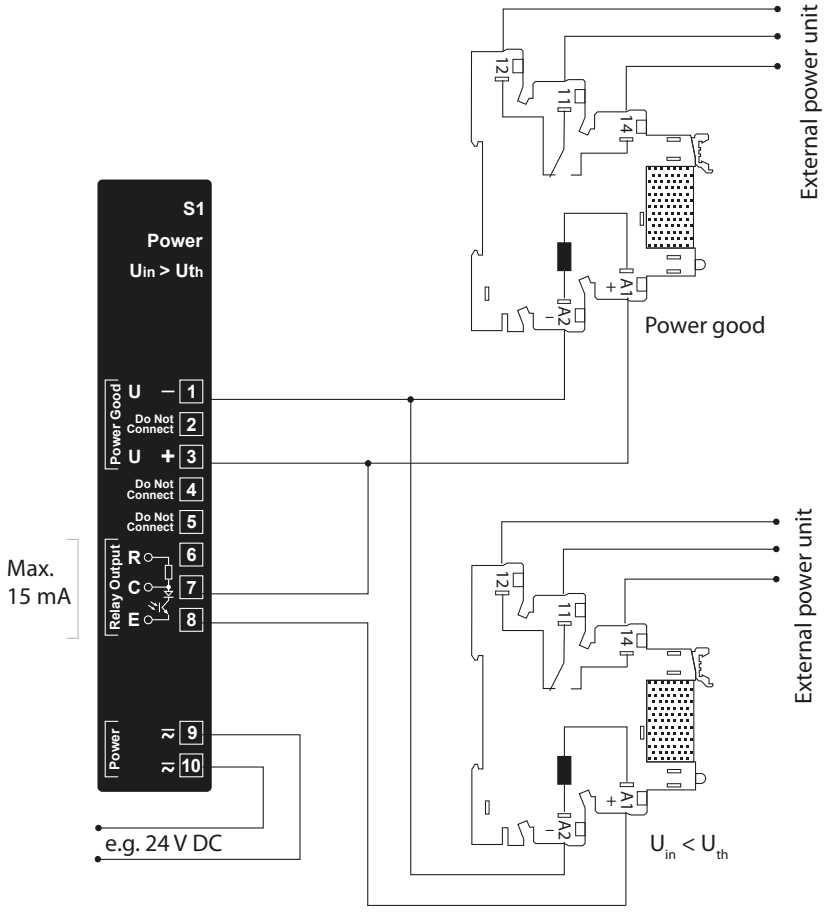
Input 50 ... 4200 V (voltage measurement)	P52		0	0	K		1-				/	0	
Basic/reinforced insulation 2000/1000 V		0											
Basic/reinforced insulation 4800/3600 V		1											
Without protective covers for input/output terminals						0							
With protective covers for input/output terminals						1							
Power supply output terminals: push-in spring cage terminals							1-						
Multi-range devices: up to 10 switching thresholds*)								M	nnnnn				
Multi-range devices: up to 9 switching thresholds + 1 testing position*)								MS	nnnnn				
Fixed-range model: 1 switching threshold with binary solid state relay output xxxxV [V]								B	xxxxV				
Product type voltage presence detector										R			
With diagnostics function, without separate diagnostics contact												0	
Power supply 24 V AC/DC													0
Power supply 24 ... 230 V AC/DC													1

*) ProLine P 52000: (±) 50 ... 1800 V, with or without testing position (solid state relay closed)
ProLine P 52100: (±) 50 ... 4200 V, with or without testing position (solid state relay closed)

ProLine P50000 Accessories (already included in product code, for re-orders only)	Order No.
P50000 protective covers with screw fixing, one cover each for input (black) and output/power supply (transparent)	ZU 1030
P50000 cable support sleeves, 2 pieces	ZU 1031

Connection Examples

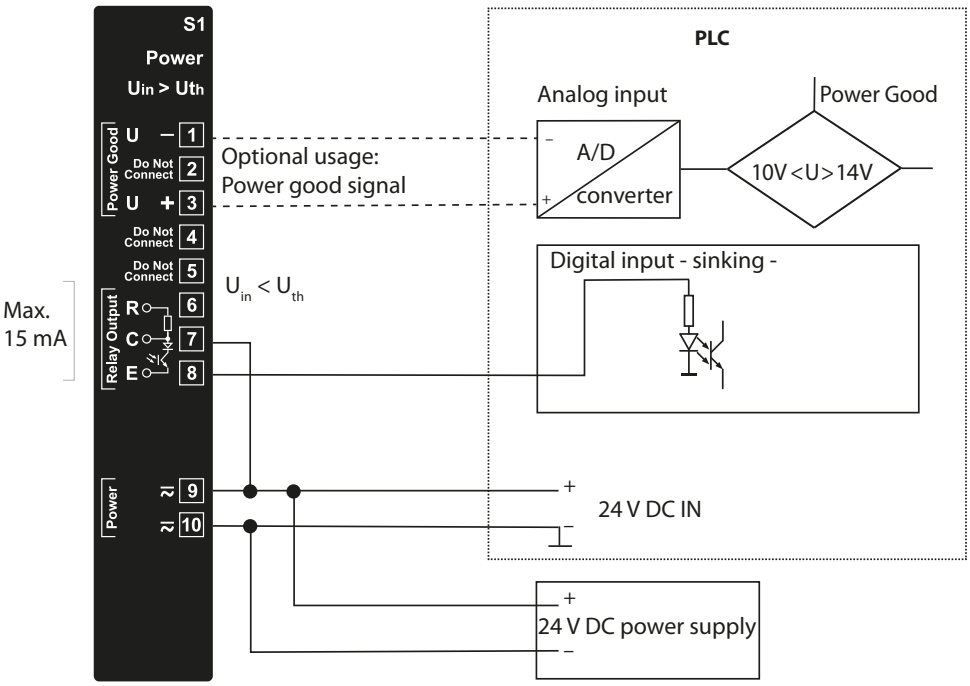
Use of External Relays — Relays 12 V, 15 mA e.g. Finder FIN 38.51 12 V (no additional power supply required)



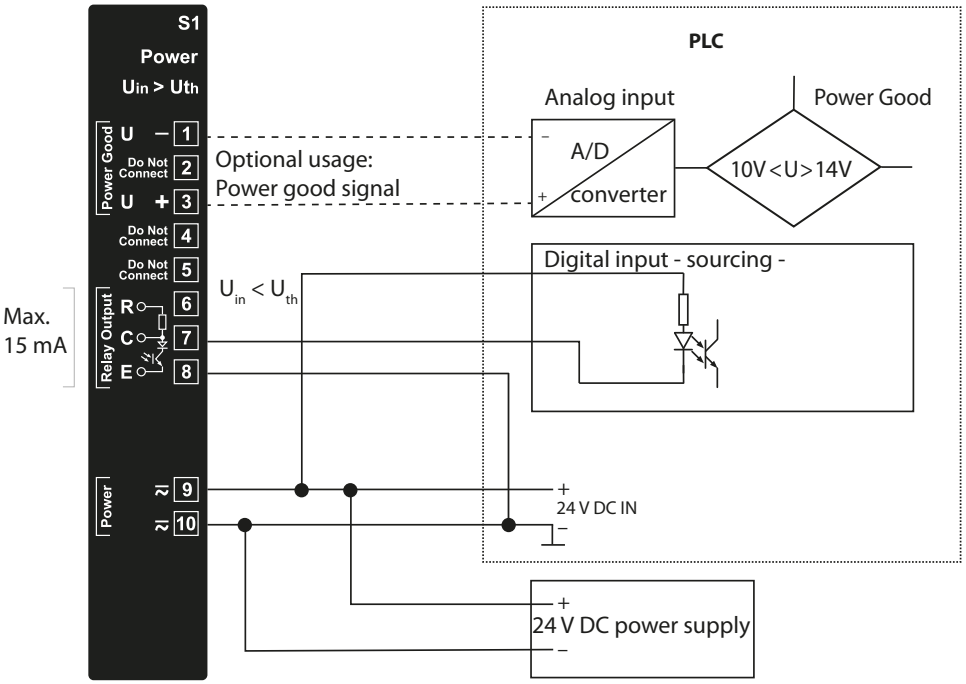
Connection Examples

Signaling Voltage Presence to a PLC

PLC digital input (“sinking input”)



PLC digital input (“sourcing input”)



Specifications

ProLine P52*00 Input	Model	Switching threshold range (DC)[b]	Overload capacity permanent	Overload capacity short-time (1 s)
Switching thresholds[a]	P52000	50 … 1800 V	± 2000 V	± 3400 V
	P52100	50 V … 4200 V	± 4800 V	± 7100 V
Input resistance	10 MΩ	50 … 4200 V		
Input capacitance	< 10 pF			

a) The switching thresholds refer to the absolute value of the input signal. In other words, the solid state relay (output) opens when the positive threshold is exceeded or when the value drops below the negative threshold. $|U_{th}| \leq 50 ... 4200$ V

b) AC upon request

Tolerances

Max. measurement error (switching thresholds)	≤ 5 %
Hysteresis	3.5%

Switching Function (Output)

Signals that input signal exceeds switching threshold (absolute value of U_{Th})	Floating solid state switch (sourcing output, sinking output) based on EN 61131-2 (PLC), compatible with type 1 digital PLC inputs (among others), connection to sourcing or sinking inputs, connection to high-resistance inputs		
	Switching voltage	24 V DC (5 ... 30 V DC)	Contact opens when switching threshold is exceeded, in case of error and in testing position of the rotary switch. The output is protected against inverse polarity and short circuits up to 30 V DC. The maximum permissible voltage between the power good output and the output is 50 V. Unused terminals must be floating.
	Switching current	Max. 15 mA	Short-circuit limiting I < 60 mA
	Voltage drop	Max. 3 V	
	Minimum input trigger time	2 ms	
	Switching delay	2 ms	
	Minimum hold time	300 ms	
Power good signal	Operating readiness of device (connection of power supply, monitoring of internal power supply unit) is signaled. "Power good" state: Nominal voltage 12 V DC (10 ... 14 V DC), max. 30 mA For information on using the power good signal, see connection examples.		

Specifications

Power Supply

Broad-range power supply	Supply voltage range	24 ... 230 V AC/DC
	Max. permissible supply voltage	253 V AC/DC
	Lowest limit of AC supply	19.2 V AC
	Lowest limit of DC supply	16.8 V DC acc. to EN 50155
24 V power supply	Supply voltage range	24 V ± 30 % (DC)/± 20 % (AC)
Broad-range power supply / 24 V power supply	Lowest limit of DC supply — short-time	14.4 V DC/100 ms acc. to EN 50155, RIA 12 (brownout)
	Short interruptions	Max. 10 ms
	Class S2 acc. to EN 50155, with 40 mA output: monitor output bypassed	
	AC frequency	48 … 440 Hz
	Max. power consumption	2.5 W / 6 VA

ProLine P52100 Isolation	Across Input and Output/Power Supply	
Test voltage	18 kV AC	Type test
	16 kV AC	100 % routine test
Partial discharge extinction voltage	> 8 kV AC	10 pC
Rated isolation voltage EN 50124-1, IEC 62497-1, EN 50123-1, EN 50178	Basic insulation Max. 4800 V AC/DC	Overvoltage category OV3, pollution degree PD3 Rated impulse voltage: 33 kV
UL 347 (P 52100)	4800 V AC/DC	Rated impulse voltage: 33 kV
Rated isolation voltage EN 50124-1, IEC 62497, EN 50178	Protection against electric shock by reinforced insulation Max. 3600 V AC/DC	Overvoltage category OV3, pollution degree PD3, for EN 50178: PD2 Rated impulse voltage: 33 kV
Contact protection (protection against electric shock)	Max. 3600 V AC/DC	With ZU 1030 protective covers, ZU 1031 cable support sleeves acc. to EN 50153 range I to III
Clearances	Min. 60 mm	
Creepage distances	Min. 90 mm	CTI 600, insulant group I acc. to EN 50123-1, EN 50124-1

ProLine P 52000 VPD

Specifications

ProLine P52000 Isolation	Across Input and Output/Power Supply	
Test voltage	12 kV AC	Type test
	10 kV AC	100 % routine test
Partial discharge extinction voltage	> 6 kV AC	10 pC
Rated isolation voltage	Basic insulation	Overvoltage category OV3, pollution degree PD3
EN 50124-1, IEC 62497-1, EN 50123-1, EN 50178, UL 347	Max. 2000 V AC/DC	Rated impulse voltage: 20 kV
Rated isolation voltage	Protection against electric shock by reinforced insulation	Overvoltage category OV3, pollution degree PD3, for EN 50178: PD2
EN 50124-1, IEC 62497, EN 50178	Max. 1000 V AC/DC	Rated impulse voltage: 20 kV
Contact protection (protection against electric shock)	Max. 1000 V AC/DC	With ZU 1030 protective covers, ZU 1031 cable support sleeves acc. to EN 50153 range I to III
Clearances	Min. 60 mm	
Creepage distances	Min. 90 mm	CTI 600, insulant group I acc. to EN 50123-1, EN 50124-1

Isolation	Across Output and Power Supply	
Test voltage	4 kV	100 % routine test / type test
Rated isolation voltage	Protection against electric shock by reinforced insulation	Overvoltage category OV3, pollution degree PD3 for EN 50178: PD2
EN 50124-1, IEC 62497, EN 50178, EN 61140/EN 61010-1, UL347	Max. 300 V AC/DC	Rated impulse voltage: 6.4 kV

Ambient Conditions		
Temperature class	TX	EN 50125-1, EN 50155
Operating temperature	–40 ... 85 °C	
Storage temperature	–50 ... 90 °C	
Relative humidity	20 ... 95 %	Limit values for continuous operation
	75 %	Annual average
	95 ... 100 %	Occasional
Altitude classes	A1, AX	EN 50125, reduced isolation level for heights of 2000 to 4000 m AMSL
Air pressure during operation	600 ... 1060 hPa	

Specifications

Standards and Approvals

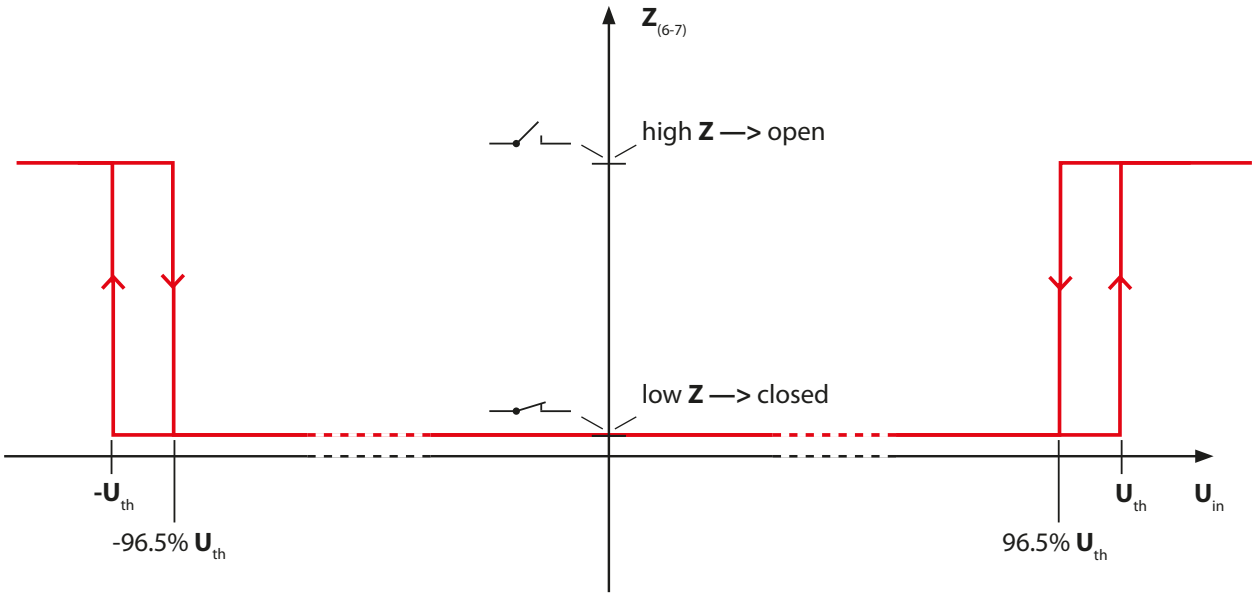
Mechanical load	EN 61373 (shock and vibration)	Category 1, Class B
	Certified by an independent test laboratory	
EMC	EN 50121-1, EN 50121-3-2 (railway applications)	
	EN 61326-1 (product standard)	
	AC power supply AC and DC power supply	Emitted interference acc. to Class B Emitted interference acc. to Class A
	Certified by an independent test laboratory	
Fire protection	EN 45545-2 (NF F 160-101/-102)	
	Outdoor applications up to HL 3	
	Certified by an independent test laboratory	
UL	UL 347 listed in E356768	
RoHS conformity	According to directive 2011/65/EU	

Further Data

MTBF	155 / 131 years	40 °C/45 °C average ambient temperature, continuous operation, stationary operation in well-kept rooms, no ventilation, EN 61709 (SN 29500)
	Deviating MTBF values for operation on rolling stock	
Weight with/without covers	Approx. 780 g/650 g	
Input protection	High voltage terminals under protective cover, with rubber sleeves over high voltage cables	IP54 acc. to EN 60529
	Without protective covers	IP00
Output protection	Output terminals under protective cover	IP51 acc. to EN 60529
	Without protective covers	IP20
Encapsulation	Electronics completely encapsulated by potting with a silicone-free polyurethane casting resin	
Mounting	on a metallically conductive or non-conductive surface using 4 screws (see dimension drawings for hole pattern)	
	on a 35 mm DIN rail acc. to EN 60715	
Maintenance	The devices are maintenance-free.	
Disposal	at waste management facility in accordance with local regulations	

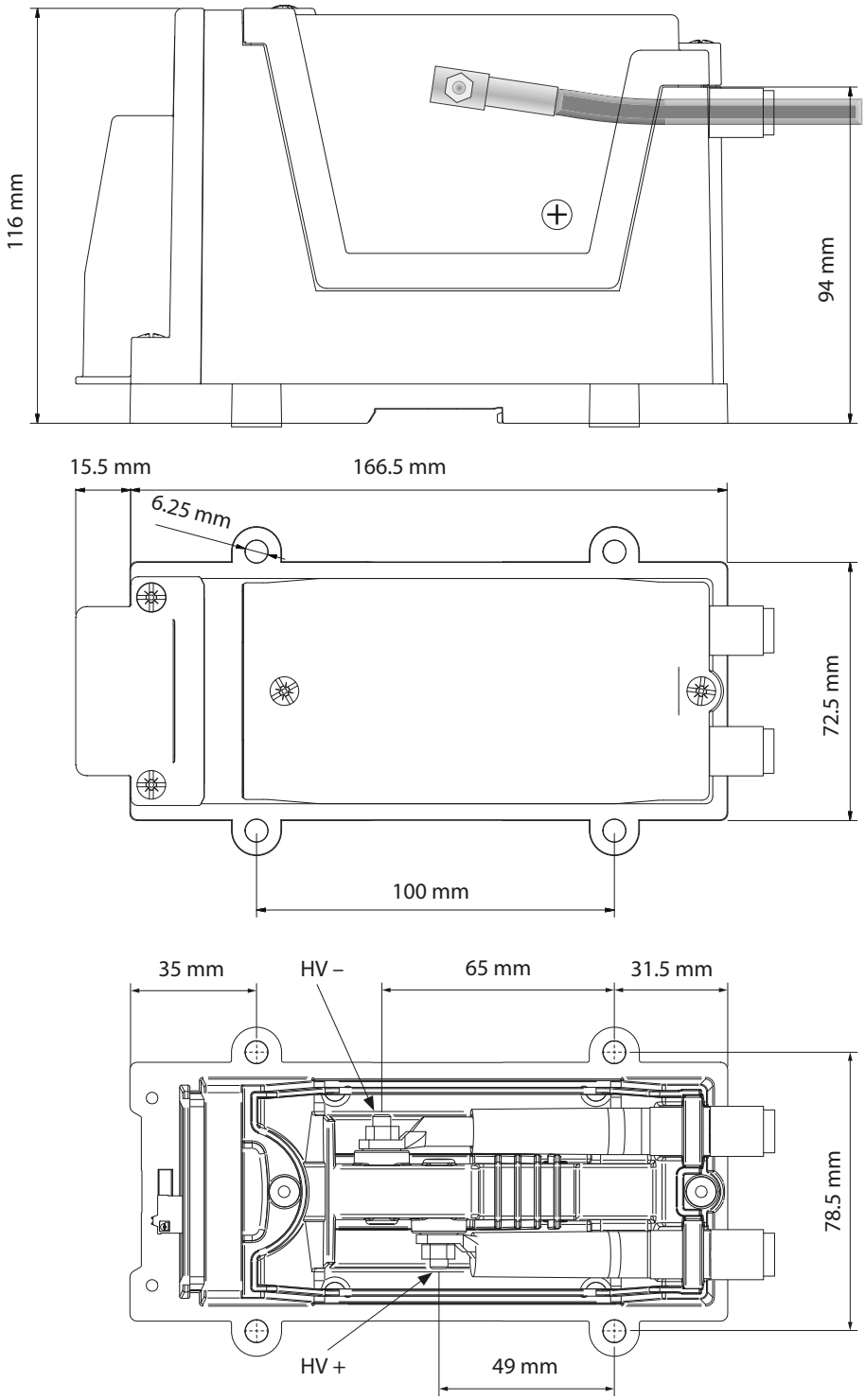
Switching Behavior of Relay Output

Output Status of Solid State Relay



U_{in}	$U_{in} > U_{th}$ LED	Power LED	Relay Output	Power Good
$U_{in} < U_{th}$	off	on	closed	12 V
U_{in} undefined, i.e., internal error detected or supply voltage off	off	off	**open**	**0 V**
$U_{in} > U_{th}$	on	on	**open**	**12 V**

Dimension Drawing



Knick

Interface Technology

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

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Knick
The Art of Measuring

Knick has been among the leading manufacturers of electronic measurement devices for more than 70 years. Signal conditioners from the Berlin company are used successfully throughout the world, e.g., in industrial applications, high voltage motors, substations and other areas of railway infrastructure.

The new ProLine P 50000 high voltage transducers have been specially developed for use in the rolling stock sector. In compliance with all currently applicable railway standards, they ensure safety with their innovative functions in modern electric or diesel-electric locomotives and multiple units.

TP-212.420 P52000 VPD EN 0419