Knick

User Manual

ProLine P16000

Pulse Frequency Conditioner

Read before installation.
Keep for future use.

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1 Safety

Symbols and Markings on the Product

Special conditions and the product's possible danger points. Read the user manual, observe the specifications, and follow the instructions in the safety guide.

Intended Use

The pulse frequency conditioner measures and transmits the pulse frequency of speed sensors or rotary encoders without disturbing the original signal circuit, and converts it into electrically isolated analog standard signals. Converting the pulse frequency into a standard signal eliminates the need for pulse counting inputs at the control unit. The standard signals 0 … 10 V, 0 … 20 mA, or 4 … 20 mA linearly represent the corresponding input frequency ranges.

This product is suitable for use in industrial applications. It is also suitable for use on rolling stock, albeit with the following limitation: due to the possibility of transient or permanent overvoltages, the product must not be connected to rotary encoders mounted on wheel axles of electric vehicles in which power is returned via the wheel-rail contact. The product may be used if such voltage overloads do not occur. This is the case with speed sensors on transmission shafts and motor axles, and with wheel sensors on vehicles that use the following power systems:

- Diesel-electric
- Diesel-hydraulic
- Stored energy (battery, fuel cell)
- 2-pole (e.g. two separate conductor rails)

The defined rated operating conditions must be observed when using this product. Using the product improperly or for any purpose other than its intended purpose is not permitted and may result in injury to persons or damage to objects or the environment. → *Specifications*

Protection Against Electric Shock

The voltages applied to the device must not exceed the permissible values. The licensed electrician must ensure that protective measures are evaluated and implemented in accordance with the local and national codes and regulations that apply to the area in which the product is being used.

ESD - Electrostatic Discharge

Appropriate measures must be taken to protect the product against direct electrostatic discharge (ESD).

Installation

The product may only be installed by a licensed electrician. The product must be installed in an enclosure that can only be opened with the help of tools. National regulations and temperature ratings of cable materials must be observed during the selection and installation of cables and lines. Observe the following instructions:

- Install the product on a 35 mm DIN rail in an enclosure (without using a DIN rail bus connector).
- Use shielded signal and control lines.
- Use an appropriate grounding and connection concept.
- Avoid strong interference sources such as solenoid coils, frequency converters, etc., or adequate shielding/safe clearance.

Cable properties and preparation
→ *Handling of Push-in Terminals, Cable Preparation*

Signaling readiness for operation → *Specifications*

Knick
Elektronische Messgeräte
GmbH & Co. KG

Knick

Headquarters
Beuckestraße 22 • 14163 Berlin
Germany
Phone: +49 30 80191-0
Fax: +49 30 80191-200
info@knick.de
www.knick.de

Local Contacts
www.knick-international.com

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This document was published on March 01, 2021.
The latest documents are available for download on our website under the corresponding product description.

TA-P16000-KNEN03
098488

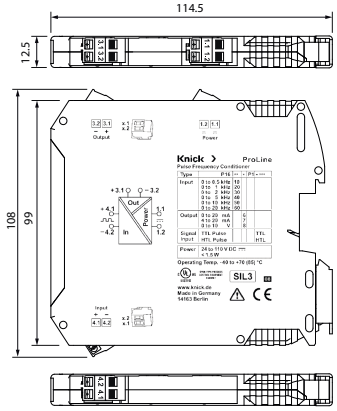
2 Product

2.1 Product Code (Excerpt)

P16x0x P1-xxx Pulse Frequency Conditioner

Input	Output	Order number for input pulse	
		TTL product line	HTL product line
0 … 0.5 kHz	0 … 20 mA	P16106P1-TTL	P16106P1-HTL
0 … 1 kHz		P16206P1-TTL	P16206P1-HTL
0 … 2 kHz		P16306P1-TTL	P16306P1-HTL
0 … 5 kHz		P16406P1-TTL	P16406P1-HTL
0 … 10 kHz		P16506P1-TTL	P16506P1-HTL
0 … 20 kHz		P16606P1-TTL	P16606P1-HTL
0 … 0.5 kHz	4 … 20 mA	P16107P1-TTL	P16107P1-HTL
0 … 1 kHz		P16207P1-TTL	P16207P1-HTL
0 … 2 kHz		P16307P1-TTL	P16307P1-HTL
0 … 5 kHz		P16407P1-TTL	P16407P1-HTL
0 … 10 kHz		P16507P1-TTL	P16507P1-HTL
0 … 20 kHz		P16607P1-TTL	P16607P1-HTL
0 … 0.5 kHz	0 … 10 V	P16108P1-TTL	P16108P1-HTL
0 … 1 kHz		P16208P1-TTL	P16208P1-HTL
0 … 2 kHz		P16308P1-TTL	P16308P1-HTL
0 … 5 kHz		P16408P1-TTL	P16408P1-HTL
0 … 10 kHz		P16508P1-TTL	P16508P1-HTL
0 … 20 kHz		P16608P1-TTL	P16608P1-HTL

2.2 Dimension Drawing, Labeling Position of Push-in Terminals

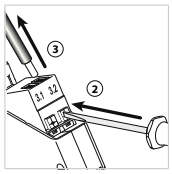


Note: All dimensions are given in millimeters.

3 Handling of Push-in Terminals, Cable Preparation

Connect cable

Disconnect cable

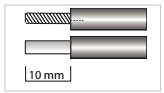


Connect cable:
01. Push the cable in such that it cannot be pulled out **(1)**.

Disconnect cable:
01. Press and hold **(2)**.
02. Pull out the cable **(3)**.

Conductor cross-section:
0.25 … 2.5 mm² / AWG 23 … 14

Single cables, solid or flexible with ferrule, *with or without collar*



Notes:
- Adhere to the stripping length or length of the ferrule *Length without collar*: 10 mm.
- Check that the cable is securely attached. If the jacket or the collar of the cable has an outer diameter > 4 mm, pay particular attention to ensuring that the cable is securely attached.
- Select a fuse matching the cable cross-section.
- Ambient temperatures > 60 °C require cables rated 75 °C or higher according to NEC.

4 Terminal Assignments

Terminal	P16*0* P1-***	
	Pulse Frequency Conditioner	
1.1	Power supply 24 … 110 V DC	
1.2	Power supply 24 … 110 V DC	
3.1	Output V/I	+
3.2	Output V/I	-
4.1	Input V	+
4.2	Input V	-

5 Decommissioning

The product must be removed from operation and secured against reconnection if the following applies:

- The product is visibly damaged
- Failure to perform the intended function
- Prolonged storage at temperatures outside the specified temperature range

The product may only be recommissioned following a professional routine test conducted by the manufacturer.

Disposal

The local codes and regulations must be observed when disposing of the product.

6 Specifications

Pulse Frequency Conditioner Input Data	
Pulse input	0 … 0.5 kHz/0 … 20 kHz
Level	TTL product line: Low < 1.5 V, High > 3.5 V, max. 30 V (5V CMOS input)
	HTL product line: Low < 3 V, High > 8 V, max. 30 V
Input resistance	60 kΩ … 100 kΩ
Input capacitance	< 100 pF
Overload capacity	Max. 110 V
Current Output Data	
Max. output range	0 … 20 mA or 4 … 20 mA
Max. output current in the case of input overdrive	< 40 mA
Load	≤ 11.55 V (550 Ω at 21 mA)
Overload capacity	Max. 30 V DC external voltage
Residual ripple	< 10 mV_{rms} at 500 Ω load
Voltage Output	
Max. output range	0 … 10 V
Max. output voltage in the case of input overdrive	< 16 V
Load	≤ 10 mA (1 kΩ at 10 V)
Overload capacity	Max. 30 V DC external voltage
Residual ripple	< 10 mV_{rms}
Short-circuit-proof	Yes

Transmission Behavior	
Measurement error	< 0.2 % full scale (at drive level < 2 %: additional error + 0.2 %, for model 1610*P1-***: + 0.4 %)
Lin. transmission range	0 … 1.05 x full scale
Temperature coefficient	≤ 50 ppm/K full scale, T_{ref} = 23 °C
Response time T_{90}	Approx. 800 ms up to 5 kHz
	Approx 35 ms for 10 … 20 kHz
Power Supply	
Broad-range power supply	24 … 110 V DC - 30 %, + 40 % P < 1.5 W
Overvoltage limit (short duration)	110 … 154 V DC/≤ 100 ms crit. A
	125 … 154 V DC/≤ 1 s crit. B
Undervoltage limit (short duration)	14.4 V/100 ms acc. to EN 50155, RIA 12 Brownout
Temporary supply dips	Interruption class S2 (max. 10 ms)
Change-over class	C1
Display	Green LED display for power supply
	LED located at center of front face
EMC	
Immunity to interference	Industrial applications EN 61326
	Railway applications EN 50121-1; EN 50121-3-2
Emitted interference	Industrial applications EN 61326
	Railway applications EN 50121-1; EN 50121-3-2

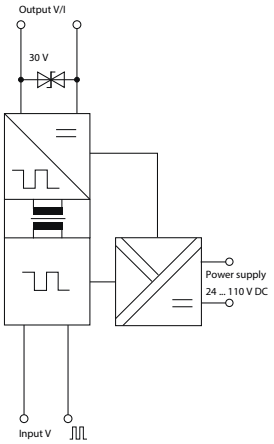
Isolation	
Test voltages	
Type test	3 kV AC, 50 Hz, 1 min
	acc. to IEC/EN/UL 61010-1, Tab. 4
Routine test [1]	1,9 kV AC, 50 Hz, 10 s
Working voltages	
Protection against electric shock	Protective separation according to EN 61140 with reinforced insulation according to EN 50124-1, IEC 62497-1, IEC/EN 61010-1 up to 300 V AC/DC, overvoltage category II and pollution degree 2 (At altitudes > 2000 m, the permissible working voltages are reduced to 150 V AC/DC.)
Certifications	
Functional safety	SIL 3 (according to IEC/EN 61508 or Category 1, PLc according to ISO/EN 13849-1 for absence of interaction on signal circuits connected to the input, certified by an independent test laboratory)
UL	UL 61010-1 listed in E340287
Fire protection	Outdoor applications up to HL 3, certified according to EN 45545-2 by an independent test laboratory; the product does not contain any flammable materials in accordance with the standard.
	NF F 160-101/-102
Railway suitability	Type test according to EN 50155, certified by an independent test laboratory

Ambient Conditions	
Usage	Use in enclosed areas: PD2, weather-protected. Excluded: water or wind-driven precipitation (rain, snow, hail etc.)
Ambient temperature during operation	-40 … +70 °C Short-time +85 °C / 10 min
Operating temperature class	OT4 according to EN 50155
Switch-on extended operating temperature class	ST1 according to EN 50155
Ambient temperature during transport and storage	-50 … +85 °C
Altitude	Max. 4000 m (AMSL) At altitudes > 2000 m, the permissible working voltages are reduced to 150 V AC/DC.
Class of altitude range	AX according to EN 50125-1
Relative humidity	5 … 95 %
Shock and vibration	Category 1, class B according to IEC/EN 61373
Further Data	
MTBF mean time between failures	139.7 years (according to IEC/EN 61709/SN 29500, average ambient temperature 45 °C, continuous operation, stationary operation in well-kept rooms, no ventilation)
Housing	Type: modular housing with push-in terminals
	Dimensions: 99 x 114.5 x 12.5 mm (L x H x W)
Protection	IP20
Mounting	Snap-on mounting for 35 mm DIN rail (without DIN rail bus connector) acc. to IEC/EN 60715
Connection	Conductor cross-section: max. 2.5 mm^2, AWG 23 ... 14
Weight	Approx. 90 g

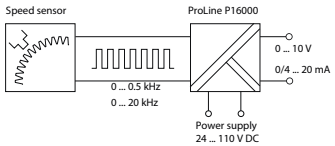
1) Routine test documented by test report 2.2 according to EN 10204.

7 Appendix

7.1 Block Diagram

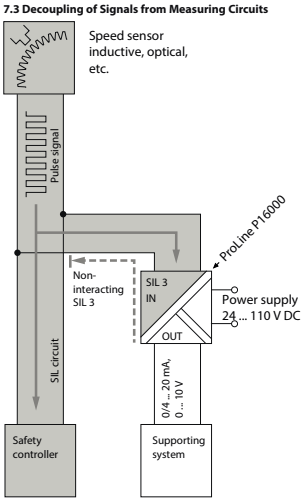


7.2 Wiring Example



⚠WARNING! Fast transients! Fast transients may result in damage to the insulation of the pulse frequency conditioner.
Read and comply with the notes in the "Intended Use" section.

7.3 Decoupling of Signals from Measuring Circuits



IN: Signal input, OUT: Signal output

7.4 SIL Safety Manual (Excerpt)

Safety Function

The safety function for safety-related applications according to IEC/EN 61508 up to SIL3 or according to ISO/EN 13849-1 up to Category 1 PLc consists of the absence of interaction in accordance with the following definition:
The input is non-interacting.

Absence of interaction during normal operation:

- Input resistance > 60 kΩ
- Interaction < 3 µA
- Electrically isolated, up to 300 V reinforced insulation

Absence of interaction during fault conditions:

- Input resistance > 60 kΩ
- Interaction < 30 µA
- Electrically isolated, up to 300 V reinforced insulation

Note: After 8 to 12 years,
the failure rates of the electronic components will increase according to IEC/EN 61508-2, 7.4.9.5, note 3.

Functional Safety

Notes on the product's scope, the determined safety characteristics, and the proof test can be found in the SIL Safety Manual.