

- Resolution 0.36 mm
- Operating range 30 – 250 mm
- High-accuracy temperature compensation
- Foreground and background interference suppression
- Switched output pnp
- Short-circuit proof and reverse-polarity protection
- High switching frequency
- 4 sensor models
- Column sensor
- Modular system
- Compact design M18*1
- Stainless steel housing

General electrical and mechanical Data:	
Operating range	30 - 250 mm
Blind zone (no analyzing signal)	0 - 30 mm
Angle of beam spread	see detection zone
Transducer frequency	approx. 320 kHz
Resolution, sampling rate	0.36 mm
Reproducibility	< 1 mm
Temperature drift	0.17 % / K
Temperature compensation	Yes, with models usc and usr
Absolute accuracy	< 1 mm with usc and usr
Switching frequency	30 Hz
Switching hysteresis	2 mm
Operating voltage UB	10 – 30 V DC, reverse-polarity protection
Voltage ripple	± 10%
No-load supply current	< 25mA
Switched output	pnp, $U_B - 2 V$, $I_{max} = 500 mA$ short-circuit-proof, reverse-polarity protection, normally open contact (NOC)
Control input	$U_{imax} = U_B$, $R_L \geq 10 k_{\Omega}$
Housing	Brass sleeve, nickel coated thread M18*1, alternatively: stainless steel, thread M18*1
Class of protection to DIN 40 050	IP 65
Adjusting measures	Not necessary
Operating temperature	-20° C to +70° C
Storage temperature	-40° C to +85° C

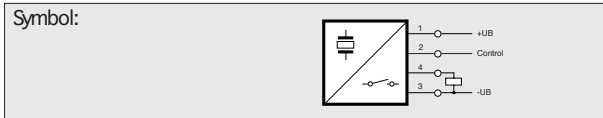
The pico sensors represent a new generation of cost-effective ultrasonic proximity switches in a compact housing.

The proximity switches of the pico series are equipped with a special transducer, providing an extremely narrow and homogeneous detecting zone. For the first time, monitoring filling level in small cans like yoghurt cups or bottles possible.

The sensors have a blind zone of only 30 mm; the operating range rates from 30 to 250 mm.

The sensor types differ in their switched pnp output function. Specific importance lies on the control input (pin 2) of the 4-pole plug; therefore, the sensors do not need adjustment elements.

With the modular system you can design your individual ultrasonic proximity switch according to your requirements.



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Functional Principle

The ultrasonic proximity switch of the pico family is based on the pulse-echo principle:

The ultrasound pulses transmitted by the pico sensor are reflected by a target. The pico sensor calculates its distance from the delay between sent ultrasound pulse and received echo signal.

• Background suppression

If the measured distance is smaller than the internally preset switching distance, the output is set.

• Resolution 0.36 mm

The pico proximity switches have a very high resolution of 0.36 mm.

• High accuracy

The pico-usc-25/OD realizes an absolute accuracy better than ± 1 mm over the entire temperature range.

The Detection Zone

The detection zone describes the area where a standard reflector is reliably detected.

The dark-grey area determines the region where a thin rod (diameter 10 mm) is detected. This is the operating range of the sensor.

The light-grey area determines the region where a large plate is detected, provided that it is adjusted in an optimum angle with respect to the transducer. Beyond the light-grey area analyzing ultrasound echoes is impossible.

The ultrasonic proximity switches of the pico series provide

an extremely narrow and homogeneous beam spread. Diameter of the sound beam is smaller than 40 mm within the operating range.

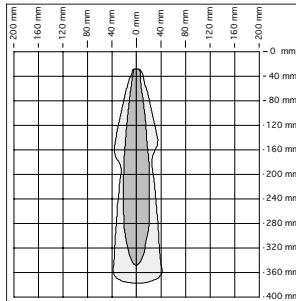


Figure 1: pico proximity switch with enlarged sound pressure, detection zone for 10 mm rod and plate.

The detection zone can even be reduced by reducing the sound pressure; nevertheless, it has to be taken into account that the sensitivity is lower than with HV-types. Sensors with reduced sound pressure should therefore be used only with high-reflective targets.

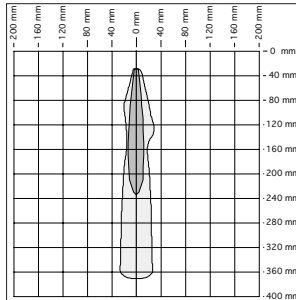


Figure 2: pico proximity switch with reduced sound pressure, detection zone for 10 mm rod and plate.

Stainless Steel Housing

A stainless steel housing with threaded tube M18*1 is available for applications in food industry

Pin-Assignment of the Plug

The pico sensors are equipped with a 4-pole M12 initiator plug.

Pin assignment and color coding of the optional KSTX-cable are as follows:

Pin	Function	Color
1	+U _B	Brown
3	-U _B *	Blue
4	S	Black
2	Control	White



* -U_B is the negative potential of the supply voltage, commonly GND

The Standard-Proximity Switch pico-usf-6/25/CD

The ultrasonic proximity switch pco-usf-6/25/CD serves two fixed switching distances. The switching distance is selected by the control input.

With open control input or control input set to -U_B, the switching distance is 60 mm. With control input set to +U_B, the switching distance is 250 mm. (The switching points are not temperature-compensated.)

Adjustment within a small range is possible by the threaded sensor housing.

For other switching distances and further, individual features please refer to "pico Modular System".

The Reference Sensor pico-usr-25/CD

If small differences in height (only a few millimeters) have to be detected at high temperature oscillations, the pico-usr-25/CD sensor is used.

First, the pico-usr-25/CD carries out a measurement against the fixed background. Afterwards the measured distance values of the targets are compared to this reference value.

The control input of the pico-usr-25/CD is switched to "low" to store the distance to the background into the RAM.

If the control input is switched to "high" potential, the actual measured values are compared to the reference value. The switched output is activated as soon as the difference between the reference value (background) and the target is 5 mm. This difference in height of 5 mm is a fixed preset value and cannot be changed.

For other values, please refer to "pico Modular System".

The Bit Stream Sensor pico-usb-25/CD

The bit stream sensor pico-usb-25/CD is a cost-effective ultrasound sensor with an analog output.

The pico-usb-25/CD transmits the distance information via the pnp switched output bit-serially. The Start-bit is followed by 10 Data-bits and a Stop-bit. Each bit has a signal length of 100 μ s. The entire telegram has a length of 1,200 μ s.

The pico-usb-25/CD transmits a new telegram approximately every 8 ms.

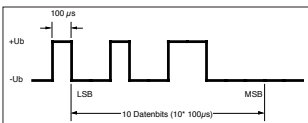


Figure 3: pico-usb-25/CD, data format serial protocol

The 10 data bits provide the information about the distance in the order LSB ... MSB.

The transmitted binary value contains the distance information in steps of 0.36 mm. An offset of 24 mm has to be added.

Example:

$$00.1100.1000_{bin} = 200_{dez}$$

$$200 * 0.36 \text{ mm} + 24 \text{ mm} = 96 \text{ mm}$$

To operate the pico-usb-25/CD, set the control input to +U_B.

The Column Sensor pico-usc-25/CD

The pico-usc-25/CD serves for applications where several ultrasonic proximity switches have to be operated in a row. The pico-usc-25/CD sensors synchronize automatically to minimize interference in case of small mounting distance.

All adjustments of the switching distances are set centrally at one pico-usc-25/CD sensor: A master sensor measures the distance of a fixed reference point. His switched pnp output is connected to the control input of the slave sensors. The slave sensors detect the distance to the targets. The control input of the master sensor is set to +UB. This identifies the pico-usc-25/CD as master or slave.

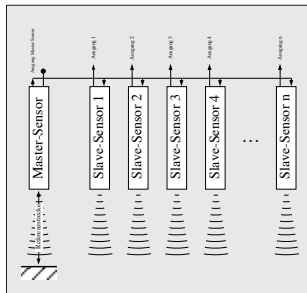


Figure 4: pico-usc-25/CD column sensor

The master sensor now transmits the reference value with every measurement to the connected slave sensors via the output. This reference value serves as switching distance for the slave sensors. Simultaneously, the slave sensors are synchronized by the serial protocol.

To set a new switching distance, only the reference distance has to be changed!

If the reference distance is located near to the slave sensors, all temperature influences are compensated "online" without delay.

This allows highly accurate measurements.

The pico-usc-25/CD is also available with additional foreground suppression (please refer to "pico Modular System"). The switched output is only activated if the target is placed within a window defined by foreground and background suppression.

Advantages of the Column Sensor

- Automatic synchronization of the sensors
- Small mounting distance of the sensors possible
- Extremely fast temperature compensation
- No adjustment of the sensors needed
- Highly accurate measurements possible
- Easy handling

Applications

- Fill detection in beverage industry
- Fill detection of yoghurt cups and other small bundles
- Fill detection of tins
- Σ Presence detection

Standard Models	pico Modular System																			
Standard proximity switch (2 fixed pre-set switching distances selectable via control input)	pico-usf-6/25/CD/	HV	/	E																
Reference sensor (adjusting the switching distance to background)	pico-usr-25/CD/	HV	/	E																
Bit stream sensor (serial, bit-serial output of the distance via pnp switched output)	pico-usb-25/CD/	HV	/	E																
Column sensor (synchronization and automatic switching point adjustment)	pico-usc-25/CD/	HV	/	E																
Ordering example:	pico-	ubf	-	70	/	120	/	5	/	1	/	5	/	CD/	S	/	HV	/	E	
Standard proximity switch		ubf																		
Reference sensor		ubr-25																		
Column sensor		ubc-25																		
1st switching distance (via height difference) in mm		31 - 250																		
2nd switching distance in mm		31 - 250																		
Hysteresis in mm		1 - 10																		
Damping (switch-off delay)		1 - 250																		
Window in mm		0 - 30																		
Output function NCC/NOC		0 or 5																		
Raised sound pressure		- or HV																		
Stainless steel housing		- or E																		

pico Modular System

With standard models, output function NOC, hysteresis and other parameters are fixed and cannot be changed.

If your application requires other parameters like other switching distance with usf-model, larger hysteresis or output function NCC, design your individual ultrasonic proximity switch using the pico Modular System.

The table on the left lists all parameters that can be selected individually. The marked parameters are available with the respective sensor model.

Ordering of a sensor from the pico Modular System is bound on a minimum order quantity of 50 pieces / model.

• Foreground Suppression
(Windowing / Window Mode)

Models ubf and ubc from the pico Modular System can suppress the foreground: the switched output is activated only if the target is placed within the window.

The window lies symmetrically around the switching point; switching hysteresis influences the signal at both ends in a similar way if the target leaves the window. With model ubf window length is valid for both switching distances 1 and 2.

• Damping

The damping works as minimum-value damping. If a target approaches the sensor, smaller values are accepted immediately. If the target departs from the sensor, the last measured value is kept for n measuring cycles before a new value is accepted.