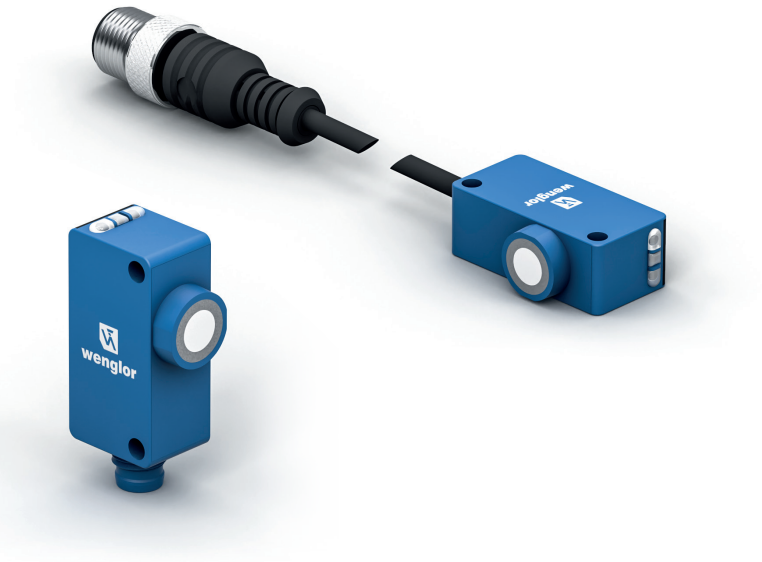
EN

wenglor
the innovative family

U1KTxxx

Ultrasonic Reflex Sensor



IO-Link

Operating instructions

Translation of the Original Operating Instruction
Right of modifications reserved
Available as PDF version only
Version 2.0.0
Status: 31.01.2024
www.wenglor.com

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1. General

1.1 General Information Concerning these Instructions

- These instructions are valid for the products U1KTxxx.
- They make it possible to use the product safely and efficiently.
- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Local accident prevention regulations and national work safety regulations must be complied with as well.
- The product is subject to further technical development, and thus the information contained in these operating instructions may also be subject to change. The current version can be found at www.wenglor.com in the product's separate download area.



NOTE!
The operating instructions must be read carefully before using the product and must be kept on hand for later reference.

1.2 Explanations of Symbols

- Safety precautions and warnings are emphasized by means of symbols and attention-getting words.
- Safe use of the product is only possible if these safety precautions and warnings are adhered to.

The safety precautions and warnings are laid out in accordance with the following principle:



ATTENTION-GETTING WORD!
Type and Source of Danger!
Possible consequences in the event that the hazard is disregarded.
- Measures for averting the hazard.

The meanings of the attention-getting words, as well as the scope of the associated hazards, are listed below:



DANGER!
This word indicates a hazard with a high degree of risk which, if not avoided, results in death or severe injury.



WARNING!
This word indicates a hazard with a medium degree of risk which, if not avoided, may result in death or severe injury.



CAUTION!
This word indicates a hazard with a low degree of risk which, if not avoided, may result in minor or moderate injury.



ATTENTION:
This word draws attention to a potentially hazardous situation which, if not avoided, may result in property damage.



NOTE!
A note draws attention to useful tips and suggestions, as well as information regarding efficient, error-free use.

1.3 Limitation of Liability

- The product has been developed in consideration of the current state-of-the-art and applicable standards and guidelines. Subject to change without notice.
- A valid declaration of conformity can be accessed at www.wenglor.com in the product's separate download area.
- wenglor sensoric elektronische Geräte GmbH (hereinafter referred to as "wenglor") excludes all liability in the event of:
    - Non-compliance with the instructions
    - Use of the product for purposes other than those intended
    - Use by untrained personnel
    - Use of unapproved replacement parts
    - Unapproved modification of products
- These operating instructions do not imply any guarantee from wenglor with regard to the described procedures or specific product characteristics.
- wenglor assumes no liability for printing errors or other inaccuracies contained in these operating instructions, unless wenglor was verifiably aware of such errors at the point in time at which the operating instructions were prepared.

1.4 Copyrights

- The contents of these instructions are protected by copyright law.
- All rights are reserved by wenglor.
- Commercial reproduction or any other commercial use of the provided content and information, in particular graphics and images, is not permitted without previous written consent from wenglor.

2. For Your Safety

2.1 Use for Intended Purpose

This sensor is used to detect objects and measure distances.

Ultrasonic Sensors emit pulsed ultrasonic waves at a certain frequency using air as a transmitting medium. The sensors evaluate the transit time of the ultrasound reflected from the object. Parameters can be taught into the sensors using the teach-in key, via an input or via IO-Link. The output is switched when the preselected switching point is reached. Two independent switching outputs can be set up. Furthermore, the measured value can be read out via IO-Link 1.1. In addition to the reflex mode, two sensors can also be operated in the through-beam mode.

This product can be used in the following industry sectors:

- Special machinery manufacturing
- Heavy machinery manufacturing
- Logistics
- Automotive industry
- Food industry
- Packaging industry
- Pharmaceuticals industry
- Clothing industry
- Plastics industry
- Woodworking industry
- Consumer goods industry
- Paper industry
- Electronics industry
- Glass industry
- Steel industry
- Aviation industry
- Construction industry
- Chemicals industry
- Agriculture industry
- Alternative energy
- Raw materials extraction

2.2 Use for Other than the Intended Purpose

- Not a safety component in accordance with 2006/42/EC (Machinery Directive).
- The product is not suitable for use in potentially explosive atmospheres.
- The product may only be used with accessories supplied or approved by wenglor, or combined with approved products. A list of approved accessories and combination products can be accessed at www.wenglor.com on the product detail page.



DANGER!
Risk of personal injury or property damage in case of use for other than the intended purpose!
Use for other than the intended purpose may lead to hazardous situations.
- Observe instructions regarding use for intended purpose.

2.3 Personnel Qualifications

- Suitable technical training is a prerequisite.
- In-house electronics training is required.
- Trained personnel who use the product must have uninterrupted access to the operating instructions.



DANGER!
Risk of personal injury or property damage in case of incorrect initial start-up and maintenance!
Personal injury and damage to equipment may occur.
- Adequate training and qualification of personnel.

2.4 Modification of Products



DANGER!
Risk of personal injury or property damage if the product is modified!
Personal injury and damage to equipment may occur. Non-observance may result in loss of the CE marking and the guarantee may be rendered null and void.
- Modification of the product is impermissible.

2.5 General Safety Precautions



NOTE!
- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- In the event of possible changes, the respectively current version of the operating instructions can be accessed at www.wenglor.com in the product's separate download area.
- Read the operating instructions carefully before using the product.
- Protect the sensor against contamination and mechanical influences.

2.6 Approvals and protection class



3. Technical Data

Order No. / Technical Data	U1KT001	U1KT002	U1KT003	U1KT004
Ultrasound Data				
Working Range, Reflex Sensor	30…400 mm			
Working Range, Through-Beam Sensor	1…800 mm			
Setting Range Reflex Sensor	30…400 mm			
Reproducibility	4 mm			
Linearity Deviation	4 mm			
Resolution	0,5 mm			
Ultrasonic Frequency	325 kHz			
Aperture Angle	< 12 °			
Service Life (ambient temp. = +25° C)	100000 h			
Switching Hysteresis	1 %			
Electrical Data				
Supply Power	18…30 V DC			
Current Consumption (operating voltage = 24 V)	< 20 mA			
Switching Frequency, Reflex Sensor	30 Hz			
Switching Frequency, Through-Beam Sensor	70 Hz			
Response Time, Reflex Sensor	17 ms			
Response Time, Through-Beam Sensor	8 ms			
Temperature Range	–30…60 °C			
Number of Switching Outputs	2			
Switching Output Voltage Drop	< 2,5 V			
Switching Output Switching Current	100 mA			
Synchronous Operation	Up to 40 Sensors			
Short-Circuit Proof	yes			
Reverse Polarity Protected	yes			
Overload-Proof	yes			
Lockable	yes			
Interface	IO-Link			
IO-Link Version	1.1			
Data Storage	yes			
Protection Class	III			
Mechanical Data				
Setting Method	Teach-In			
Housing Material	Plastic			
Degree of Protection	IP68			
Connector Type	M8×1; 4-pin	M8×1; 4-pin	M12 ×1; 4-pin	M8×1; 4-pin
Cable length l	—	—	200 mm	—
Technical Safety Data				
MTTFd (EN ISO 13849-1)	1106,71a			

* Referring to the switching distance, at least 2 mm.

Order No. / Technical Data	U1KT001	U1KT002	U1KT003	U1KT004
Output functions (Delivery status)				
PNP	x		x	x
NPN		x		
NO				x
NO	x	x	x	

Reflex Mode

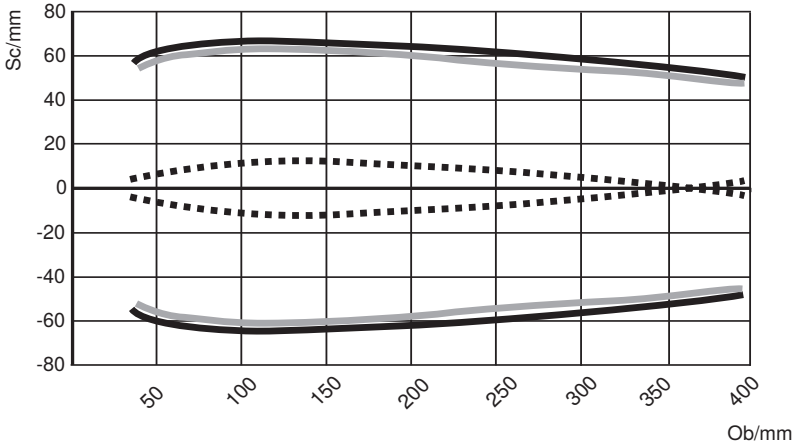
Filter value	Switching Frequency (Hz)	Response Time (ms)
0	30	17
1	24	20,4
2	21	23,8
3	18	27,2
4	16	30,6
5	14	34
6	13	37,4
7	12	40,8
8	11	44,2
9	10	47,6
10	9,5	51
11	9	54,4
12	8,5	57,8
13	8,5	57,8
14	8,5	57,8
15	8,8	57,8
16	3	125
17	1,5	250
18	0,4	1.000
19	0,2	2.000
20	0,15	3.000

Through-Beam Mode

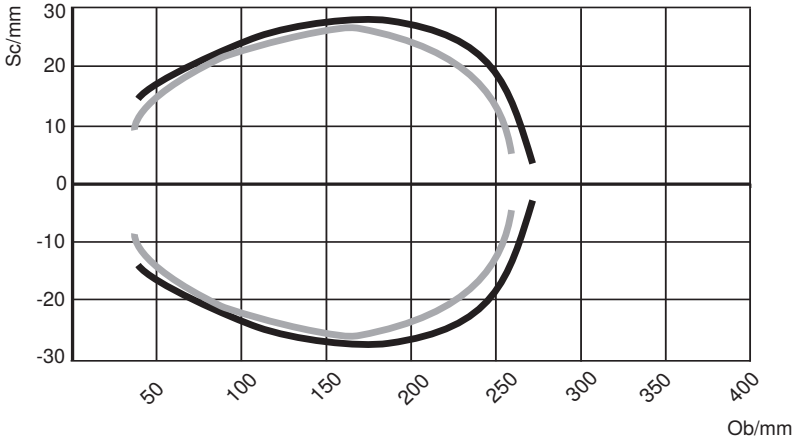
Filter value	Switching Frequency (Hz)	Response Time (ms)
0	70	7,1
1	47	10,7
2	38	13,3
3	31	16
4	27	18,7
5	23	21,3
6	20	24
7	18	26,7
8	17	29,3
9	15,5	32
10	14	34,7
11	13	37,3
12	12,5	40
13	11,5	42,7
14	11	45,3
15	11	45,3
16	3	125
17	1,5	250
18	0,4	1.000
19	0,2	2.000
20	0,15	3.000

3.1 Sonic Cone Diagrams

Measurement of the sonic cone on a 100 x 100 mm plate
Characteristic curves show the position of the center or the front edge of the measured object (100 × 100 mm plate) at the time of switching.



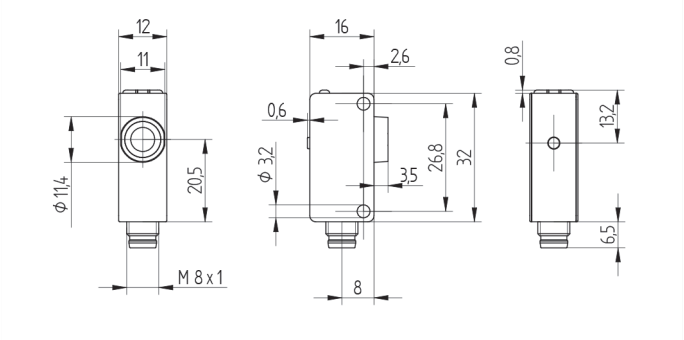
Measurement of the sonic cone on a rod with a diameter of 25 mm
Characteristic curves show the position of the center or the front edge of the measured object (Ø 25 mm rod) at the time of switching.



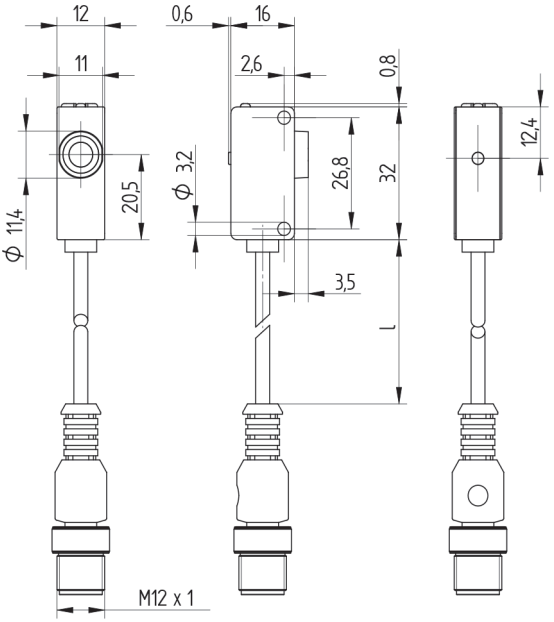
Ob = Object Sc = Sonic cone width
Standard sonic cone (center of the measured object)
Narrow sonic cone (center of the measured object)
Standard sonic cone (front edge of the measured object)

3.2 Housing Dimensions

U1KT001/U1KT002/U1KT004



U1KT003

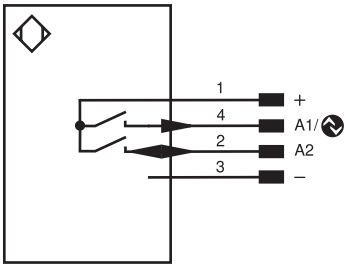


All dimensions in mm
Screw M3 = 0,5 Nm

3.3 Connection Diagram

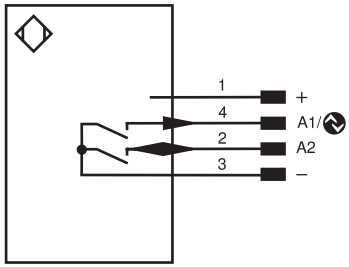
U1KT001/U1KT003

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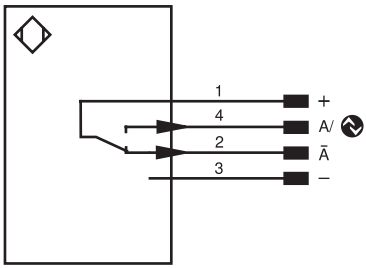
U1KT002

260



U1KT004

215



Legend

+	Supply Voltage +	
–	Supply Voltage 0 V	
~	Supply Voltage (AC Voltage)	
A	Switching Output	(NO)
Ā	Switching Output	(NC)
V	Contamination/Error Output	(NO)
V̄	Contamination/Error Output	(NC)
E	Input (analog or digital)	
T	Teach Input	
Z	Time Delay (activation)	
S	Shielding	
RxD	Interface Receive Path	
TxD	Interface Send Path	
RDY	Ready	
GND	Ground	
CL	Clock	
E/A	Output/Input programmable	
	IO-Link	
PoE	Power over Ethernet	
IN	Safety Input	
OSSD	Safety Output	
Signal	Signal Output	
Bl_D+/-	Ethernet Gigabit bidirect. data line (A-D)	
EN0RS422	Encoder 0-pulse 0-0̄ (TTL)	

PT	Platinum measuring resistor
nc	not connected
U	Test Input
Ū	Test Input inverted
W	Trigger Input
W –	Ground for the Trigger Input
O	Analog Output
O –	Ground for the Analog Output
BZ	Block Discharge
AMV	Valve Output
a	Valve Control Output +
b	Valve Control Output 0 V
SY	Synchronization
SY –	Ground for the Synchronization
E+	Receiver-Line
S+	Emitter-Line
⏚	Grounding
SnR	Switching Distance Reduction
Rx+/–	Ethernet Receive Path
Tx+/–	Ethernet Send Path
Bus	Interfaces-Bus A(+)/B(–)
La	Emitted Light disengageable
Mag	Magnet activation
RES	Input confirmation
EDM	Contactor Monitoring

ENARS422	Encoder A/Ā (TTL)
ENBRS422	Encoder B/B̄ (TTL)
ENA	Encoder A
ENB	Encoder B
AMIN	Digital output MIN
AMAX	Digital output MAX
AOK	Digital output OK
SY In	Synchronization In
SY OUT	Synchronization OUT
OLT	Brightness output
M	Maintenance
rsv	reserved

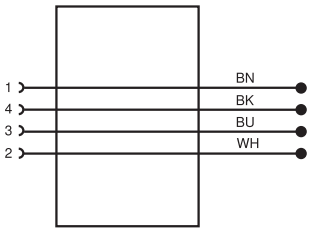
Wire Colors according to IEC 60757

BK	Black
BN	Brown
RD	Red
OG	Orange
YE	Yellow
GN	Green
BU	Blue
VT	Violet
GY	Grey
WH	White
PK	Pink
GNYE	Green/Yellow

3.4 Complementary Products (see catalog)

wenglor offers Connection Technology for field wiring.

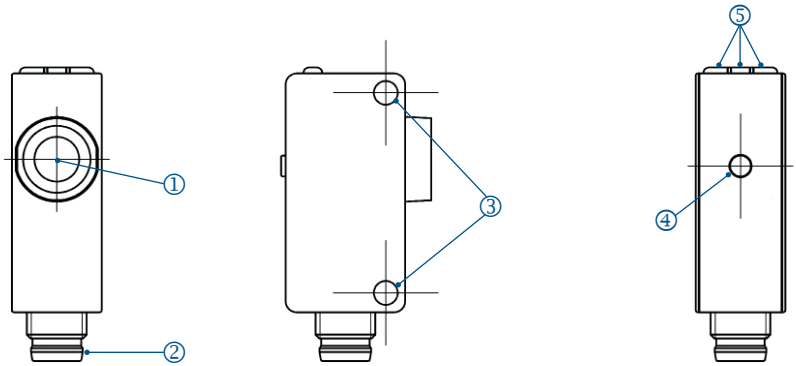
Suitable Mounting Technology No.	400
Suitable Mounting Technology No.	7
	S02



IO-Link-Master

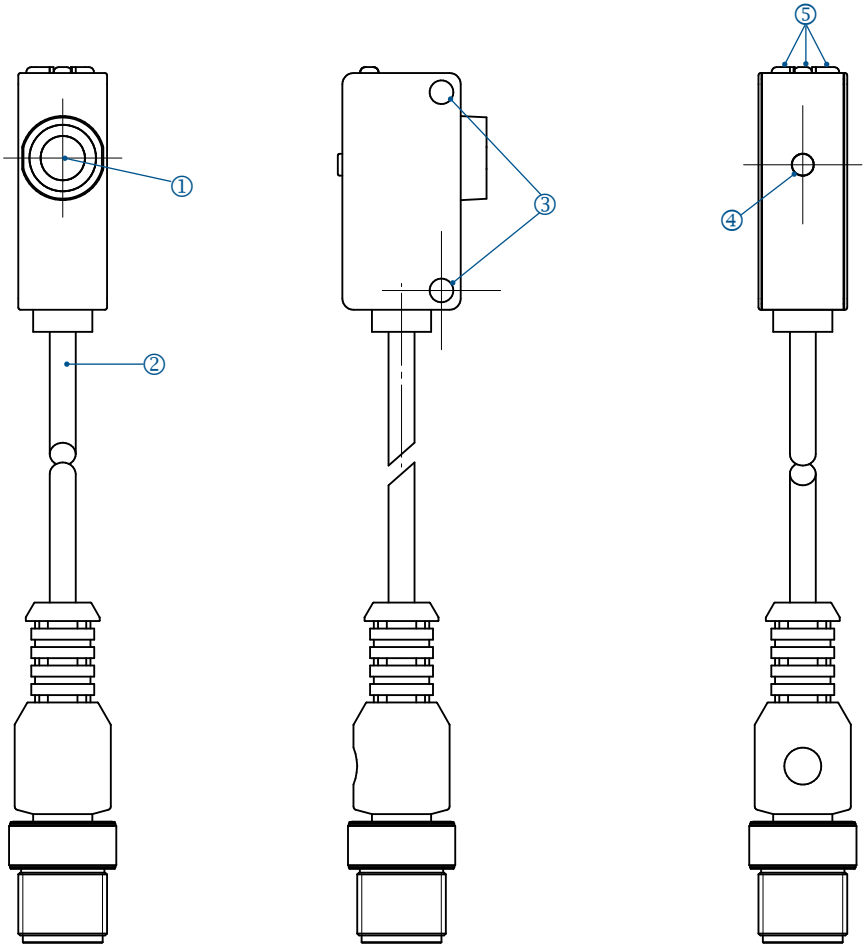
3.5 Layout

U1KT001/U1KT002/U1KT004



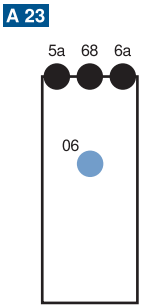
① = Sensing Face
② = Plug Connector
③ = Mounting Holes
④ = Teach-In Key
⑤ = Indicator LEDs

U1KT003



① = Sensing Face
② = Cable Connector
③ = Mounting Holes
④ = Teach-In Key
⑤ = Indicator LEDs

3.6 Control panel



06 = Teach Button
5a = Switching Status Display, O1
68 = Supply Voltage Indicator
6a = Switching Status Display, O2

3.7 Scope of Delivery

- Product
- Quickstart
- Mounting-Set 01

4. Transport and Storage

4.1 Transport

Upon receipt of shipment, inspect the goods for damage in transit. In the case of damage, conditionally accept the package and notify the manufacturer of the damage. Then return the device making reference to damage in transit.

4.2 Storage

The following points must be taken into condition with regard to storage:

- Do not store the product outdoors.
- Store the product in a dry, dust-free place.
- Protect the product against mechanical impacts.
- Protect the product against exposure to direct sunlight.



ATTENTION:
Risk of property damage in case of improper storage!
The product may be damaged.
- Comply with storage instructions.

5. Installation and Electrical Connection

5.1 Installation

- Protect the product from contamination during installation.
- Observe all applicable electrical and mechanical regulations, standards, and safety rules.
- Protect the product against mechanical influences.
- Make sure that the sensor is mounted in a mechanically secure fashion.
- If the object has smooth surfaces, the angle between the axis of the sound waves and the surface of the object should be 90° ±3°. The angle can be considerably larger in the case of rough object surfaces.
- The sensor's sensing face must remain unobstructed.

NOTE!
Observe the blind spot.
In the area between the sensor's active surface and the beginning of its working range, correct functioning of the sensor is not assured. No objects may be located in this area.

	Object position			Switching position / switching LED	Error output / error LED	Measured value, IO-Link
Working range (30...450 mm)		×		Defined	Defined	Defined
Blind spot (0...30 mm)	×			Undefined	Undefined	Undefined
Above the working range (> 450 mm)			×	Defined	Defined	Defined

ATTENTION!
Risk of property damage in case of improper installation!!
The product may be damaged.
- Comply with installation instructions.

CAUTION!
Risk of personal injury or property damage during installation!
Personal injury and damage to the product may occur.
- Ensure a safe installation environment.

5.2 Electrical Connection

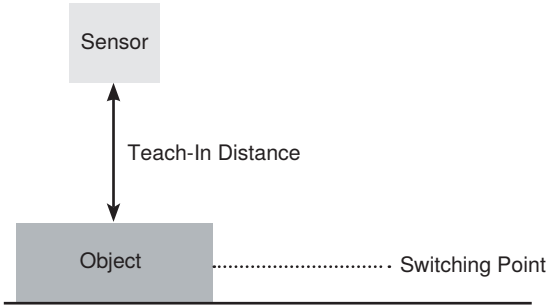
- Connect the sensor to 18 to 30 V DC (see section "3.3 Connection Diagram", page 12).

6. Delivery status

Technical Data	U1KT001	U1KT002	U1KT003	U1KT004
Sensor Mode	Normal			
Filter	0			
Sonic Cone	Standard			
Processdatatype	Outputs and Measured Value			
Temperature Mode	Intern			
A2 Pin Function	Switching Output	Switching Output	Switching Output	Switching Output antivalent
A1 Teach Mode	Foreground			
A1, A2 PNP/NPN	PNP	NPN	PNP	
A1 NO/NC	NO			
A1 Switch Point	400			
A1 Hysteresis Additional	0			
A2 Teach Mode	Foreground			–
A2 NO/NC	NO			NC
A2 Switch Point	400 mm			–
A2 Hysteresis Additional	0			–

7. Setup via the Teach-In Key

The switching distance to the object can be taught in for both outputs by pressing the teach-in key on the sensor (foreground teach-in). When using the U1KT004, only switching output O1 can be set in the delivery state due to the preset antivalent switching output.



Foreground Teach-In for Switching Output 1
1. Mount the sensor in accordance with the mounting instructions.
2. Position the object in front of the sensor.
3. Press and hold the teach in key until the A1 switching status LED starts blinking.
4. Release the teach in key after 2 seconds.
5. The distance is taught in and the LED at output 1 lights up briefly in order to confirm successful teach-in.

Foreground Teach-In for Switching Output 2
1. Mount the sensor in accordance with the mounting instructions.
2. Position the object in front of the sensor.
3. Press and hold the teach in key until the A2 switching status LED starts blinking.
4. Release the teach in key after 5 seconds.
5. The distance is taught in and the LED for output 2 lights up briefly in order to confirm successful teach-in.

When using the antivalent switching output of the U1KT004, a new distance is stored on A2 when the teach button is pressed for 5 seconds. However, this value is irrelevant for the switching of the antivalent output. Only the switching point of A1 is relevant.

NOTE!
If there's no object within the measuring range, switching distance is set to the end of the setting range.

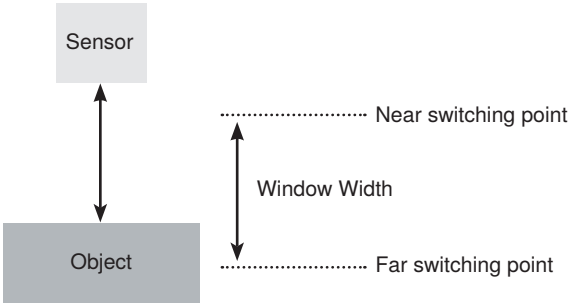
8. Settings via IO-Link

Further settings can be entered to the sensor via the IO-Link interface.

8.1 Window Teach-In

In addition to foreground teach-in (default setting), there's also a window teach-in option for both outputs:

1. Enter or teach in far switching point.
2. Enter or teach in near switching point.
3. The sensor is switched when an object is located between the two switching points.



NOTE!
The far switching point must be greater than the near switching point.

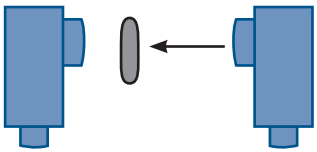
8.2 Through-Beam Sensor Operating Mode

In addition to the reflex mode (default setting), a through-beam operating mode is also available. Two sensors are required to this end.

1. Set up one sensor as an emitter.
2. Set up another sensor as a receiver.
3. If the receiver is operated as a normally closed contact, it's switched when an object is located between the emitter and the receiver.

Technical Data in the Through-Beam Mode:

Range:	1 to 800 mm
Switching Frequency:	70 Hz
Response Time:	8 ms



NOTE!
The sonic cone of the receiver determines the sensitivity of the through-beam mode.

- With the standard sonic cone the maximum working range is possible.
- Set the sonic cone to narrow at the receiver, in order to detect even small objects between the emitter and the receiver.

NOTE!
Sensors in reflex and through beam mode must not be used together.

Differentiation between one and two layers of thin material such a paper or foil is possible in the through-beam operating mode.

1. Position the emitter and the receiver a short distance from each other.
2. Adjust distance between the emitter and the receiver so that the receiver continues to switch for one layer but not for two.

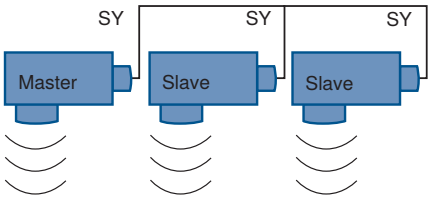
NOTE!
Teach-in via the teach-in key is not possible in the through-beam operating mode. Adjustments can be made by changing the distance between the emitter and the receiver and with the help of the sonic cone settings at the receiver.

8.3 Synchronous Operating Mode

Several sensors can be used together in the synchronous operating mode in order to detect a large surface. The sensors emit ultrasonic pulses simultaneously (synchronously).

1. Connect all of the sensors' pin 2 terminals to each other.
2. Set up one sensor as the synchronous master.
3. Set up all other sensors as synchronous slaves.

NOTE!
In synchron master or synchron slave mode, the A2 pin function is automatically set to synchron output or synchron input. Changes in the A2 pin function are not possible in synchron mode.



NOTE!
Synchronous operation is only possible with the A1 output function set to PNP. Furthermore, only one digital output is available at sensors which are operated in the synchronous mode, because pin 2 is required for synchronization.

NOTE!

- Sensors in synchronous mode must have the same sonic cone settings.
- The response time of the sensors in synchronous mode is longer by 1.9 × the response time in normal mode (e.g. filter 0: response time in normal mode = 17 ms; response time in synchronous mode = 32 ms).

8.4 “Mute” Operating Mode

When this operating mode is activated, the ultrasonic transmitter (transducer) of the sensor is switched off. No measurements are taken. The switching behavior is identical to when no signal is received in reflective operation or as a through-beam sensor.

8.5 Locking

If 18 to 30 V DC is continuously applied to the teach-in input, the teach-in key is locked and protected against inadvertent changes.

1. Change the A2 pin function to external teach-in.
2. Permanently connect pin A2 to 18 to 30 V DC.
3. The sensor is protected against inadvertent changes caused by the teach-in key.

8.6 External Teach-In

Teach in input A1 via the teach-in input.

1. Set the A2 pin function to external teach-in.
2. Apply 24 V to pin 2 for at least 1 second, but for no more than 4 seconds.
3. As soon as voltage drops at the input, A1 is taught in.

8.7 External Temperature Compensation

As a standard feature, temperature is compensated with the help of the internal temperature sensor. Continuous transmission of external temperature values to the sensor is also possible.

1. Set the temperature mode to external.
2. Enter a fixed temperature or transmit the temperature value from another measuring instrument.

NOTE!

Regular updating of external temperature data is recommended, in order to prevent abrupt temperature changes and jumps in measurement results resulting therefrom. If no temperature value is transmitted when the sensor is started up in the external temperature mode, the standard value of 23 °C is used.

8.8 Error Output

The error output is switched in the following cases:

- Very small or poorly reflective (sound-absorbing) objects are located within the working range.
- Incorrect assembly.
- The object is located outside of the working range.
- Strong air turbulence.
- Excessively strong ultrasound sources are located within the measuring range.

8.9 Filters

- The selected filter affects response time (see section “Response Time (ms)”, page 9) and the number of distance values which will be evaluated.
- The longer the response time of the selected filter the more distance values are collected and evaluated.

	Filters 0 to 15	**Filters 16to 20**
Mode of operation of the filters	• Median filter	• Median filter
Performance in case of missing/ invalid distance value (e.g. deflection of the ultrasonic signal due to water movement)	• Individual invalid distance values are not taken into account in the calculation of the median.	• The sensor waits for a valid distance value until the specified response time has elapsed. This prevents inadvertent switching due to individual invalid values.
Performance in the event of continuous changes (continuously valid distance value)	• Read-out in accordance with filter response time	• Continuous changes to the fill-level are read out immediately.

9. IO-Link

Process and parameters data can be found at www.wenglor.com in the product's separate download area.

10. Maintenance Instructions



NOTE!

- This wenglor sensor is maintenance-free.
- It's advisable to clean and to check the plug connections at regular intervals.
- Do not clean the sensor with solvents or cleansers which could damage the product.
- The product must be protected against contamination during initial start-up.

11. Proper Disposal

wenglor sensoric GmbH does not accept the return of unusable or irreparable products. Respectively valid national waste disposal regulations apply to product disposal.

12. Appendix

12.1 Change Index, Operating Instructions

Version	Date	Description/Change
1.0.0	21.12.16	Initial version of the operating instructions
1.1.0	17.05.17	Further information regarding the through-beam operating mode
1.2.0	02.01.18	New device U1KT002
1.3.0	20.02.19	Supplement, new filters 16 to 20 • 3 "Technical Data" on page 7: filter value tables expanded • 8.9 "Filters" on page 23 supplemented • Available as of revision C (U1KT001) or revision A (U1KT002) 3.3 "Connection Diagram" on page 12 wiring diagram adapted
1.4.0	08.04.19	Further Information on Installation (blind spot)
1.5.0	03.08.20	Supplement section 8.4 ""Mute" Operating Mode" on page 22
1.6.0	19.07.21	New device U1KT003
1.7.0	26.09.22	Supplement section 8.9 "Filters" on page 23
1.8.0	29.03.23	New device U1KT004
1.9.0	16.11.23	Supplement section 3.1 "Sonic Cone Diagrams" on page 10
2.0.0	31.01.24	Adaptation 3.1 "Sonic Cone Diagrams" on page 10

12.2 EU Declaration of Conformity

The EU declaration of conformity can be found on our website at www.wenglor.com in the product's separate download area.