



# Ultrasonic Sensors

For Ultrasonic Detection

# Reliable detection and measurement with SICK's new ultrasonic sensors

Light and sound are two natural phenomena which enables every living being to recognize their environment without physical contact and over widely varying distances. Likewise, industrial processes require reliable environmental information. SICK's UM18, UM30 and UC12 ultrasonic sensors detect objects and measure distances using sound.

Ultrasonic sensors are often the better choice in many industrial applications requiring sensor technology.



## UC12 Features

- Sensing distance: 20...150 (250) mm and 55...250 (350) mm
- Temperature compensation
- 1 x PNP/NPN switching output
- Excellent background suppression
- Rotatable M12 4-pin plug: L+, M, Q, /Q
- Small & compact W12 housing
- Single push button teach for 3 modes

### UC12 Ultrasonic Sensors – small and compact

The UC12 comes in the same compact housing as the W12 series of sensors, and offers complete mechanical and electrical compatibility. It also has a teachable switching point for three modes and rotatable connection plug – providing more flexibility.

The UC12 has a sensing range of 20...250 or 50...350 mm with a switching point that can be taught-in. Due to its IP 67 metal housing, the sensor is suitable for harsh conditions. Another advantage of the UC12 is its ability to detect transparent objects or liquids. In addition to fill level measurement, the UC12 is ideal for positioning tasks, monitoring heights and distances for collision prevention, and other object detection applications.

## UM18 Features

- Sensing distance: 30...250 (350) mm
- 2 versions: High-End & Standard
- Set up / Teach-In: Via MF-Input
- High-End variant:
  - Temperature compensation
  - 2 Function LEDs
  - Synchronization
  - ObSB Mode
  - 2 switching outputs

### UM18 - Integrated switching reliability for critical objects

The UM18 Ultrasonic Sensor from SICK is ideal for applications where space is limited, as well as for detecting objects with critical levels of reflectivity. The device, in a compact M18 housing, is available in two variants – Standard and High End. Both offer an operating sensing distance between 30 mm and 250 mm, as well as teach-in and switching threshold programming via the control cable. Applications include the detection of transparent objects, checking liquid levels in test tubes, and measuring fill levels.

A background teach-in feature is an additional advantage. Objects with surfaces or shapes that are critical in terms of their sound reflectivity can be reliably detected. This feature is called object between sensor and background mode (foreground suppression). Detecting shiny, colorful, sound absorbent and odd-shaped objects (such as potato chip bags on a conveyor) is possible by teaching the sensor to a constant background.



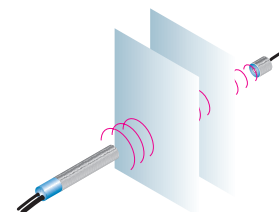
## UM18 Double Sheet Detector Features

- 2 PNP outputs for: double sheet and misfed sheet determination
- Detection of different materials
- Plug and Play sensor: automatic adjustment on the material
- Stand-alone device: no additional unit necessary
- Compact design

### UM18 Double Sheet Detector

The sender and receiver of the UM18 are located in an 18 mm threaded tube, and, because they are mounted only 40 mm apart, can be accommodated in the most confined spaces. No need to tell it what to do. The UM18 adjusts to its task automatically.

The UM18 can find out whether one or two sheets of film, paper, metal or cardboard lie between its sender and receiver.



## UM30 Features

- High flexibility: analog output U/I - automatic adaptation
- Teach-in up to 6 m
- Temperature compensation in the sensor head
- 1 and 2 switching outputs Q and /Q

### UM30 Ultrasonic Sensors

The UM30 has three sensing ranges. The minimum operating distance is 30 mm and the long sensing range is 6000 mm. The UM30 is unaffected by dust-laden air, steam, vapor and spray. The background can be blanked almost completely.

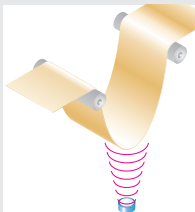
The UM30 is available with switching or analog outputs. Depending on the task, objects can simply be detected or their distance measured. Ultrasonic time measurements depend on the medium transmitting the sound, e.g. the air. UM30 sensors automatically compensate for temperature fluctuations, ensuring precision and reliability.

# Ultrasonic Detection

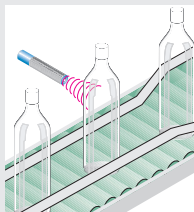


## Sensors with a profile – defining the detection area

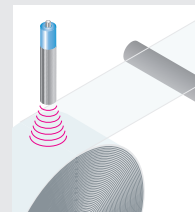
SICK ultrasonic sensors generate an ultrasonic wave by means of a piezo element in the front part of the housing. The wave spreads in the atmosphere in accordance with the laws of physics. The same piezo element can detect and measure the sound reflected by an object. Therefore, it functions alternately as sender and receiver (transceiver). The measurement principle of ultrasonic sensors is based on the time taken for ultrasonic wave to travel through air. The signals are transmitted in defined “packages.” With the help of its processing electronics, the transceiver evaluates the time taken between the transmission of a sound “package” and the arrival of the reflection from an object. As a result, either a signal is sent via an analog interface, or a switching signal depending on a previously set distance parameter is sent through a binary output. The accuracy of the measurement and the maximum sensing range lie within a tolerance range which depends mainly on the state of the carrier medium (air) and the roughness of the object in question.



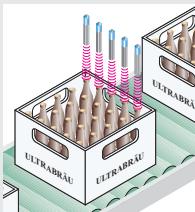
◀ Adjust: control material looping



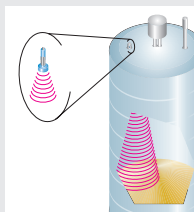
◀ Detection: recognize transparent objects



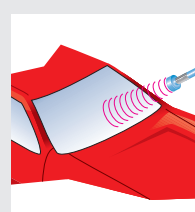
◀ Unwind: distance measurement for diameter check



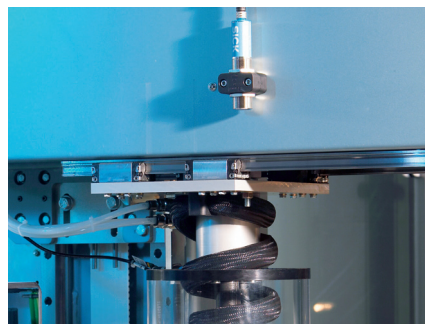
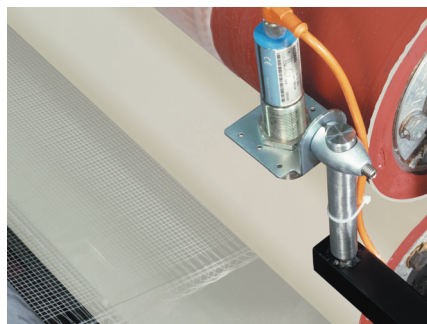
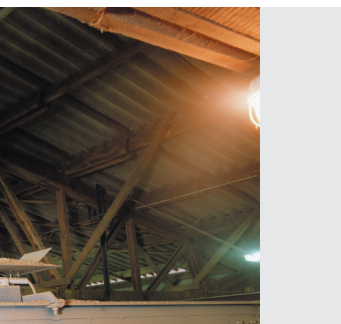
◀ Package: “engaged” check on package content



◀ Monitoring: level control in silos and containers



◀ Positioning: object-detection and distance-measurement independent of material



#### Detection and measurement, regardless of material

Detection of transparent objects such as glass and film are often a difficult task for sensors, as are clear and colored fluids. But it is hard to deceive an ultrasonic. Almost all materials affect and reflect sound waves.

#### Never confused by bright colors

Not even the oddest colors can bias ultrasonic sensors. Reflective objects do not irritate them at all. When objects change color, there is no need to readjust the sensors. They just go on working as before.

#### Sound has an advantage – even on superficial inspection

Whether the surface is rough or smooth, reflecting or retro-reflecting, regular or irregular in shape, ultrasonic sensors are generally unaffected. They detect objects reliably and almost independently of their appearance.

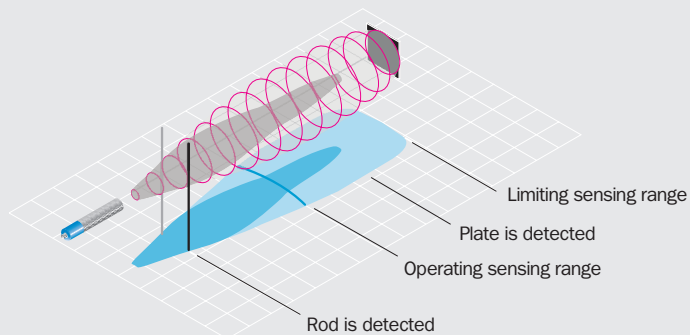
#### Highly reliable, even under difficult conditions

Dust and dirt, steam and spray are no problem for ultrasonic sensors. Unfavorable environments have little effect on them. Interferences are simply “blanked out.” And they do not even mind strong light and adverse temperatures.

#### Detection range

To determine the area of detection of the sensors, a series of measurements are carried out with two standardized objects, a thin round rod and a plate. The three-dimensional area within which the sensor responds to the rod is in the form of a thin club. It marks the typical operating sensing range of the sensor.

The sensor responds to the plate within the area of a larger beam. This area defines the maximum or limit detection range of the sensor. When projected onto a two-dimensional grid, typical profiles are created. These are the operating diagrams of the ultrasonic sensors, from which the operating sensing range, the limiting sensing range, the specific shape and the zone of the detection range can be read off. Objects which are smaller than the round rod may only be detected within an area smaller than the operating sensing range.



## Ultrasonic Sensor Overview



|                                                             | UC12                     | UM18-5111X               | UM18-20012<br>DOUBLE SHEET<br>DETECTOR                                                             |
|-------------------------------------------------------------|--------------------------|--------------------------|----------------------------------------------------------------------------------------------------|
| <b>Sensing Range</b>                                        | 20...250 mm (<350)       | 30...250 mm (<350)       | —                                                                                                  |
| Ultrasonic Frequency                                        | 380, 500 kHz             | 320 kHz                  | 400 kHz                                                                                            |
| Resolution                                                  | 0.18 mm                  | 0.36 mm                  | Double sheets not completely glued together                                                        |
| Reproducibility                                             | ±0.15%                   | ±0.15% of final value    | —                                                                                                  |
| Accuracy                                                    | ≤2%                      | ≤2% of final value       | —                                                                                                  |
| <b>Installation Distance</b>                                |                          |                          |                                                                                                    |
| <b>Sender-Receiver</b>                                      | —                        | —                        | 40 mm ± 3 mm                                                                                       |
| Blind Zone                                                  | —                        | —                        | 7 mm, each time before sender and receiver                                                         |
| Permissible Angle Deviation                                 | —                        | —                        | ±45° perpendicular to sheet                                                                        |
| <b>Operational Area</b>                                     |                          |                          |                                                                                                    |
| Paper Grams per Square Meter                                | —                        | —                        | 20...1200 g/m <sup>2</sup>                                                                         |
| Metal-Laminated Sheets and Films                            | —                        | —                        | ≤0.4 mm thickness                                                                                  |
| Self-Adhesive Films, Metal Sheets                           | —                        | —                        | ≤0.3 mm                                                                                            |
| Ultra-Fine Corrugated Cardboard                             | —                        | —                        | —                                                                                                  |
| <b>Supply Voltage V<sub>S</sub><sup>1)</sup></b>            | 10...30 V DC             | 10...30 V DC             | 12...30 V DC                                                                                       |
| Ripple                                                      | 10%                      | ±10%                     | ±10%                                                                                               |
| Current Consumption <sup>2)</sup>                           | <40 mA                   | ≤40 mA                   | ≤45 mA                                                                                             |
| Response Time                                               | 27 ms                    | 32 ms                    | —                                                                                                  |
| Switching Frequency                                         | <25/s                    | 15 hZ                    | —                                                                                                  |
| Switching Hysteresis                                        | 2.0 mm                   | 2.0 mm ±10%              | —                                                                                                  |
| Standby Delay                                               | <300 ms                  | <300 ms                  | 300 s                                                                                              |
| Double-Sheet Switching/Q <sub>1</sub> <sup>3)</sup>         | —                        | —                        | PNP, V <sub>S</sub> -2 V, I <sub>max</sub> =500mA                                                  |
| Mis-Fed-Sheet Switching Output/Q <sub>2</sub> <sup>3)</sup> | —                        | —                        | PNP, V <sub>S</sub> -2 V, I <sub>max</sub> =500mA                                                  |
| Response Time <sup>4)</sup>                                 | —                        | —                        | 2.5 ms or 6.5 ms                                                                                   |
| Off Delay                                                   | —                        | —                        | 10 ms                                                                                              |
| V <sub>S</sub> at Control Unit <sup>4)</sup>                | —                        | —                        | Response time 6.5 ms:<br>V <sub>S</sub> >9 V DC<br>Response time 2.5 ms:<br>V <sub>S</sub> <5 V DC |
| <b>Connection Type</b>                                      | Plug M12, 4-pin          | Plug M12, 5-pin          | Cable PVC, 2 m; 5 x 0.25 mm <sup>2</sup>                                                           |
| Sender Cable <sup>5)</sup>                                  | —                        | —                        | PVC, 1.2 m with 2-pin plug                                                                         |
| Receiver Cable <sup>6)</sup>                                | —                        | —                        | PVC, 1 m with 2-pin plug                                                                           |
| Enclosure Rating                                            | IP 67                    | IP 67                    | IP 65                                                                                              |
| <b>Ambient Temperature<sup>6)</sup></b>                     |                          |                          |                                                                                                    |
| Operation                                                   | -4...158°F (-20...70°C)  | -13...158°F (-25...70°C) | 41...140°F (5...60°C)                                                                              |
| Storage                                                     | -40...185°F (-40...85°C) | -40...185°F (-40...85°C) | -40...185°F (-40...85°C)                                                                           |
| <b>Approximate Weight</b>                                   | 75 g                     | 65 g (with 2 nuts)       | 280 g                                                                                              |
| <b>Housing Material</b>                                     | Nickel-plated brass      | Nickel-plated brass      | Nickel-plated brass                                                                                |

1) Limit values

2) Without load

3) Outputs short-circuit protected

4) Automatic switching between voltage and current outputs dependent on load

- Current output 4...20 mA: R<sub>L</sub> ≤ 500 Ω, V<sub>S</sub> ≥ 20 V; R<sub>L</sub> ≤ 100 Ω, V<sub>S</sub> ≥ 12 V

- Current output 0...10 mA: R<sub>L</sub> ≤ 100 kΩ, V<sub>S</sub> ≥ 15 V

5) Only with UM30-XXX3: Recovery time 32 ms according to EMC EN 50 319

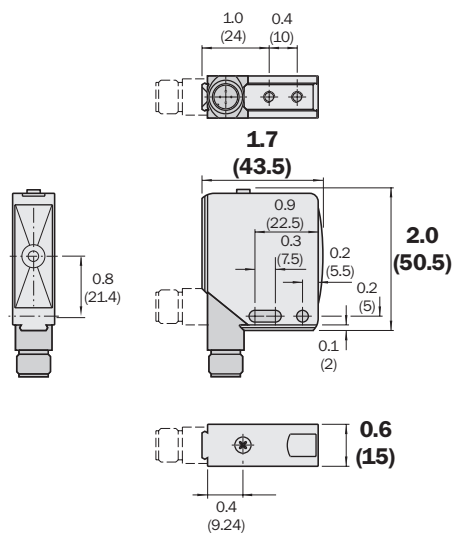
6) Temperature compensation at -68...122°F (20...50°C)



| UM30-1111X                 | UM30-1211X                 | UM30-1311X                 | UM30-1411X                 | UM30-1511X                 |
|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 30...250 mm (<350)         | 60...350 mm (<600)         | 200...1300 mm (<2000)      | 350...3400 mm (<5000)      | 800...6000 mm (<8000)      |
| 320 kHz                    | 400 kHz                    | 200 kHz                    | 120 kHz                    | 80 kHz                     |
| 0.36 mm                    | 0.36 mm                    | 0.36 mm                    | 1.0 mm                     | 1,0 mm                     |
| ±0.15% of final value      | ±0.15% of final value      | ±0.15% of final value      | ±0.15% of final value      | ±0.15% of final value      |
| ≤2% of final value         | ≤2% of final value         | ≤2% of final value         | ≤2% of final value         | ≤2% of final value         |
| —                          | —                          | —                          | —                          | —                          |
| —                          | —                          | —                          | —                          | —                          |
| —                          | —                          | —                          | —                          | —                          |
| —                          | —                          | —                          | —                          | —                          |
| 12...30 V DC <sup>1)</sup> | 12...30 V DC <sup>1)</sup> | 12...30 V DC <sup>1)</sup> | 12...30 V DC <sup>1)</sup> | 12...30 V DC <sup>1)</sup> |
| ±10%                       | ±10%                       | ±10%                       | ±10%                       | ±10%                       |
| ≤70 mA                     | ≤70 mA                     | ≤70 mA                     | ≤70 mA                     | ≤70 mA                     |
| 50 ms                      | 70 ms                      | 110 ms                     | 180 ms                     | 240 ms                     |
| 11/s                       | 8/s                        | 6/s                        | 3/s                        | 2/s                        |
| 2.5 mm                     | 5 mm                       | 20 mm                      | 50 mm                      | 100 mm                     |
| 2 s                        | 2 s                        | 2 s                        | 2 s                        | 2 s                        |
| —                          | —                          | —                          | —                          | —                          |
| —                          | —                          | —                          | —                          | —                          |
| —                          | —                          | —                          | —                          | —                          |
| —                          | —                          | —                          | —                          | —                          |
| Plug M12, 5-pin            | Plug M12, 5-pin            | Plug M12, 5-pin            | Plug M12, 5-pin            | Plug M12, 5-pin            |
| —                          | —                          | —                          | —                          | —                          |
| —                          | —                          | —                          | —                          | —                          |
| IP 65                      | IP 65                      | IP 65                      | IP 65                      | IP 65                      |
| —                          | —                          | —                          | —                          | —                          |
| -4...158°F (-20...70°C)    | -4...158°F (-20...70°C)    | -4...158°F (-20...70°C)    | -4...158°F (-20...70°C)    | -4...158°F (-20...70°C)    |
| -40...185°F (-40...85°C)   | -40...185°F (-40...85°C)   | -40...185°F (-40...85°C)   | -40...185°F (-40...85°C)   | -40...185°F (-40...85°C)   |
| 260 g                      | 260 g                      | 260 g                      | 310 g                      | 360 g                      |
| Nickel-plated brass        | Nickel-plated brass        | Nickel-plated brass        | Nickel-plated brass        | Nickel-plated brass        |

# Technical Information

## Ultrasonic Sensor UC12

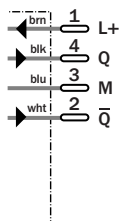
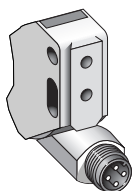


dimensions in inches (mm)

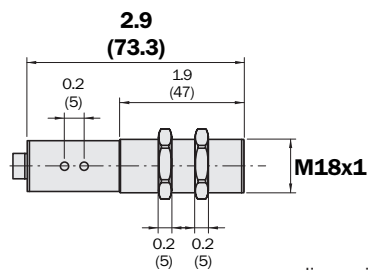
### Connection type for UC12

All types

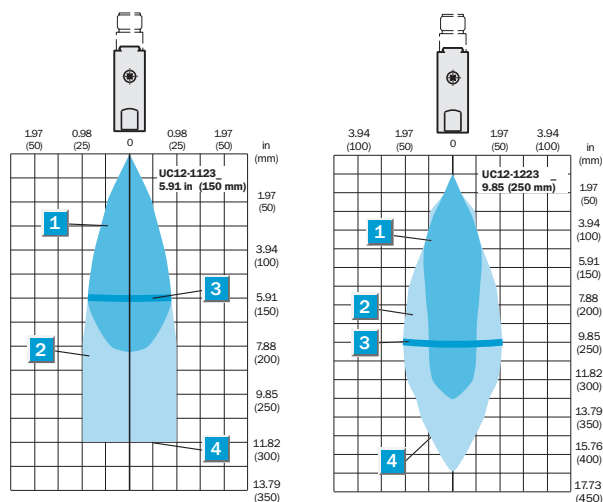
4-pin, M12



## Ultrasonic Sensor UM18



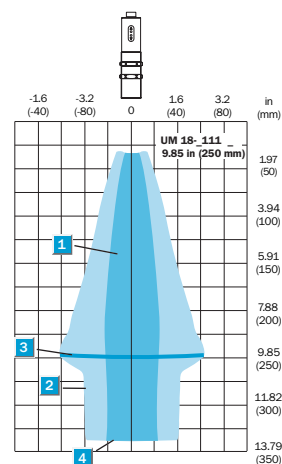
dimensions in inches (mm)



- 1 Aligned plate 10 x 10 mm
- 2 Tube diameter 10 mm
- 3 Operating sensing range
- 4 Maximum sensing range

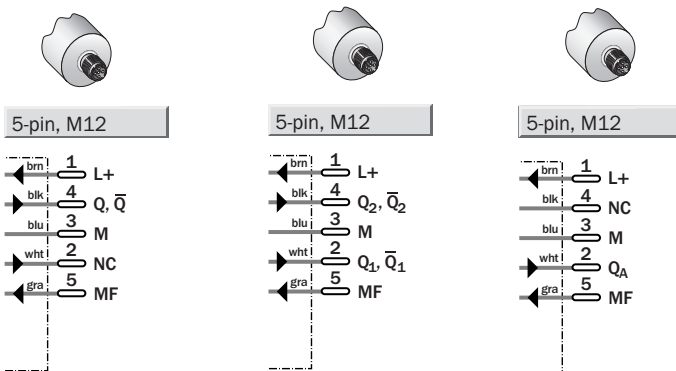
### Order Information

| Type       | Order No. |
|------------|-----------|
| UC12-11231 | 6029831   |
| UC12-12231 | 6029832   |
| UC12-11235 | 6029833   |
| UC12-12235 | 6029834   |

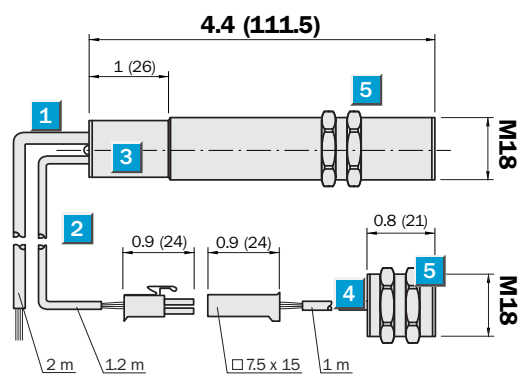


- 1 Aligned plate 500 x 500 mm
- 2 Tube diameter 10 mm
- 3 Operating sensing range
- 4 Maximum sensing range

| Connection type for UM18 |            |            |
|--------------------------|------------|------------|
| UM18-51111               | UM18-51112 | UM18-11116 |
| UM18-51115               | UM18-51114 | UM18-11117 |

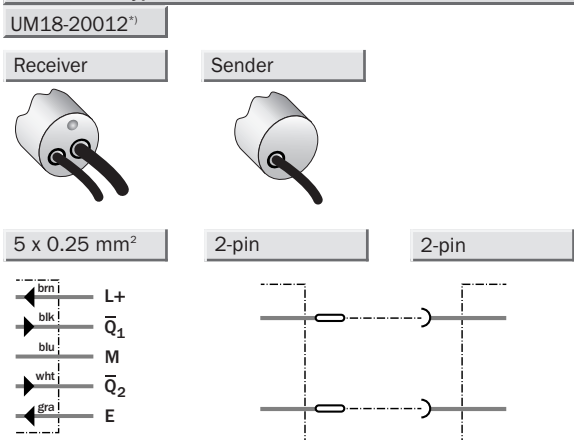


Dimensional Drawing for UM18 Double Sheet Detector



dimensions in inches (mm)

#### Connection Types for UM18 Double Sheet Detector



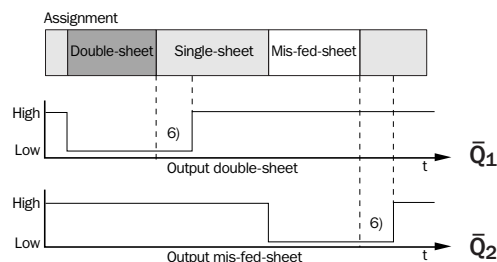
\*) Sender/receiver pair:  
Individual components on request

| Order Information |           |
|-------------------|-----------|
| Type              | Order No. |
| UM18-51111        | 6028965   |
| UM18-51112        | 6028964   |
| UM18-51114        | 6028973   |
| UM18-51115        | 6028974   |
| UM18-11116        | 6029507   |
| UM18-11117        | 6029508   |

#### Adjustments Possible for UM18 Double Sheet Detector

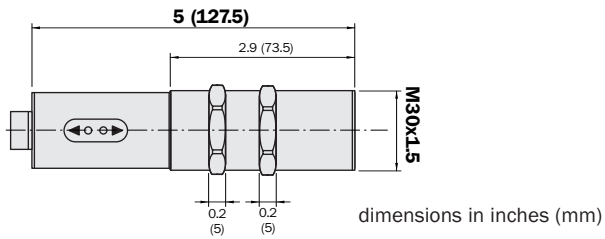
- 
- 1 Connection cable 2 m (receiver)
  - 2 Connection cable 1.2 m, 2-pin sender and receiver
  - 3 2-color LED indicator, receiver
  - 4 Connection cable 1 m, 2-pin sender and receiver
  - 5 Fastening nuts, width across 24 mm

#### Measurement Ranges for UM18 Double Sheet Detector

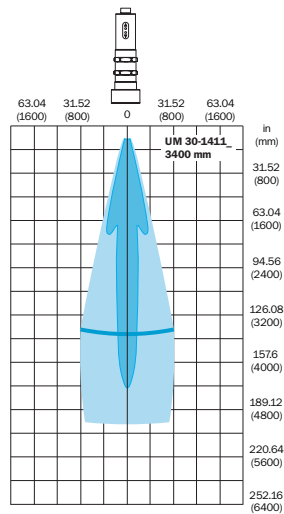
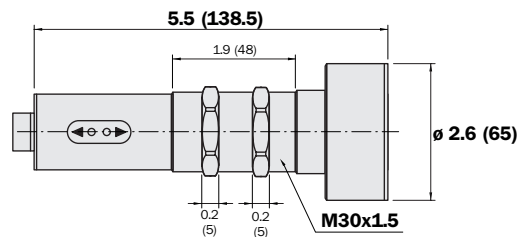
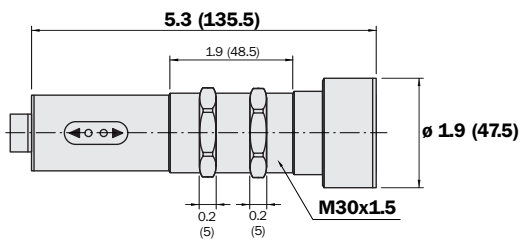
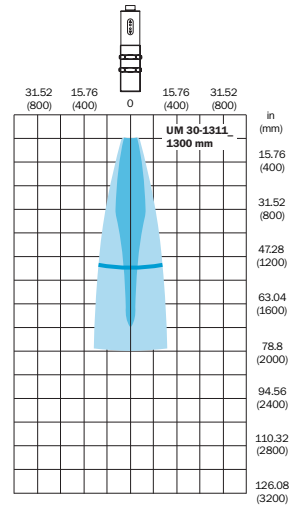
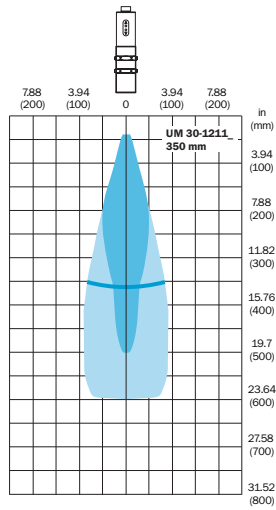
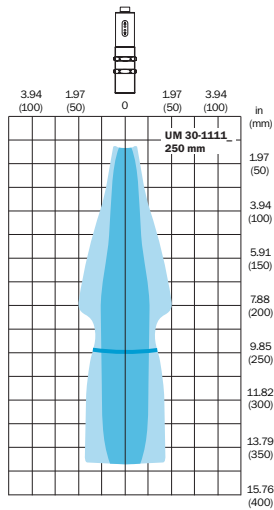


| Order Information |           |
|-------------------|-----------|
| Type              | Order No. |
| UM18-20012        | 6025670   |

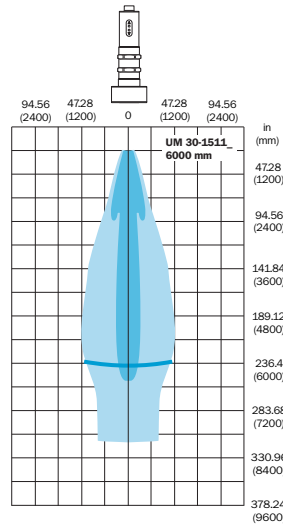
## Ultrasonic Sensor UM30



- 1 Aligned plate 500 x 500 mm
- 2 Tube diameter 10 mm
- 3 Tube diameter 27 mm
- 4 Operating sensing range
- 5 Maximum sensing range



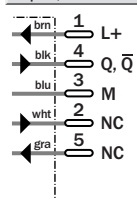
- 1 Aligned plate 500 x 500 mm
- 2 Tube diameter 27 mm
- 3 Operating sensing range
- 4 Maximum sensing range



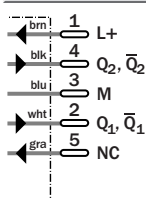
- 1 Aligned plate 500 x 500 mm
- 2 Tube diameter 27 mm
- 3 Operating sensing range
- 4 Maximum sensing range

| Connection type for UM30 |            |            |
|--------------------------|------------|------------|
| UM30-11111               | UM30-11112 | UM30-11113 |
| UM30-12111               | UM30-12112 | UM30-12113 |
| UM30-13111               | UM30-13112 | UM30-13113 |
| UM30-14111               | UM30-14112 | UM30-14113 |
| UM30-15111               | UM30-15112 | UM30-15113 |

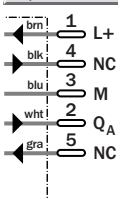
5-pin, M12



5-pin, M12



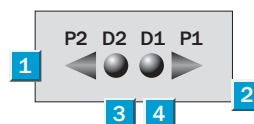
5-pin, M12



Note: NC = no connection. Please do not connect.

UM30 Control and Display Panel

All types

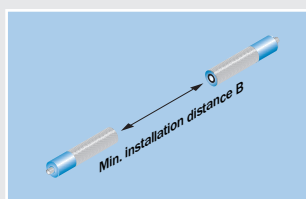
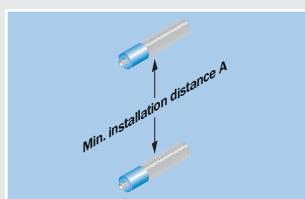


- 1 Setting key 2
- 2 Setting key 1
- 3 LED 2
- 4 LED 1

| Order Information |           |            |           |
|-------------------|-----------|------------|-----------|
| Type              | Order No. | Type       | Order No. |
| UM30-11111        | 6025655   | UM30-14111 | 6025658   |
| UM30-12111        | 6025656   | UM30-14112 | 6025663   |
| UM30-13111        | 6025657   | UM30-14113 | 6025668   |
| UM30-11112        | 6025660   | UM30-15111 | 6025659   |
| UM30-12112        | 6025661   | UM30-15112 | 6025664   |
| UM30-13112        | 6025662   | UM30-15113 | 6025669   |
| UM30-11113        | 6025665   |            |           |
| UM30-12113        | 6025666   |            |           |
| UM30-13113        | 6025667   |            |           |

## Installation

Ultrasonic sensors installed close together or opposite one another may affect each other mutually. For this reason, different axial and lateral distances have to be maintained, depending on the detection range. The sensor with the largest detection range determines the minimum distance.

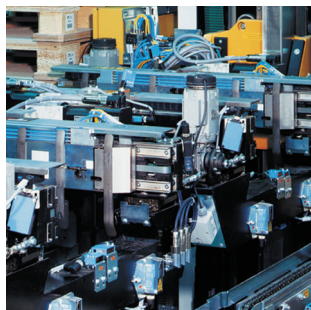


| Operating sensing range | Min. installation distance A | Min. installation distance B |
|-------------------------|------------------------------|------------------------------|
| 0.25 m                  | 10 cm                        | ≥ 100 cm                     |
| 0.35 m                  | ≥ 30 cm                      | ≥ 170 cm                     |
| 1.3 m                   | ≥ 60 cm                      | ≥ 540 cm                     |
| 3.4 m                   | ≥ 160 cm                     | ≥ 1,600 cm                   |
| 6 m                     | ≥ 260 cm                     | ≥ 3,000 cm                   |

## RANGE OF EXPERTISE

### INDUSTRIAL SENSORS

SICK is one of the world's leading manufacturers of sensors, safety systems, and automatic identification products for industrial applications. SICK holds more than 450 patents for its innovative products. Through its Industrial Sensors, Safety Systems, Automatic Identification, and Environmental and Process Analysis divisions, the company has operations in 65 countries. SICK North America is headquartered in Minneapolis, MN.



### SAFETY SYSTEMS

Products from SICK provide comprehensive safeguarding of both workers and machinery. As experts in sensor technology, SICK develops and manufactures pioneering products that provide protection in hazardous zones, dangerous locations and for safeguarding access points. By providing services, which encompass all aspects of machine safety and security, SICK is setting new standards in safety technology.



### AUTOMATIC IDENTIFICATION

Our wide range of sensors provides solutions to suit any application in the field of automation. Even under rugged ambient conditions, objects are reliably detected, counted and positioned regardless of their form, location and surface finish.



### ANALYZERS AND PROCESS INSTRUMENTATION

Whether the tasks involve identification, handling, classification or volume measurement, innovative automatic identification systems and laser measurement systems from SICK function reliably, even under rapid cycle times. Products from SICK conform to the latest standards and can be easily integrated in all industrial environments and external applications.



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