# Ultrasonic Distance Sensors

Ultrasonic sensing systems offer no-touch distance measurements to an accuracy of 1 mm through dust, smoke and vapour, in areas of high noise level, and with all types of target materials, shapes and colours, with sensing ranges from 100 mm up to 6000 mm.

### *High performance no-touch position sensing*

Increased reliability, no contamination. Honeywell ultrasonic sensors operate by exciting an acoustic transducer with voltage pulses, causing the transducer to vibrate ultrasonically. These oscillations are directed at a target and by measuring the time for the echo to return to the transducer, the distance may be calculated. This measurement technique in no way interferes with the object - it does not contaminate the target, nor does it affect the position. And being no-touch, there are no mechanical linkages to wear out.

### *Ultrasonic*

Factory noise does not affect operation because the operating frequency is well above the frequency of ambient sound. And because sound is used, air pressure, humidity and airborne contamination have little effect on accuracy; target shape, material and colour are also not critical.

### *Working method*

The sensors work with an ultrasonic transducer used for both transmitting and receiving. In each cycle, ultrasonic pulses will be transmitted. The pulses are then reflected back from the target, and received by the sensor. By means of the temperature compensated measurement of the elapsed time of the acoustic signal, the target distance is determined, with a high degree of accuracy. The resulting measurement can be output either as an analogue or a digital signal.

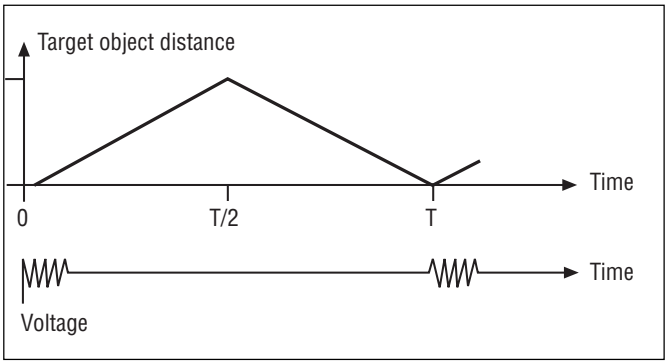



***Figure 1*** *shows the elapsed time of the acoustic pulse. The diagram shows how the pulse travels from the transducer to the target, is reflected at time T/2, and reaches the transducer at time T. Below is a diagram of the voltage at the ultrasonic transducer. Elapsed time T is directly proportional to object distance a. a = cT/2, where c is the velocity of sound.*

### *Application criteria*

The maximum sensing range depends on a number of factors such as target shape, surface, inclination to the beam axis, surface composition and environmental influences. The range values included in this catalogue are based on a target made of flat, sound-reflecting material at 25°C and still air, placed vertical to the beam axis.

### *Reflective properties*

Almost all materials and targets reflect sound, and can therefore be detected. Only sound-absorbing materials such as cotton wool, or foam rubber are either difficult or impossible to detect. Certain materials, such as textiles, weaken the ultrasonic signals, as a result of which the maximum sensing distance is less than half of the nominal value.

### *Target shape and surface*

All object shapes and surfaces can be measured using ultrasonic sensors, up to the maximum distance at which a sufficient echo reaches the sensor. Cylindrical, conical and small objects reduce the measuring range.

### *Inclination to beam angle*

If a smooth, flat target is inclined at more than half of the nominal beam angle to the normal beam axis (e.g. 5°), the echo is deflected so far that, under certain conditions, no signal is received by the sensor (see Figure 2 overleaf). At shorter target distances, the target can be inclined up to the beam (e.g. 10°) from the beam axis. In the case of targets with a rough surface, the acoustic beam is reflected diffusely. The angle of inclination to the beam may, under certain circumstances, be up to 50°, but the maximum sensing distance is reduced.

**⚠ WARNING**

**PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop devices, or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

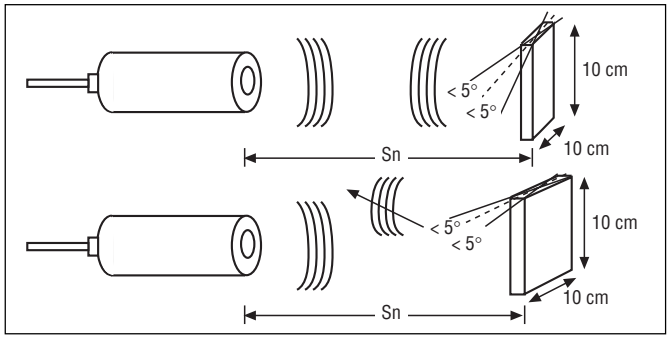



***Figure 2**: Effect of target inclination on the measurement*

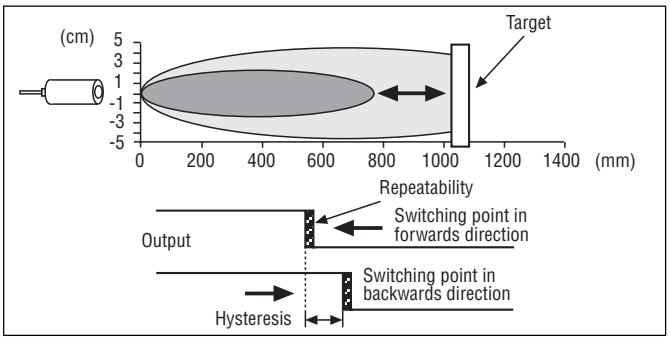



***Figure 4**: Repeatability and hysteresis*

## Environmental influences

The velocity of sound in air is temperature-dependent, and increases at a rate of 0.18 %/°C. Honeywell ultrasonic distance sensors have their own temperature transducer, which adjusts both the clock frequency of the elapsed time counter and the carrier frequency. Major temperature fluctuations within the measuring path can, however, lead to sound dispersion and refraction, which disturb the measuring result and limit the stability of the measurement (Figure 3). Air streams, turbulence and air layers of different densities can, in certain conditions, attenuate or deflect the echo to such an extent that the sensor cannot detect it. On the other hand, air humidity and normal atmospheric air pressure fluctuations have virtually no influence on the measurements.

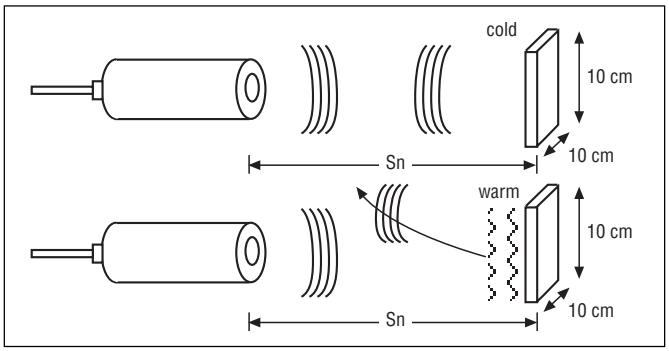



***Figure 3**: Effect of warm air turbulence on the measurement*

## Repeatability

All information concerning repeatability and hysteresis in this data sheet is valid for axial target movements (Figure 4). If a target approaches the sensor from a distance, the output switches at the set value ± the given repeatability. If the target moves further away from the sensor, the output switches back into its original condition, at a distance which is equal to the sum of the setpoint and the given hysteresis ± the repeatability. If a target moves laterally into the acoustic beam, the echo energy increases. If the measurement threshold of the sensor is reached, the output becomes active. This threshold depends on the target properties and its distance from the sensor. The position can only be determined experimentally.

## Mutual interference

Despite pulse coding, if several sensors are used simultaneously in a single application, mutual interference can occur. This phenomenon will, however, only arise if, as a result of the inclination of the object, or the positioning of two sensors opposite one another, false echo signals can be received. By using the inhibitor input, maintaining minimum distances or restricting the beam angle with a focusing reflector, the problem can be almost entirely avoided.

## Synchronisation

The majority of Honeywell ultrasonic distance sensors can be very easily synchronised by interconnecting the appropriate inputs or connecting them with an external synchronisation unit. The transmission of the acoustic pulses then occurs simultaneously. This makes it possible to use the sensors for applications in which the ultrasonic transducers are facing each other, while still avoiding mutual interference.

## Protective measures

All sensors are protected against water and dust, according to the DIN standard IP 65. The transducer is coated with silicone rubber or epoxy, but it can be attacked by aggressive acid or caustic atmospheres. It is also necessary to ensure that the transducer face remains clear of liquid or solid deposits, which could limit the performance of the sensor. Drops of water may be deposited on the transducer surface, as a result of condensation. These could severely reduce the sensor range. Also because of the risk of icing up, and because sensors detect raindrops, the suitability of these sensors for outdoor use, despite the protective measures, is limited.

## Electrical interference

All Honeywell ultrasonic sensors are protected against reverse polarity, short circuits, overloads and voltage spikes. Special protective circuitry makes the sensor almost entirely immune to electromagnetic and radio frequency interference. However, unstable measurements may arise if the sensor is placed in the vicinity of strong electrical fields. In such cases, the interconnection cables should be screened as far as possible, or separated from power cables. The use of regulated power supplies with mains filters, and limiting the maximum cable length to 50 metres can also offer possible solutions. All sensors are CE marked.

## Alignment aid

The majority of Honeywell ultrasonic distance sensors have an LED, the output intensity of which is proportional to the ultrasonic echo received. The brighter the LED, the better aligned the sensor.

Please contact your nearest Honeywell office for details of other models available.

# Selection Guide - Sensors

| Series | Reference | Mechanical characteristics: Sensor: Dimensions | Sensor: Material | Sensor: Head material | Separate control box | Sensing Distance: Dead Zone | < 1 m | Between 1 m and 2 m | > 2 m | Output: Switching: 1 switching PNP | Switching: 2 switching PNP | Analogue: 0/10 1/6 Volts | Analogue: 4/20 mA | Analogue: RS Series | Programming: None | Integrated Potentiometer | Windows™ based software required | Teach-In function using push button or plug or connector | Termination: Cable | Termination: Connector | Synchronisation: No | Synchronisation: Requires external accessory | Synchronisation: By connecting | Temperature Compensation ˚C: No | Temperature Compensation ˚C: Using external plug | Temperature Compensation ˚C: Integral | Page number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 940 | 940-F4Y-2D-001-180E | M18 | Plastic | Epoxy | | 200 | | 1500 | | ■ | | | | | | ■ | | | ■ | | | | ■ | | | ■ | 126 |
| | 940-F4Y-2D-001-300E | | | | | 100 | 600 | | | | | | | | | | | | | | | | | | | | |
| 941 | 941-C2V-2E-001 |  | Zinc | Silicone | | 200 | | 1500 | | | ■ | ■ | | | | ■ | | | | ■ | | | ■ | | | ■ | 129 |
| | 941-C2V-2E-1C0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compact 942 | 942-A4N-2D-1C1-130E | M30 | Stainless Steel | Epoxy | | 300 | | | 3000 | | ■ | ■ | | RS232 | | | ■ | | | ■ | | | ■ | | | ■ | 128 |
| | 942-A4N-2D-1C1-220S | | | Silicone | | 150 | | 1500 | | | | | | | | | | | | | | | | | | | |
| 942 2 Piece | 942-M3A-2D-1G1-220S | M30 | Stainless Steel | Silicone | ■ | 150 | | 1500 | | | | | | RS232 | | | | | ■ | ■ | | | | | | | 129 |
| 942-T | 942-T4N-2D-1C1-200E | M30 | Plastic | Epoxy | | 150 | | 1500 | | | ■ | ■ | | RS232 | | | ■ | | | ■ | | | ■ | | | ■ | 128 |
| | 942-T4N-2D-1C1-180E | | | | | 250 | | 2000 | | | | | | | | | | | | | | | | | | | |
| | 942-T4N-2D-1C1-130E | | | | | 350 | | | 3500 | | | | | | | | | | | | | | | | | | |
| | 942-T4N-2D-1D1-200E | | | | | 150 | | 1500 | | | | | ■ | | | | | | | | | | | | | | |
| | 942-T4N-2D-1D1-180E | | | | | 250 | | 2000 | | | | | | | | | | | | | | | | | | | |
| | 942-T4N-2D-1D1-130E | | | | | 350 | | | 3500 | | | | | | | | | | | | | | | | | | |
| 943 Remote Teach In | 943-F4V-2D-1C0-180E | M18 | Plastic | Epoxy | | 200 | | 2000 | | | | ■ | | | | | | Connecot pin | | ■ | | | | | | ■ | 125 |
| | 943-F4V-2D-1C0-300E | | | | | 100 | 800 | | | | | | | | | | | | | | | | | | | | |
| | 943-F4V-2D-1C0-330E | | | | | 60 | 500 | | | | | | | | | | | | | | | | | | | | |
| | 943-T4V-2D-1C0-130E | M30 | | | | 300 | | | 3500 | | | | | | | | | | | | | | | | | | |
| | 943-F4V-2D-1D0-180E | M18 | | | | 200 | | 2000 | | | | | ■ | | | | | | | | | | | | | | |
| | 943-F4V-2D-1D0-300E | | | | | 100 | 800 | | | | | | | | | | | | | | | | | | | | |
| | 943-F4V-2D-1D0-330E | | | | | 60 | 500 | | | | | | | | | | | | | | | | | | | | |
| | 943-T4V-2D-1D0-130E | M30 | | | | 300 | | | 3500 | | | | | | | | | | | | | | | | | | |
| | 943-F4V-2D-001-180E | M18 | | | | 200 | | 2000 | | | ■ | | | | | | | | | | | | | | | | |
| | 943-F4V-2D-001-300E | | | | | 100 | 800 | | | | | | | | | | | | | | | | | | | | |
| | 943-F4V-2D-001-330E | | | | | 60 | 500 | | | | | | | | | | | | | | | | | | | | |
| | 943-T4V-2D-001-130E | M30 | | | | 300 | | | 3500 | | | | | | | | | | | | | | | | | | |
| | 943-F4Y-2D-1C0-180E | M18 | | | | 200 | | 2000 | | | | ■ | | | | | | | | | | | | | | | |
| | 943-F4Y-2D-1C0-300E | | | | | 100 | 800 | | | | | | | | | | | | | | | | | | | | |
| | 943-F4Y-2D-1C0-330E | | | | | 60 | 500 | | | | | | | | | | | | | | | | | | | | |
| | 943-T4Y-2D-1C0-130E | M30 | | | | 300 | | | 3500 | | | | | | | | | | | | | | | | | | |
| | 943-F4Y-2D-1D0-180E | M18 | | | | 200 | | 2000 | | | | | ■ | | | | | | | | | | | | | | |
| | 943-F4Y-2D-1D0-300E | | | | | 100 | 800 | | | | | | | | | | | | | | | | | | | | |
| | 943-F4Y-2D-1D0-330E | | | | | 60 | 500 | | | | | | | | | | | | | | | | | | | | |
| | 943-T4Y-2D-1D0-130E | M30 | | | | 300 | | | 3500 | | | | | | | | | | | | | | | | | | |
| | 943-F4Y-2D-001-180E | M18 | | | | 200 | | 2000 | | | ■ | | | | | | | | | | | | | | | | |
| | 943-F4Y-2D-001-300E | | | | | 100 | 800 | | | | | | | | | | | | | | | | | | | | |
| | 943-F4Y-2D-001-330E | | | | | 60 | 500 | | | | | | | | | | | | | | | | | | | | |
| | 943-T4Y-2D-001-130E | M30 | | | | 300 | | | 3500 | | | | | | | | | | | | | | | | | | |
| 944 Teach-in | 944-T4V-2D-1C1-300E | M30 | Plastic | Epoxy | | 60 | 350 | | | | ■ | ■ | | | | | | ■ | | ■ | ■ | | | | | ■ | 127 |
| | 944-T4V-2D-1C1-200E | | | | | 150 | | 1500 | | | | | | | | | | | | | | | | | | | |
| | 944-T4V-2D-1C1-180E | | | | | 250 | | 2000 | | | | | | | | | | | | | | | | | | | |
| | 944-T4V-2D-1C1-130E | | | | | 350 | | | 3500 | | | | | | | | | | | | | | | | | | |
| | 944-T4V-2D-1D1-300E | | | | | 60 | 350 | | | | | | ■ | | | | | | | | | | | | | | |
| | 944-T4V-2D-1D1-200E | | | | | 150 | | 1500 | | | | | | | | | | | | | | | | | | | |
| | 944-T4V-2D-1D1-180E | | | | | 250 | | 2000 | | | | | | | | | | | | | | | | | | | |
| | 944-T4V-2D-1D1-130E | | | | | 350 | | | 3500 | | | | | | | | | | | | | | | | | | |
| 946 | 946-A4V-2D-001-175E | M30 | Stainless Steel | Epoxy | | 120 | | 2000 | | | ■ | | | | | | | ■ | | ■ | ■ | | | | | ■ | 130 |
| | 946-A4V-2D-001-400E | | | | | 50 | 500 | | | | | | | | | | | | | | | | | | | | |
| | 946-A4V-2D-001-65E | M30* | | | | 400 | | | 6000 | | | | | | | | | | | | | | | | | | |
| | 946-A4V-2D-2C0-175E | M30 | | | | 80 | | 2000 | | | | ■ | ■ | | | | | | | | | | | | | | |
| | 946-A4V-2D-2C0-380E | | | | | 30 | 500 | | | | | | | | | | | | | | | | | | | | |
| | 946-A4V-2D-2C0-65E | M30* | | | | 350 | | | 6000 | | | | | | | | | | | | | | | | | | |
| | 946-A4V-2D-2C0-85E | | | | | 200 | | | 4000 | | | | | | | | | | | | | | | | | | |
| 947 | 947-F4Y-2D-1C0-180E | M18 | Plastic | Epoxy | | 200 | | 1500 | | | | ■ | | | ■ | | | | ■ | | | | ■ | ■ | | | 126 |
| | 947-F4Y-2D-1C0-300E | | | | | 100 | 600 | | | | | | | | | | | | | | | | | | | | |
| | 947-FSY-2D-001-180E | | | | | 400** | | 1500 | | Retro | | | | | | ■ | | | | | | | | | | ■ | |
| | 947-FSY-2D-001-300E | | | | | 250** | 600 | | | | | | | | | | | | | | | | | | | | |
| | 947-T4Y-2D-001-130E | M30 | Plastic | Epoxy | | 300 | | | 2500 | ■ | | | | | ■ | ■ | | | ■ | | | | ■ | | | ■ | |
| | 947-T4Y-2D-1C0-130E | | | | | | | | | | | ■ | | | ■ | | | | | | | | | ■ | | | |
| 948 | 948-HSY-2D-001-300E | 2 parts (ER) *** | Plastic | Epoxy | | ** | 300 | | | Thru scan | | | | | | | | | ■ | | | | | No | | | 127 |
| | 948-HSY-2D-002-300E | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 948-HSY-2D-003-300E | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 948-HSY-2D-004-300E | | | | | | | | | | | | | | | | | | | | | | | | | | |

Notes:

* On these M30 models the head is wider than the body.

** Retroreflective models do not have a dead zone. The distance indicated is the minimum sensing distance.

*** Emitter + Receiver

Windows™ programming software is available for testing on request.

Information on the complete product range is available at: http://content.honeywell.com/sensing/prodinfo/ultrasonic

NPN versions are not included in this selection guide.

Special and other models are available. For more information contact your Honeywell sales office.

## Selection Guide - Accessories

| | Reference | 940 | 941 | 942 | 944 | 946 | 947 | Page number |
|---|---|---|---|---|---|---|---|---|
| Beam deflector | 43192871-001 | | | | | | | 131 |
| | 43192871-002 | | | | | | | |
| | 43192871-003 | | | | | | | |
| | 43192871-004 | | | | | | | |
| | 66195116-001 | | | | | | | |
| Connector | 66195044-001 | | | | | | | 132 |
| | 66195074-001 | | | | | | | |
| Connector and Cable | 55002 | | | | | | | 132 |
| | 55195126-001 | | | | | | | |
| Mounting Clamp | 43178389-018 | | | | | | | 132 |
| | 43178389-030 | | | | | | | |
| Power supply 24 Vdc | FF-MADB24RB | | | | | | | 131 |
| Programming | 40779 | | | | | | | 133 |
| | 55000005-002 | | | Compact | | | | |
| | 55195101-101 | | | Separate | | | | |
| | 55195101-102 | | | Compact | | | | |
| | 55000018-001 | | | 942-T | | | | |

# 943 Series Remote Teach in, Analogue or 2 switching outputs

New

The new 943 series industrial sensors are the latest addition to our product range. They have improved scanning ranges, remote teach in of the switching or analog outputs, as well as new advanced features, such as window and hysteresis modes.

## OPTIONS

### 2 switching outputs PNP NO and NPN NO

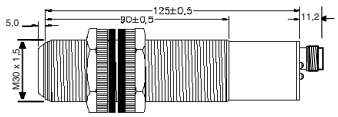
**Beam angle:** 8°
**Supply voltage:** 12 to 30 V
**Sealing:** IP67

### Analogue voltage output 0-10 V and 4-20 mA

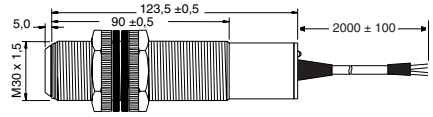
**Beam angle:** 8°
**Supply voltage:** 15 to 30 V
**Sealing:** IP67

## M30

**CONNECTOR**




**CABLE**




### M30

**Housing:** M30 x 1,5 mm plastic (PBTB)
**Max. sensing distance:** 3500 mm
**Min. sensing distance:** 300 mm
**Switching frequency:** 1.0 Hz
**Repeatability:** 0,2 % or 2 mm

| OUTPUT | TERMINATION | REFERENCE |
|---|---|---|
| PNP, 2 NO/NC | Connector | 943-T4V-2D-001-130E |
| PNP, 2 NO/NC | Cable | 943-T4Y-2D-001-130E |
| NPN, 2 NO/NC | Connector | 943-T4V-2D-002-130E |
| NPN, 2 NO/NC | Cable | 943-T4Y-2D-002-130E |

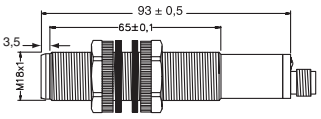
### M30

**Housing:** M30 x 1,5 mm plastic (PBTB)
**Max. sensing distance:** 3500 mm
**Min. sensing distance:** 300 mm
**Response time:** 400 ms
**Repeatability:** 0,2 % or ±2 mm

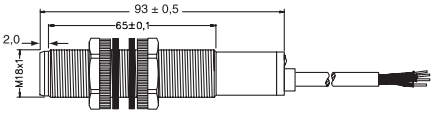
| OUTPUT | TERMINATION | REFERENCE |
|---|---|---|
| 0-10 V | Connector | 943-T4V-2D-1C0-130E |
| 0-10 V | Cable | 943-T4Y-2D-1C0-130E |
| 4-10 mA | Connector | 943-T4V-2D-1D0-130E |
| 4-20 mA | Cable | 943-T4Y-2D-1D0-130E |

## M18

**CONNECTOR**




**CABLE**




### M18

**Housing:** M18 x 1,0 mm plastic (PBTB)
**Max. sensing distance:** 2000 mm
**Min. sensing distance:** 200 mm
**Switching frequency:** 1.2 Hz
**Repeatability:** 0,2 % or 2 mm

| OUTPUT | TERMINATION | REFERENCE |
|---|---|---|
| PNP, 2 NO/NC | Connector | 943-F4V-2D-001-180E |
| PNP, 2 NO/NC | Cable | 943-F4Y-2D-001-180E |
| NPN, 2 NO/NC | Connector | 943-F4V-2D-002-180E |
| NPN, 2 NO/NC | Cable | 943-F4Y-2D-002-180E |

**Max. sensing distance:** 800 mm
**Min. sensing distance:** 100 mm
**Switching frequency:** 4.7 Hz
**Repeatability:** 0,2 % or 1 mm

| OUTPUT | TERMINATION | REFERENCE |
|---|---|---|
| PNP, 2 NO/NC | Connector | 943-F4V-2D-001-300E |
| PNP, 2 NO/NC | Cable | 943-F4Y-2D-001-300E |
| NPN, 2 NO/NC | Connector | 943-F4V-2D-002-300E |
| NPN, 2 NO/NC | Cable | 943-F4Y-2D-002-300E |

**Max. sensing distance:** 500 mm
**Min. sensing distance:** 60 mm
**Switching frequency:** 4.7 Hz
**Repeatability:** 0,2 % or 1 mm

| OUTPUT | TERMINATION | REFERENCE |
|---|---|---|
| PNP, 2 NO/NC | Connector | 943-F4V-2D-001-330E |
| PNP, 2 NO/NC | Cable | 943-F4Y-2D-001-330E |
| NPN, 2 NO/NC | Connector | 943-F4V-2D-002-330E |
| NPN, 2 NO/NC | Cable | 943-F4Y-2D-002-330E |

### M18

**Housing:** M18 x 1,0 mm plastic (PBTB)
**Max. sensing distance:** 2000 mm
**Min. sensing distance:** 200 mm
**Switching frequency:** 250 ms
**Repeatability:** 0,2 % or ±2 mm

| OUTPUT | TERMINATION | REFERENCE |
|---|---|---|
| 0-10 V | Connector | 943-F4V-2D-1C0-180E |
| 0-10 V | Cable | 943-F4Y-2D-1C0-180E |
| 4-10 mA | Connector | 943-F4V-2D-1D0-180E |
| 4-20 mA | Cable | 943-F4Y-2D-1D0-180E |

**Max. sensing distance:** 800 mm
**Min. sensing distance:** 100 mm
**Switching frequency:** 100 ms
**Repeatability:** 0,2 % or ±1 mm

| OUTPUT | TERMINATION | REFERENCE |
|---|---|---|
| 0-10 V | Connector | 943-F4V-2D-1C0-300E |
| 0-10 V | Cable | 943-F4Y-2D-1C0-300E |
| 4-10 mA | Connector | 943-F4V-2D-1D0-300E |
| 4-20 mA | Cable | 943-F4Y-2D-1D0-300E |

**Max. sensing distance:** 500 mm
**Min. sensing distance:** 60 mm
**Switching frequency:** 100 ms
**Repeatability:** 0,2 % or ±1 mm

| OUTPUT | TERMINATION | REFERENCE |
|---|---|---|
| 0-10 V | Connector | 943-F4V-2D-1C0-330E |
| 0-10 V | Cable | 943-F4Y-2D-1C0-330E |
| 4-10 mA | Connector | 943-F4V-2D-1D0-330E |
| 4-20 mA | Cable | 943-F4Y-2D-1D0-330E |

### M18/M30

**Termination:** Connector M12 x 1
Cable Preleaded 2 m

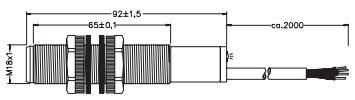
# 940/947 Series Compact, microprocessor controlled with internal temperature compensation

The new 940/947 Series is microprocessor controlled, can be set up quickly and are fitted with epoxy transducers. All the housings are sealed to IP67. The retroreflective versions allow detection of any kind of target without any dead zone. They work with a reflector target.

## OPTIONS

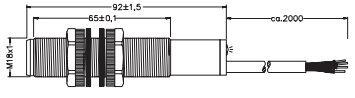
### 1 adjustable switching output PNP NO

**Max. sensing distance:** 600 mm
**Min. sensing distance:** 100 mm
**Beam angle:** 8°
**Repeatability:** 0,3 % or ±1 mm
**Switching frequency:** 25 Hz
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M18 x 1 mm plastic (PBTB)



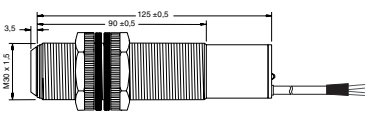

**REFERENCE**
940-F4Y-2D-001-300E

**Max. sensing distance:** 1500 mm
**Min. sensing distance:** 200 mm
**Beam angle:** 8°
**Repeatability:** 0,3 % or ±1 mm
**Switching frequency:** 8 Hz
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M18 x 1 mm plastic (PBTB)




**REFERENCE**
940-F4Y-2D-001-180E

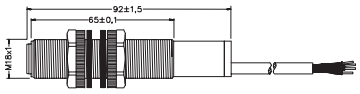
**Max. sensing distance:** 3000 mm
**Min. sensing distance:** 300 mm
**Beam angle:** 8°
**Repeatability**: 0,3% or ±1 mm
**Switching frequency:** 1 Hz
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M30 x 1,5 mm plastic (PBTB)
**Termination:** Preleaded 2 m




**REFERENCE**
947-T4Y-2D-001-130E

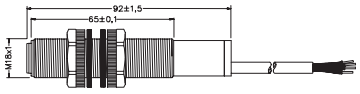
### Analogue voltage output, 0-10 V

**Max. sensing distance:** 600 mm
**Min. sensing distance:** 100 mm
**Beam angle:** 8°
**Repeatability:** 0,2 % or ±2 mm
**Response time:** 50 ms
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M18 x 1 mm plastic (PBTB)
**Termination:** Preleaded 2 m



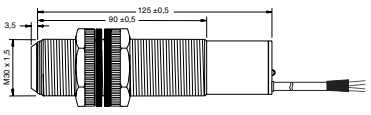

**REFERENCE**
947-F4Y-2D-1C0-300E

**Max. sensing distance:** 1500 mm
**Min. sensing distance:** 200 mm
**Beam angle:** 8°
**Repeatability:** 0,2 % or ±2 mm
**Response time:** 100 ms
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M18 x 1 mm plastic (PBTB)
**Termination:** Preleaded 2 m




**REFERENCE**
947-F4Y-2D-1C0-180E

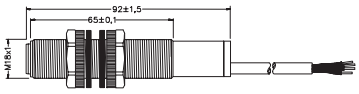
**Max. sensing distance:** 2500 mm
**Min. sensing distance:** 300 mm
**Beam angle:** 8°
**Repeatability:** 0,2 % or ±2 mm
**Response time:** 90 ms
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M30 x 1,5 mm plastic (PBTB)
**Termination:** Preleaded 2 m




**REFERENCE**
947-T4Y-2D-1C0-130E

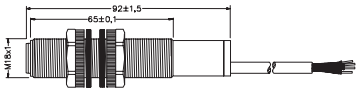
### Retroreflective, PNP NO

**Max. sensing distance:** 600 mm
**Min. sensing distance:** 0 mm
**Min. reflector distance:** 300 mm
**Beam angle:** 8°
**Switching frequency:** 25 Hz
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M18 x 1 mm plastic (PBTB)
**Termination:** Preleaded 2 m



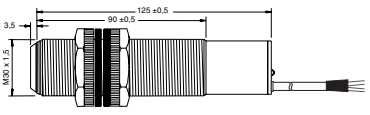

**REFERENCE**
947-FSY-2D-001-300E

**Max. sensing distance:** 1500 mm
**Min. sensing distance:** 0 mm
**Min. reflector distance:** 400 mm
**Beam angle:** 8°
**Switching frequency:** 8 Hz
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M18 x 1 mm plastic (PBTB)
**Termination:** Preleaded 2 m




**REFERENCE**
947-FSY-2D-001-180E

**Max. sensing distance:** 2500 mm
**Min. sensing distance:** 0 mm
**Min. reflector distance:** 600 mm
**Beam angle:** 8°
**Switching frequency:** 1 Hz
**Supply voltage:** 18 to 30 V
**Sealing:** IP67
**Housing:** M30 x 1,5 mm plastic (PBTB)
**Termination:** Preleaded 2 m




**REFERENCE**
947-TSY-2D-001-130E

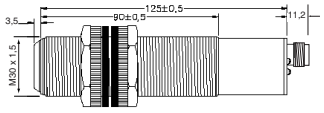
# 944 Series
# Teach in, Analogue and 2 switching outputs

The new 944 series are microprocessor controlled and fully programmable by teach-in, with the simple pressing of a button. They offer analogue and two switching outputs through a standard M-12, 5-pin connector. All the models are IP67 with chemical-resistant body and epoxy face. Parameters are stored in non-volatile memory.

## *OPTIONS*

### *2 switching outputs PNP NO Analogue output 0-10 volts*

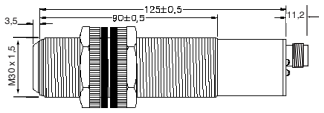
| | |
|---|---|
| **Beam angle:** | 8° |
| **Repeatability :** | 0,4 % or ±2 mm |
| **Supply voltage:** | 19 to 30 V |
| **Sealing:** | IP67 |
| **Housing:** | M30 x 1,5 mm plastic (PBTB) |




| | |
|---|---|
| **Max. sensing distance:** | 3500 mm |
| **Min. sensing distance:** | 350 mm |
| **Switching frequency:** | 0,8 Hz |
| **REFERENCE** | 944-T4V-2D-1C1-130E |
| **Max. sensing distance:** | 2000 mm |
| **Min. sensing distance:** | 250 mm |
| **Switching frequency:** | 1 Hz |
| **REFERENCE** | 944-T4V-2D-1C1-180E |
| **Max. sensing distance:** | 1500 mm |
| **Min. sensing distance:** | 150 mm |
| **Switching frequency:** | 1 Hz |
| **REFERENCE** | 944-T4V-2D-1C1-200E |
| **Max. sensing distance:** | 350 mm |
| **Min. sensing distance:** | 60 mm |
| **Switching frequency:** | 8 Hz |
| **REFERENCE** | 944-T4V-2D-1C1-300E |

### *2 switching outputs PNP NO Analogue output 4-20 mA*

| | |
|---|---|
| **Beam angle:** | 8° |
| **Repeatability :** | 0,4 % or ±2 mm |
| **Supply voltage:** | 19 to 30 V |
| **Sealing:** | IP67 |
| **Housing:** | M30 x 1,5 mm plastic (PBTB) |




| | |
|---|---|
| **Max. sensing distance:** | 3500 mm |
| **Min. sensing distance:** | 350 mm |
| **Switching frequency:** | 0,8 Hz |
| **REFERENCE** | 944-T4V-2D-1D1-130E |
| **Max. sensing distance:** | 2000 mm |
| **Min. sensing distance:** | 250 mm |
| **Switching frequency:** | 1 Hz |
| **REFERENCE** | 944-T4V-2D-1D1-180E |
| **Max. sensing distance:** | 1500 mm |
| **Min. sensing distance:** | 150 mm |
| **Switching frequency:** | 1 Hz |
| **REFERENCE** | 944-T4V-2D-1D1-200E |
| **Max. sensing distance:** | 350 mm |
| **Min. sensing distance:** | 60 mm |
| **Switching frequency:** | 8 Hz |
| **REFERENCE** | 944-T4V-2D-1D1-300E |

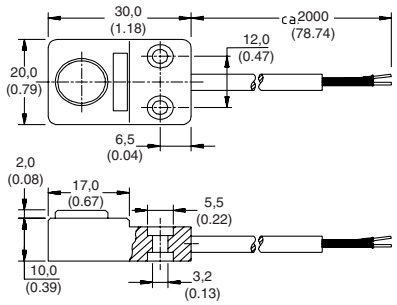
# 948 Series
# Thru scan, 2 part

The 948 series perform presence measurement by using an ultrasonic beam. The 948 series is one of the smallest ultrasonic scan through devices in the world. It is especially suited for food and beverage applications, in particular bottle counting. Easy to install, the 948 series is suitable when space is at a premium.

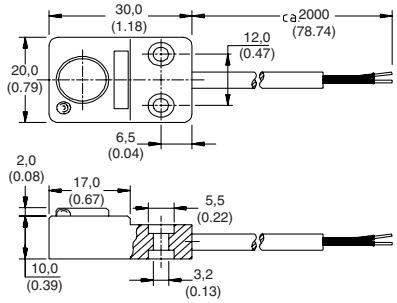
### *1 switching output NO/NC; NPN/PNP*

| | |
|---|---|
| **Max. sensing distance:** | 300 mm |
| **Beam angle:** | 8° |
| **Supply voltage:** | 18 to 30 V |
| **Sealing:** | IP67 |
| **Housing:** | Plastic rectangular |

Transmitter/ Sender/ Transmetteur




Receiver/ Empfänger/ Recepteur




| SWITCHING | REFERENCE |
|---|---|
| PNP/NO | 948-HSY-2D-001-300E |
| NPN/NO | 948-HSY-2D-002-300E |
| PNP/NC | 948-HSY-2D-003-300E |
| NPN/NC | 948-HSY-2D-004-300E |

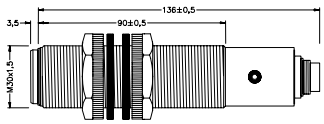
# 942-T Series with Digital Link, Analogue and 2 switching outputs

The new, plastic housing (PBTB), programmable 942-T series provides flexibility to customers through independent analogue and 2 switching outputs to suit most of the applications. The programming is easy to do using Window™ based software.

## OPTIONS

### 2 switching outputs PNP 2NO/NC Analogue output 0-10 volts

| | |
|---|---|
| **Beam angle:** | 8° |
| **Repeatability :** | 0,4 % or ±2 mm |
| **Supply voltage:** | 19 to 30 Vdc |
| **Sealing:** | Connector IP65 |
| | Front face IP67 |
| **Housing:** | M30 x 1,5 mm plastic (PBTB) |
| **Switching frequency:** | 5 to 30 Hz |




| | |
|---|---|
| **Max. sensing distance:** | 3500 mm |
| **Min. sensing distance:** | 350 mm |

**REFERENCE**
942-T4N-2D-1C1-130E

| | |
|---|---|
| **Max. sensing distance:** | 2000 mm |
| **Min. sensing distance:** | 250 mm |

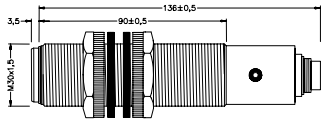
**REFERENCE**
942-T4N-2D-1C1-180E

| | |
|---|---|
| **Max. sensing distance:** | 1500 mm |
| **Min. sensing distance:** | 150 mm |

**REFERENCE**
942-T4N-2D-1C1-200E

### 2 switching outputs PNP 2NO/NC Analogue output 4-20 mA

| | |
|---|---|
| **Beam angle:** | 8° |
| **Repeatability :** | 0,4 % or ±2 mm |
| **Supply voltage:** | 19 to 30 Vdc |
| **Sealing:** | Connector IP65 |
| | Front face IP67 |
| **Housing:** | M30 x 1,5 mm plastic (PBTB) |
| **Switching frequency:** | 5 to 30 Hz |




| | |
|---|---|
| **Max. sensing distance:** | 3500 mm |
| **Min. sensing distance:** | 350 mm |

**REFERENCE**
942-T4N-2D-1D1-130E

| | |
|---|---|
| **Max. sensing distance:** | 2000 mm |
| **Min. sensing distance:** | 250 mm |

**REFERENCE**
942-T4N-2D-1D1-180E

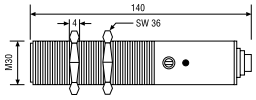
| | |
|---|---|
| **Max. sensing distance:** | 1500 mm |
| **Min. sensing distance:** | 150 mm |

**REFERENCE**
942-T4N-2D-1D1-200E

# 942 Series Compact programmable 30 mm diameter sensor

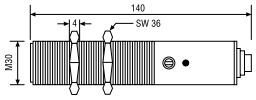
### Voltage output, 0-10 V 2 switching outputs PNP

| | |
|---|---|
| **Max. sensing distance:** | 1500 mm |
| **Min. sensing distance:** | 150 mm |
| **Beam angle:** | 10° |
| **Repeatability:** | 0,4 % or ±2 mm |
| **Switching frequency:** | 5 to 30 Hz |
| **Response time:** | 100 ms |
| **Supply voltage:** | 19 to 30 V |
| **Sealing:** | IP65 |
| **Housing:** | M30 x 1,5 mm stainless steel |




**REFERENCE**
942-A4N-2D-1C1-220S

| | |
|---|---|
| **Max. sensing distance:** | 3000 mm |
| **Min. sensing distance:** | 300 mm |
| **Beam angle:** | 8° |
| **Repeatability:** | 0,4 % or ±2 mm |
| **Switching frequency:** | 5 to 30 Hz |
| **Response time:** | 100 ms |
| **Supply voltage:** | 19 to 30 V |
| **Sealing:** | IP65 |
| **Housing:** | M30 x 1,5 mm stainless steel |

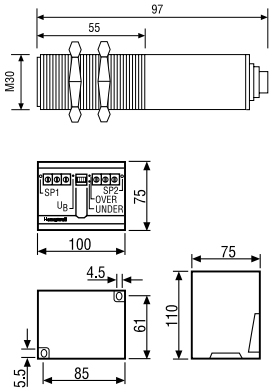



**REFERENCE**
942-A4N-2D-1C1-130E

# 942 Series
# 2 Piece
# 30 mm diameter sensor with RS232 Interface

### *Voltage and current output*
### *2 switching RS232 interface*

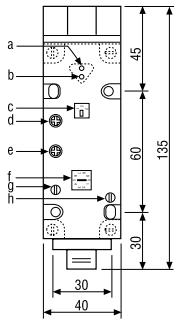
| | |
|---|---|
| **Max. sensing distance:** | 1500 mm |
| **Min. sensing distance:** | 150 mm |
| **Beam angle:** | 10° |
| **Repeatability:** | 0,2 % or ±1 mm |
| **Switching frequency:** | 5 to 8 Hz |
| **Response time:** | 120 ms |
| **Supply voltage:** | 19 to 30 V |
| **Sealing:** | IP65 |
| **Housing:** | M30 stainless steel |




**REFERENCE**
Complete sensor: 942-M3A-2D-1G1-220S

# 941 Series
# Limit switch style

| | |
|---|---|
| **Max. sensing distance:** | 1500 mm |
| **Min. sensing distance (adjustable):** | 200 mm |
| **Beam angle:** | 10° |
| **Repeatability:** | ±1 mm |
| **Supply voltage:** | 18 to 50 V |
| **Sealing:** | IP65 |
| **Housing:** | Zinc die-cast, sea water resistant paint finish |




941-C2V-2E-1C0
a LED echo
b LED Vdc
f Adjustment dead zone
g Adjustment receive sensitivity
h Adjustment slope

941-C2V-2E-2C0
a LED echo
b LED Vdc
c Output adjustment
d Offset
e Gain
f Adjustment dead zone
g Adjustment receive sensitivity

## *OPTIONS*

### *Analogue voltage output, 0-10 V*

| | |
|---|---|
| **Response time:** | 150 ms |

**REFERENCE**
941-C2V-2E-1C0

### *Switching*
### *2 adjustable switching outputs PNP NO*

| | |
|---|---|
| **Switching frequency:** | 10 Hz |

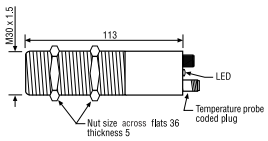
**REFERENCE**
941-C2V-2E-001

# 946 Series
# Teach In
# 30 mm diameter precision output

## OPTIONS

### Analogue voltage (0-10 V) and current (4-20 mA) output

**Beam angle:** 5°
**Repeatability:** < 0,1 %
**Supply voltage:** 10 to 30 V
**Sealing:** IP65
**Housing:** M30 x 1,5 mm stainless steel
**Termination:** M12 connector

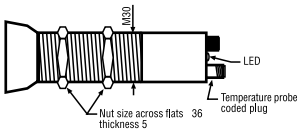



**Max. sensing distance:** 500 mm
**Min. sensing distance:** 30 mm
**Response time:** 21 ms

**REFERENCE**
946-A4V-2D-2C0-380E

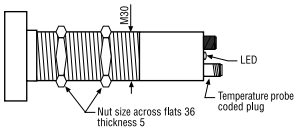
**Max. sensing distance:** 2000 mm
**Min. sensing distance:** 80 mm
**Response time:** 65 ms

**REFERENCE**
946-A4V-2D-2C0-175E




**Max. sensing distance:** 4000 mm
**Min. sensing distance:** 200 mm
**Response time:** 145 ms

**REFERENCE**
946-A4V-2D-2C0-85E

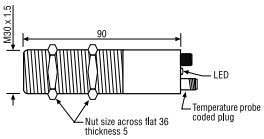



**Max. sensing distance:** 6000 mm
**Min. sensing distance:** 350 mm
**Response time:** 285 ms

**REFERENCE**
946-A4V-2D-2C0-65E

### 2 adjustable switching outputs PNP NO

**Beam angle:** 5°
**Repeatability:** < 1 %
**Supply voltage:** 10 to 30 V
**Sealing:** IP65
**Housing:** M30 x 1,5 mm stainless steel
**Termination:** M12 connector

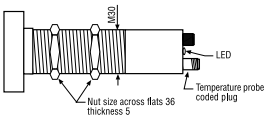



**Max. sensing distance:** 500 mm
**Min. sensing distance:** 50 mm
**Response time:** 65 ms

**REFERENCE**
946-A4V-2D-001-400E

**Max. sensing distance:** 2000 mm
**Min. sensing distance:** 120 mm
**Response time:** 195 ms

**REFERENCE**
946-A4V-2D-001-175E




**Max. sensing distance:** 6000 mm
**Min. sensing distance:** 400 mm
**Response time:** 850 ms

**REFERENCE**
946-A4V-2D-001-65E

# Accessories

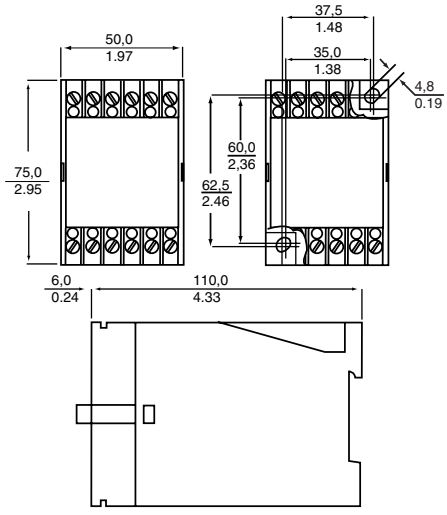
*Due to regional agency approval requirements, some products may not be available in your area. Please contact your regional Honeywell office regarding your choice of product.*

## Power supply

### *24 Vdc regulated power supply with output relay*

The FF-MADB24RB is a small and versatile power supply usually used with the ultrasonic distance sensors, but may be used for any purpose. The power supply accepts 115 or 230 Vac input, is regulated to 24 Vdc. An internal SPDT relay may be triggered by NPN or PNP sensor output.

**Use with Series:** 940, 941, 942, 944, 946, 947
**Supply voltage:** 110 Vac or 220 to 240 Vac
**Circuit protection:** Short circuit
**Load current:** 150 mA max.
**LED indication:** Output relay
**Output type:** Relay SPDT 4 A/250 Vac, 3 A/60 Vdc
**Termination:** Screw
**Housing:** Plastic
**Housing type:** DIN rail mount, 2 holes Ø4,5 mm




**REFERENCE**
FF-MADB24RB

## Beam Deflectors

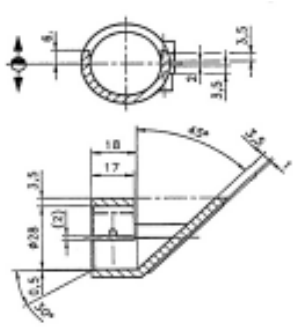
Beam deflectors deflect the ultrasonic beam by 90° with virtually no signal loss. They are extremely useful in applications where space is limited; they allow the space required for the dead zone to be accommodated when setting up the sensor. The focusing beam deflector concentrates the ultrasonic beam, preventing unwanted reflection. It reduces the beam angle by approximately half.

The 43192871 series is made of stainless steel and may be used to fix the sensor. The 66195116-001, made of plastic, is available for M30 sensors only and cannot be used to fix the sensor.

### *OPTIONS*

#### *Compact - M30*

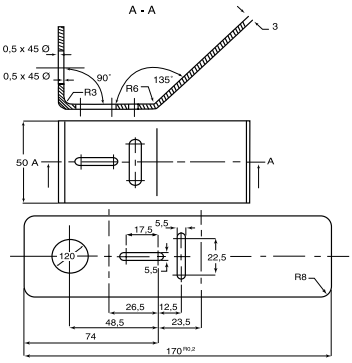
**Use with Series:** 942, 944, 946, 947
**Housing:** Plastic



**REFERENCE**
66195116-001

#### *M30*

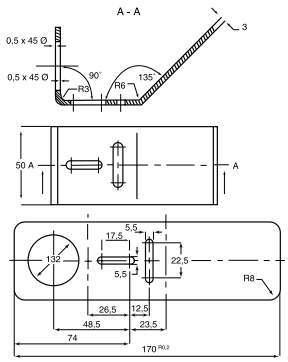
**Use with Series:** 940, 942, 944, 946, 947
**Housing:** Stainless steel




| | REFERENCE |
|---|---|
| | 43192871-001 |
| **Focusing** | 43192871-002 |

#### *M18*

**Use with Series:** 940, 942, 944, 946, 947
**Housing:** Stainless steel




| | REFERENCE |
|---|---|
| | 43192871-003 |
| **Focusing** | 43192871-004 |

# Accessories (continued)

## M12 Connectors

### OPTIONS

### WITHOUT CABLES

#### M12 female, 5 pin, 5 screw terminals

The 66195044-001 is used for the 940, 941, 944, 947 series but may be used for any industrial sensor with standard M12 4 pin or 5 pin connector. The 66195044-001 connector is usually included with every sensor of the above series for connectorised models.

| | |
|---|---|
| **Use with Series:** | 940, 941, 944, 947 |
| **Housing:** | Plastic |
| **Termination:** | Female M12 |
| **Number of pins:** | 5 |

**REFERENCE**
66195044-001

#### M12 female, 7 pin (942 Series)

The 66195074-001 is used for the ultrasonic distance sensor heads 942-A4M. It needs to be wired and soldered at the setup of the sensor. The 66195074-001 is included in every package of the 942 separate series (942 M3A...) but not in the spare ultrasonic heads (942-A4M..).

| | |
|---|---|
| **Use with Series:** | 942 |
| **Housing:** | Stainless Steel |
| **Termination:** | Female Binder |
| **Number of pins:** | 7 |

**REFERENCE**
66195074-001

### WITH CABLES

#### M12 female, 5 pin, 2 metre cable (supplied with 946 Series)

The 55002 is a 5 pin, M12 female, metal, cable connector with 2 metres of cable attached. It is used with the 946 series but may be used for any industrial sensor with standard M12 4 pin or 5 pin connector. The 55002 cable connector is included with every sensor of the 946 series.

| | |
|---|---|
| **Use with Series:** | 940, 941, 944, 946, 947 |
| **Termination:** | Female M12 |
| **Number of pins:** | 5 |

**REFERENCE**
55002

#### Female, 8 pin, 2 metre cable (942 Series Compact)

The 55195126-001 is an 8 pin, female, metal, cable connector with 2 metres of cable attached. It used with the 942-A4N compact series. This device is useful but not necessary to setup the sensor, as every ultrasonic distance sensor 942-A4N is provided with a female connector without cable, with pins to solder.

| | |
|---|---|
| **Use with Series:** | 942 |
| **Housing:** | Stainless steel |
| **Termination:** | Female Binder |
| **Number of pins:** | 8 |

**REFERENCE**
55195126-001

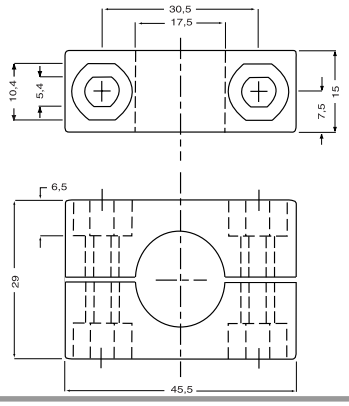
## Mounting Clamps

The 43178389 are plastic mounting clamps usually used with the ultrasonic distance sensors, but may be used with any M18 or M30 industrial sensors. The 43178389 feature 2-part plastic clamps with 2 M5x60 mm screws and nuts.

### OPTIONS

#### M18

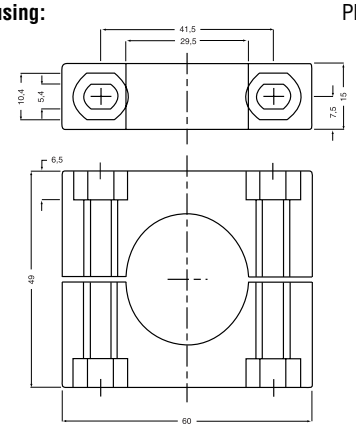
| | |
|---|---|
| **Use with Series:** | 940 |
| **Housing:** | Plastic |




**REFERENCE**
43178389-018

#### M30

| | |
|---|---|
| **Use with Series:** | 942, 944, 946, 947 |
| **Housing:** | Plastic |




**REFERENCE**
43178389-030

# Programming

## OPTIONS

### Software

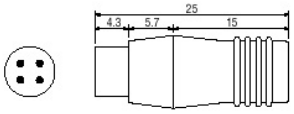
The software package 55195101-101 contains software for programming 942 series separate and 55195101-102 for the 942 series compact . The software runs under Microsoft Windows™ versions 95™ and later.

Both packages contain an RS-232 cable (crossed) with 2 Sub-D 9 pin connectors, to connect to a PC. For 55195101-101 (942 Series separate), the other end of the cable connects to the control box 942-M0A.... by screw terminals. For 55195101-102 (942 Series compact), the other end of the cable connects to programming module 55000005-002.

For sensor series 942T... the programming cable gives easy access to the RS232 interface. The RS232 interface of the connector is directly connected to the Sub-D 9 pin connector, which allows easy connection to a PC. The Windows™ based software is easy to use and is supplied on a floppy disc with the programming cable.

| | REFERENCE |
|---|---|
| 942-A Series Separate | 55195101-101 |
| 942-N Series Compact | 55195101-102 |
| 942-T Series (includes programming cable) | 55000018-001 |

### Programming adaptor for 946 Series




**Use with Series:** 946
**Sealing:** IP65
**Number of pins:** 4

**REFERENCE**
40779

### 942 Series Compact programming module

The 55000005-002 is a programming module for the 942-A4N series. Although this device is not necessary to setup the sensor, it is very useful as it provides quick connections for the RS-232 data link and the 'hold' switch.

It features 1 connector din Sub-D 9 pin, compatible with the cable included in the software package 55195101-102, 1 microswitch to put the sensor in 'hold' mode (necessary for the RS-232 link), 1 female and 1 male connector to be inserted between the customer's interface and the 942-A4N sensor.

The 55000005-002 may be used to programme any number of sensors and is not necessary in the usual run of the application. It is not compatible with 942 separate series.

**REFERENCE**
55000005-002

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