

Honeywell

Interactive Catalog Replaces Catalog Pages

Honeywell Sensing and Control has replaced the PDF product catalog with the new **Interactive Catalog**. The **Interactive Catalog** is a power search tool that makes it easier to find product information. It includes more installation, application, and technical information than ever before.



**Click this icon to try the new
Interactive Catalog.**

Proximity Sensors

Ultrasonic Precision Proximity Sensors



Ultrasonic position sensors solve the toughest sensing problems. Ultrasonic sensors detect targets made of virtually any material, regardless of color. Clear, transparent, shiny targets are seen as easily as dark and opaque materials. Ultrasonic sensors detect materials ranging from clear glass bottles to black rubber tires without physical contact. In a shrink wrapping operation, for instance, the sensor can be applied so that it ignores the shiny highly reflective wrap, and concentrates only on the target. These highly accurate sensors use a time lapse system to provide **background suppression**. Background suppression is the ability of the sensor to detect the intended target and ignore background materials, regardless of color or reflectance.

HARSH DUTY APPLICATION

Ultrasonic sensors have the unique ability to perform in dry, dusty environments. Ash, soot, sawdust and the like do not impede the ability of the sensor to perform accurately and repeatedly. Many other sensing technologies falter in this type of severe environment.

TEMPERATURE COMPENSATION

Ultrasonic sensors use the surrounding air as the transport medium for the ultrasonic signal. The speed of sound in air varies as the temperature changes. The sensors automatically compensate for these ambient air temperature changes. A time elapsed temperature compensation circuit in each sensor continually adjusts the

sensor to operate within ± 0.2 to $\pm 0.5\%$ of the setpoint, depending upon the listing, over 0 to 50°C. They will operate over 0 to 70°C, but the temperature error will be larger.

BACKGROUND SUPPRESSION

900 Series ultrasonic sensors sense the intended target without sensing material located just behind it. They operate on an elapsed time measurement system. When the sensor is adjusted to sense a target at a given distance, a timing window is established. The sensor accepts or acknowledges **only** the echoes received within this window. Signals echoing from background material take longer, and are not acknowledged.

HIGH CARRIER FREQUENCY

Ultrasonic sound is defined as any sound greater than 20,000 cycles per second (20 kHz). 900 Series operate between 130 and 300 kHz, and are more noise immune to air and sound disturbances than sensors operating at lower frequency. Typical industrial environments have a peak noise level between 40-50 kHz, causing false actuations in ultrasonic sensors operating close to this noise peak. 900 Series ultrasonic sensors transmit a burst of high frequency sound waves, much higher in frequency than the noise in typical industrial environments.

INHIBIT/SYNC SIGNAL SETTING

With the exception of the low cost 945 Series, the 900 Series offer an Inhibit/Sync function which controls the sensor's mode of operation. When the Inhibit/Sync wire is connected to ground (0 VDC), the sensor is placed in the inhibit mode.

Multiplexing/Synchronizing

Sensors; When two or more sensors are mounted close to each other, acoustic interference is possible. Inhibit multiplexes the sensors so that only one transmits the ultrasonic signal at a given time. Also, the inhibit signal wires from all the sensors can be connected together, synchronizing the sensors to transmit at the same time.

FEATURES

- Sense virtually any material:
 - Solid or liquid
 - Metallic or non-metallic
 - Transparent, translucent or opaque
- **Background suppression**
- Temperature compensation
- 940 Series – 30 mm diameter cylindrical high performance
 - DC switching and analog outputs
 - Preleaded or connector style
 - Stainless steel or plastic (self-contained) housing
 - No external amplifiers necessary
 - Sealed to IP 65
- 941 Series – Limit Switch Style
 - High performance
 - 2 set point switching outputs
 - Analog output
 - Micro connector style
 - No external amplifiers needed
 - Sealed to IP 65
- 942 Series – 30 mm diameter cylindrical high performance stainless steel sensor head, remote amplifier
 - Sensor sealed to IP 65
 - Remote amplifier sealed to IP54
 - Compact sensor available
 - Dual switching outputs
 - BCD outputs
 - HEX outputs
 - Analog outputs
 - Adjustable null and span
 - High scanning range
- 945 Series – 18 mm diameter cylindrical low cost/high performance
 - Analog output
 - DC switching outputs
 - Plastic or stainless steel housings
 - Sealed to IP 65
- 946 Series
 - 30mm self contained stainless steel housing
 - 2 setpoints or analog outputs
 - Programmable
 - Sealed to IP 65
 - High scan range

Proximity Sensors

Ultrasonic Precision Proximity Sensors

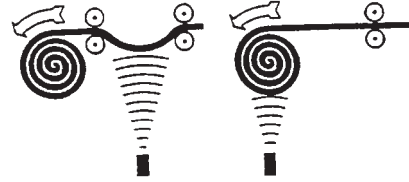
TYPICAL APPLICATIONS

Application

- Roll diameter measurement
- Wind and unwind control
- Web tension or loop measurement

Used in:

- Paper processing
- Film processing
- Rubber/tire processing
- Steel processing

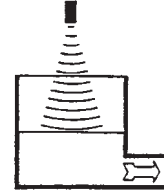


Application

- Level control in tanks (granular/liquid)
- Fill level in bottling/canning applications

Used in:

- Food and beverage
- Chemical
- Plastics industry

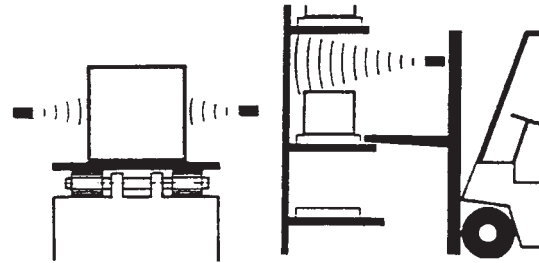


Application

- Part presence/absence sensing
- Glass and clear parts detection

Used in:

- Food and beverage
- Material handling
- Assembly equipment

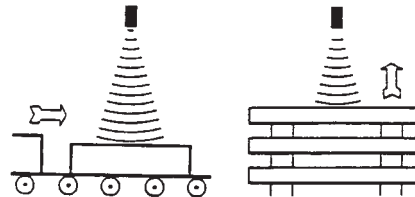


Application

- Height/width measurement
- Packaging

Used in:

- Material handling
- Metal working

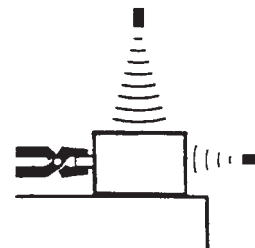


Application

- Distance measurement
- Work-piece positioning for robotics
- Height measurement

Used in:

- Automotive
- Metal working
- Assembly equipment





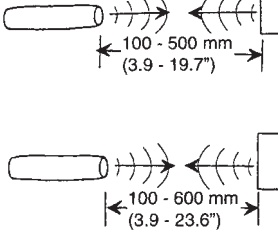

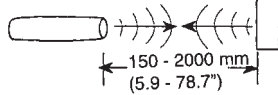

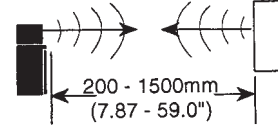



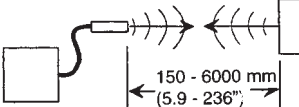

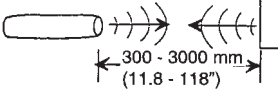

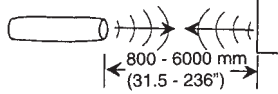
Proximity Sensors

Ultrasonic Product Selection Guide

OPERATION PRINCIPLE

Ultrasonic sensors have an acoustic transducer which is vibrating at ultrasonic frequencies. The pulses are emitted in a cone-shaped beam and aimed at a target object. Pulses reflected by the target to the sensor are detected as echoes. The device measures the time delay between each emitted and echo pulse to accurately determine the sensor-to-target distance.

All materials sensing Ultrasonic Position Sensors solve the toughest sensing problems and detect targets made of virtually any material, regardless of color. They detect clear, transparent and shiny targets as easily as dark and opaque materials. This ability allows ultrasonic sensors to detect materials ranging from clear glass bottles to black rubber tires. In a shrink wrapping operation, for instance, the sensor can accurately and repeatedly detect the wrapping material regardless of how shiny or clear it may be. Ultrasonic sensors also work well in tough environments — fumes, dust, noisy.

Sensor Family	Distance	Input	Output Type	Repeatability	Application Criteria
945 F/N  945-L/S 	 <p>100 - 500 mm (3.9 - 19.7")</p> <p>100 - 600 mm (3.9 - 23.6")</p>	19-30 VDC	PNP N.O. or NPN N.O. Single Digital or 1-6 Volts Analog	$\pm 5\text{mm}$ (0.020") or 0.3% of measured distance $\pm .5\text{mm}$ (0.020") or .3% of measured distance	<ul style="list-style-type: none"> Low cost/compact Smallest cylindrical available Excellent price/performance Thru-scan/specular capable Plastic housing - digital setpoint Stainless Steel housing - analog output - L Series Small dead zone External setpoint adjustment possible
	 <p>150 - 2000 mm (5.9 - 78.7")</p>	18-30 VDC	PNP or NPN N.O. Digital or Analog output	$\pm 1\text{mm}$ (0.040")	<ul style="list-style-type: none"> For longer range or difficult detection applications Stainless steel housing, analog Connector micro style Internal or remote adjustment 18 mm plastic housing, digital
	 <p>200 - 1500mm (7.87 - 59.0")</p>	20-48 VDC	PNP N.O. Dual Digital 0-10 Volts analog	$\pm 1\text{mm}$ (.040")	<ul style="list-style-type: none"> Limit switch rugged housing Output slope adjustment Ease of installation in hi-low tank control (no concerns over crosstalk)
  	 <p>150 - 6000 mm (5.9 - 236")</p>	19-30 VDC	PNP N.O. or N.C. Dual Digital and 0-10 Volts 4-20mA BCD/HEX PNP N.O. and PNP N.C. Dual Digital RS232 or RS485 programmable available	$\pm 1\text{mm}$ or 0.2% of measured distance	<ul style="list-style-type: none"> Highly flexible outputs Simple set-up and installation Highest accuracy/performance OEM and user product
	 <p>300 - 3000 mm (11.8 - 118")</p>	19-30 VDC	PNP N.O. or N.C. 0-10 Volts or 4-20 mA RS232 or RS485 programmable	$\pm 2\text{mm}$	<ul style="list-style-type: none"> Self contained Programmable Analog output independent of the setpoint position
	 <p>800 - 6000 mm (31.5 - 236")</p>	10-30 VDC	Analog, 0-10 Volts or 4-20 mA PNP, Dual Digital	Programmable	<ul style="list-style-type: none"> Voltage and current output Programmable Up to 6000 mm scan range 2 independent setpoints NO, NC window characteristic possible

Proximity

Ultrasonic Sensors


Compact 18 mm Diameter Digital

940 Series

FEATURES

- Sensing distance up to 1,5 meters
- 18 mm diameter housing
- IP 67 sealing
- High output current
- High power transducer
- Microprocessor controlled

ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Digital Output	Termination	Catalog Listing
18 mm dia. PBTB Plastic 	200 - 1500 (7.87 - 59.05)	PNP, N.O.	Cable	940-F4Y-2D-001-180E
		NPN, N.O.	Cable	940-F4Y-2D-002-180E
		PNP, N.O.	Connector cable	940-F4X-2D-001-180E
		NPN, N.O.	Connector cable	940-F4X-2D-002-180E
	150 - 700 (5.9 - 27.5)	PNP, N.O.	Cable	940-F4Y-2D-001-300E
		NPN, N.O.	Cable	940-F4Y-2D-002-300E
		PNP, N.O.	Connector cable	940-F4X-2D-001-300E
		NPN, N.O.	Connector cable	940-F4X-2D-002-300E

* Standard target is 120 mm square of mild steel perpendicular to ultrasonic beam.

SPECIFICATIONS

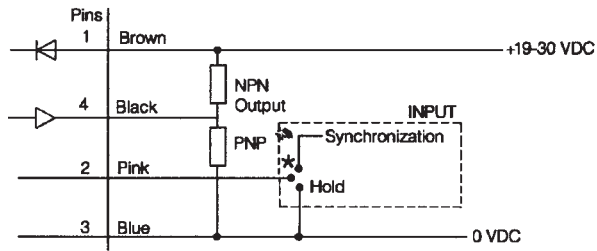
Catalog Listings	940-F4Y-2D-001-180E 940-F4Y-2D-002-180E 940-F4X-2D-001-180E 940-F4X-2D-002-180E	940-F4Y-2D-001-300E 940-F4Y-2D-002-300E 940-F4X-2D-001-300E 940-F4X-2D-002-300E
Max. Sensing Distance	1500 mm (59.05 in.)	700 mm (27.5 in.)
Min. Sensing Distance	200 mm (7.87 in.)	150 mm (5.91 in.)
Beam Angle	8°	8°
POWER SUPPLY		
Supply Voltage	19 - 30 VDC	
Supply Current	<25 mA without load	<35 mA without load
Circuit Protection	Reverse polarity	
OUTPUT CHARACTERISTICS		
Load Current	0 - 500 mA	
Switching Frequency	8 Hz	25 Hz
Hysteresis	~ 2% of setpoint	~ 2.5% of setpoint
Repeatability	± 1 mm	
Setpoint Adjustment	4-turn potentiometer	
Circuit Protection	Short circuit	
ENVIRONMENTAL		
Operating Temperature	-15 to 70°C (5 to 158°F)	
Storage Temperature	-25 to 85°C (-13 to 185°F)	
Sealing	IP 67	
SPECIAL FEATURES		
Hold Input	Stops transmission and reception when input is connected to 0 VDC. Last output will be stored until input is disconnected	
Synchronization Input	Avoids mutual interference from several sensors by interconnecting the hold input from each sensor.	
LED Indicator	Illuminates when sensor detects target	

Ultrasonic Sensors

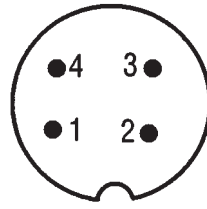
940 Series

Compact 18 mm Diameter Digital

WIRING DIAGRAM



940-F4X/Y-20-001/2-300E Versions only



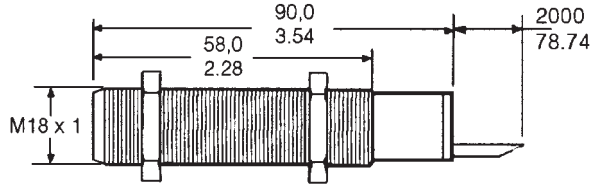
4-pin DC Micro (M12 x 1)

Pin	Color
1	BRN
2	PINK
3	BLU
4	BLK

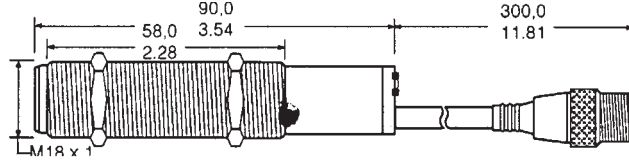
*Normal operation with no connection

MOUNTING DIMENSIONS (For reference only)

940-F4X/Y-20-001/2-180E



940-F4X/Y-2D-001/2-300E



ACCESSORIES

	Catalog Listing	Feature
Mounting clamp	43178389-018	Allows mounting to a flat surface
Beam deflector	43192871-003	Allows right angle mounting (Approx. dim. 50 x 170 mm)
Focusing beam deflector	43192871-004	Reduces beam angle by approximately 1/2 (Approx. dim. 35 x 52 mm)
Straight connector w/o cable	66195044-001	Connector has screw terminals for wiring connection
Right angle connector w/o cable	66195045-001	Connector has screw terminals for wiring connection
24 VDC Power supply, Relay output, 110 VAC input	FF-MADB24RB	See page B102 for more information
24 VDC Power supply, On/Off delay, 110 VAC input	FF-MADC24RB	See page B102 for more information

Proximity

Ultrasonic Sensors


30 mm Diameter Analog

940 Series

FEATURES

- Measuring range up to 2000 mm (78.74 in.)
- High repeatability

ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Analog Output	Termination	Catalog Listing
 30 mm dia. Stainless Steel	300 - 2000 (11.81 - 78.74)	1.5 - 10 V	Cable	940-A4Y-AD-1C0-130E
	150 - 1200 (5.90 - 47.24)	1.25 - 10 V	Cable	940-A4Y-AD-1C0
			Connector	940-A4V-AD-1C0

* Standard target is 120 mm square of mild steel perpendicular to ultrasonic beam.

SPECIFICATIONS

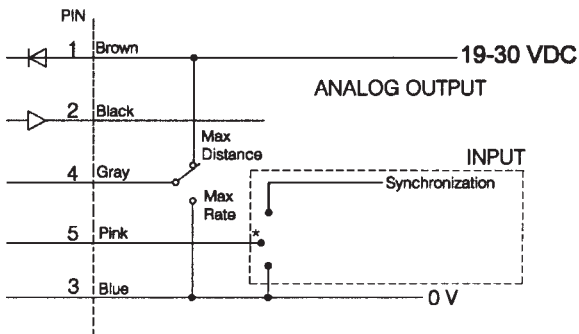
Catalog Listings	940-A4Y-AD-1C0-130E		940-A4Y-AD-1C0 940-A4V-AD-1C0	
	Max. Range	Max. Rate	Max. Range	Max. Rate
Max. Sensing Distance	2000 mm (78.74 in.)	1000 mm (39.37 in.)	1200 mm (47.2 in.)	600 mm (23.6 in.)
Min. Sensing Distance	300 mm (11.8 in.)		150 mm (5.91 in.)	
Beam Angle	8°		10°	
POWER SUPPLY				
Supply Voltage	19 - 30 VDC			
Supply Current	<20 mA without load			
Circuit Protection	Reverse polarity			
OUTPUT CHARACTERISTICS				
Load Current	10 mA max.			
Switching Frequency	6 Hz		11 Hz	
Repeatability	±2 mm		±1 mm	
Linearity	<0.2%			
Output Adjustment	4 Turn Potentiometer			
Output Mode	Max. Range or Max. Rate selected by wiring terminal connection			
Circuit Protection	Short Circuit			
ENVIRONMENTAL				
Operating Temperature	0 to 50°C (32 to 122°F)			
Storage Temperature	0 to 70°C (32 to 158°F)			
Sealing	IP 65			
SPECIAL FEATURES				
Hold Input	Stops transmission and reception of sensor when input is connected to 0 VDC. Analog output would be zero.			
Synchronization Input	Avoids mutual interference from several ultrasonic sensors (external synchronization unit required; see Accessories)			
LED Indicator	Illuminates when sensor detects a target			

Ultrasonic Sensors

940 Series

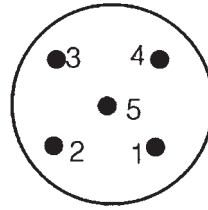
30 mm Diameter Analog

WIRING DIAGRAM



*Normal operation with connection +19-30 VDC

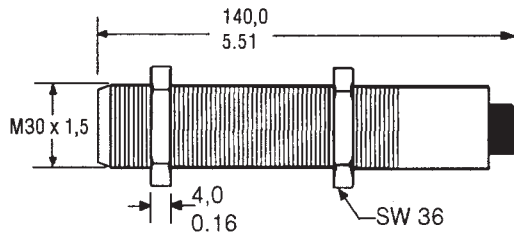
CONNECTOR VERSION ONLY



Pin	Color
1	BRN
2	WHT
3	BLU
4	BLK
5	GRAY

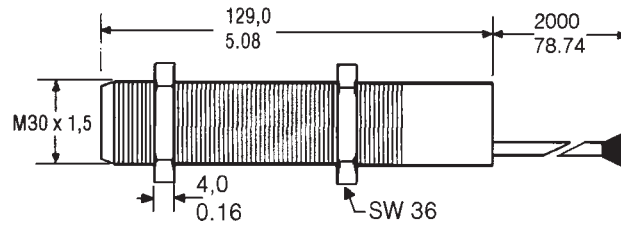
MOUNTING DIMENSIONS (For reference only)

940-A4V-AD-1C0



940-A4Y-AD-1C0-130E

940-A4Y-AD-1C0



ACCESSORIES

	Catalog Listing	Feature
Mounting clamp, 30 mm sensor	43178389-030	Allows mounting to a flat surface
Beam deflector	43192871-001	Allows right angle mounting (Approx. dim. 50 x 170 mm)
Focusing beam deflector	43192871-002	Reduces beam angle by approximately 1/2
Compact deflector	66195116-001	Allows right angle mounting (Approx. dim. 35 x 52 mm)
2 meter cable, Straight connector	RKT5-612/2M	Used for wiring to connector version
5 meter cable, Straight connector	RKT5-612/5M	Used for wiring to connector version
2 meter cable, Right angle connector	RKWT5-612/2M	Used for wiring to connector version
5 meter cable, Right angle connector	RKWT5-612/5M	Used for wiring to connector version
Synchronization unit	55000001	Controls up to 100 sensors


Proximity

Compact 30 mm Diameter Analog and Digital, RS232/RS485 Interface

FEATURES

- Programmable
- RS232 or RS485 interface
- 0 - 10 VDC/4 - 20 mA output
- Two N.O. PNP outputs or one N.O. PNP/one N.C. PNP output

ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Analog Output	Digital Output	Interface	Catalog Listing
30 mm dia. Stainless Steel  272,1g (9.6 oz)	300 - 3000 (11.8 - 118)	0 - 10 V	PNP, N.O./N.C.	RS232	942-A4N-2D-1C1-130E
		4 - 20 mA	PNP, N.O./N.C.	RS232	942-A4N-2D-1D1-130E
		0 - 10 V	PNP, N.O./N.C.	RS485	942-A4N-2D-1E1-130E
		4 - 20 mA	PNP, N.O./N.C.	RS485	942-A4N-2D-1F1-130E
	150 - 1500 (5.9 - 59.1)	0 - 10 V	PNP, N.O./N.C.	RS232	942-A4N-2D-1C1-220S
		4 - 20 mA	PNP, N.O./N.C.	RS232	942-A4N-2D-1D1-220S
		0 - 10 V	PNP, N.O./N.C.	RS485	942-A4N-2D-1E1-220S
		4 - 20 mA	PNP, N.O./N.C.	RS485	942-A4N-2D-1F1-220S
	100 - 600 (3.94 - 23.6)	0 - 10 V	PNP, N.O./N.C.	RS232	942-A4N-2D-1C1-300E

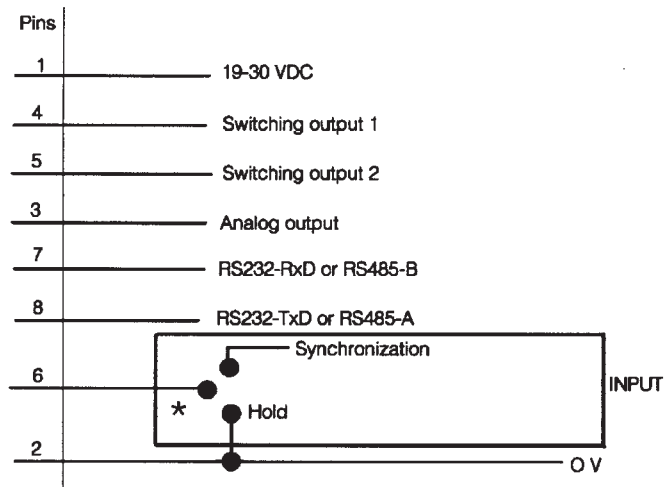
* Standard target is 120 mm square of mild steel perpendicular to ultrasonic beam.

SPECIFICATIONS

Catalog Listings	942-A4N-2D-1C1-130E 942-A4N-2D-1D1-130E 942-A4N-2D-1E1-130E 942-A4N-2D-1F1-130E	942-A4N-2D-1C1-220S 942-A4N-2D-1D1-220S 942-A4N-2D-1E1-220S 942-A4N-2D-1F1-220S	942-A4N-2D-1C1-300E
Max. Sensing Distance	3000 mm (118 in.)	1500 mm (59.1 in.)	600 mm (23.6 in.)
Min. Sensing Distance	300 mm (11.8 in.)	150 mm (5.91 in.)	100 mm (3.94 in.)
Beam Angle	8°	10°	8°
POWER SUPPLY			
Supply Voltage	19 - 30 VDC		
Supply Current	< 30 mA without load		
Circuit Protection	Reverse Polarity		
OUTPUT CHARACTERISTICS (DIGITAL)			
Load Current	0 - 100 mA		
Hysteresis	Programmable (0 - 255 mm)		
Switching Frequency	Programmable 5-30 Hz	Programmable 5-30 Hz	Programmable 5-50 Hz
Repeatability	±2 mm or ±0.4% of reading		
Setpoint Adjust	Programmable within sensing range		
Circuit Protection	Short circuit		
OUTPUT CHARACTERISTICS (ANALOG)			
Switching Frequency	Programmable 5-30 Hz	Programmable 5-30 Hz	Programmable 5-50 Hz
Repeatability	±2 mm or ±0.4% of reading		
Linearity	3 mm or ±0.5%		
Output Adjust	Programmable		
Circuit Protection	Short circuit		
ENVIRONMENTAL			
Operating Temperature	-15 to 70°C (5 to 150°F)		
Storage Temperature	-25 to 85°C (-13 to 185°F)		
Sealing	IP 65		
SPECIAL FEATURES			
Hold Input	Stops transmission and reception when input is connected to 0 VDC. Analog output would be zero.		
Synchronization input	Avoids mutual interference from several sensors by interconnecting the Hold input from each sensor.		
LED Indicator	Illuminates when sensor detects target		
Programmable Parameters	Analog Output: Span, Offset, Positive or Negative slope Digital Output: Hysteresis, N.O./N.C.		

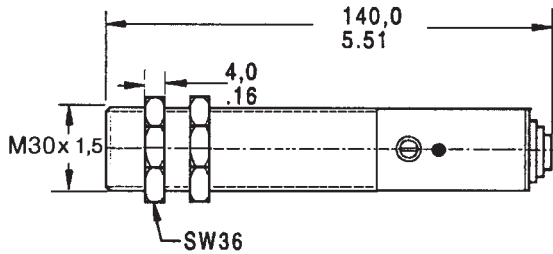
Compact 30 mm Diameter Analog and Digital, RS232/RS485 Interface

WIRING DIAGRAM



*Normal operation with no connection

MOUNTING DIMENSIONS (For reference only)



ACCESSORIES


	Catalog Listing	Features
Mounting clamp	43178389-030	Allows mounting to flat surface
Beam deflector	43192871-001	Allows right angle mounting (approx. dim. 50 x 170 mm)
Focusing beam deflector	43192871-002	Reduces beam angle by approximately 50%
Compact deflector	66195116-001	Allows right angle mounting (approx. dim. 35 x 52 mm)
Programming adapter	55000005-002	Allows sensor programming via RS232 interface
RS232/RS485 converter	55000003-001	Converts RS232 interface to RS485 interface
24 VDC Power supply, relay output, 110 VAC input	FF-MADB24RB	See page B102 more information
24 VDC Power supply, On/Off delay, 110 VAC input	FF-MADC24RB	See page B102 more information
Software package (disk, manual, cable + 1 sub min D9 connector)	55195101-101	Allows programming of sensor
Software package (disk, manual, cable + 2 sub min D9 connectors)	55195101-102	Allows programming of sensor
Straight connector	66195126-001	Used for wiring to connector
2 meter cable with straight connector	55195126-001	Used for wiring to connector

2-Piece 30 mm Diameter Precision Switching, Analog, Digital BCD, Hexadecimal Outputs

FEATURES

- **Background suppression**
- Sensor sealed to IP 65
- Amplifier sealed to IP 54
- DIN rail mounting
- Compensated over 0 to 50°C (32 to 120°F)
- Amplifier provides analog, digital switching, BCD or hexadecimal outputs

ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Digital Output**	Multiplex Digital Output	Analog Output	Catalog Listing***
30 mm (1.18 in.) Stainless steel sensor head  272g (9.6 oz)	150 - 1500 (5.9 - 59.0)	Two PNP N.O. or N.C.	BCD/HEX	0 - 10 VDC 4 - 20 mA	942-M3A-2D-1G1-220S *Standard target: 120 mm thick square of mild steel perpendicular to ultrasonic beam. **N.O./N.C. output selectable ***Includes stainless steel sensor head, cable, straight connector and amplifier.

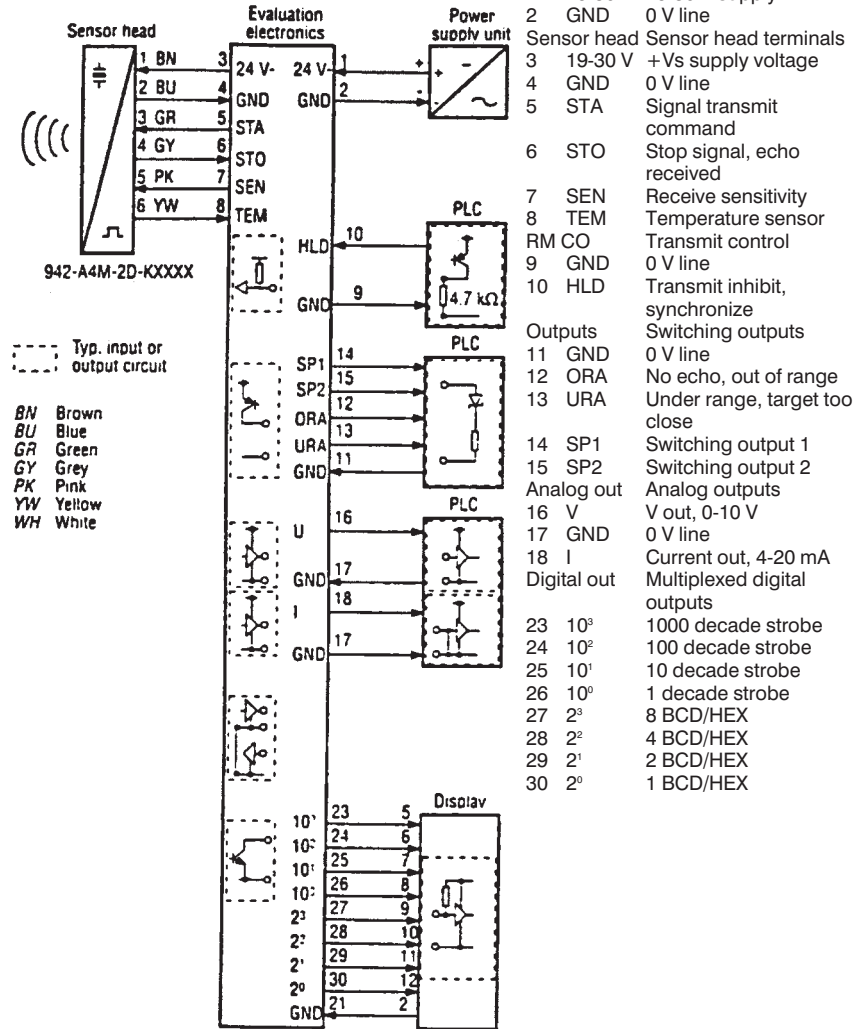
SPECIFICATIONS

Max. Sensing Distance	1500 mm (59.1 in.)
Min. Sensing Distance	150 mm (5.91 in.)
Beam Angle	10°/5°
POWER SUPPLY	
Supply Voltage	19-30 VDC
Supply Current	< 130 mA without load
Circuit Protection	Reverse polarity
OUTPUT CHARACTERISTICS (DIGITAL)	
Load Current	0-100 mA
Hysteresis	±1% of setpoint
Switching Frequency	8 Hz
Repeatability	±1 mm or 0.2% of reading
Setpoint Adjustment	Digital switches
Output Adjustment	Beam angle 10° w/max. sensitivity or beam angle 5° w/min. sensitivity
Circuit Protection	Short circuit
OUTPUT CHARACTERISTICS (MULTIPLEX DIGITAL)	
Resolution	1 mm
Information Output	Bit Parallel/Word Serial
Setpoint Adjustment	Beam angle 10° w/max. sensitivity or beam angle 5° w/min. sensitivity
OUTPUT CHARACTERISTICS (ANALOG)	
Switching Frequency	8 Hz
Repeatability	±1 mm or 0.2% of reading
Linearity	±2 mm or 0.3%
Output Range Adjustment	Digital switches
Output Adjustment	Beam angle 10° w/max. sensitivity or beam angle 5° w/min. sensitivity
Min. Load Resistance (VDC)	1000 Ohms (0-10 VDC output)
Max. Load Resistance (mA)	250 Ohms (4-20 mA output)
Slope of Output	Positive or Negative via switch
ENVIRONMENTAL	
Operating Temperature	Sensor head: 0 to 70°C (32 to 158°F)/Amplifier: 0 to 50°C (32 to 122°F)
Storage Temperature	Sensor head/Amplifier: -25 to 85°C (-13 to 185°F)
Sealing	Sensor Head: IP 65/Amplifier: IP 54
SPECIAL FEATURES	
LED Indicators	RED - Under Range/ RED - Over Range: illumination dependent on analog range chosen and target position with respect to sensor YELLOW - Setpoint: illuminates when target reaches setpoint 1 or setpoint 2
Hold Input	Stops transmission and reception when input is connected to 0 VDC. Last output stored until input is disconnected
Synchronization Input	Avoids mutual interference from several sensors by interconnecting the hold input from each sensor

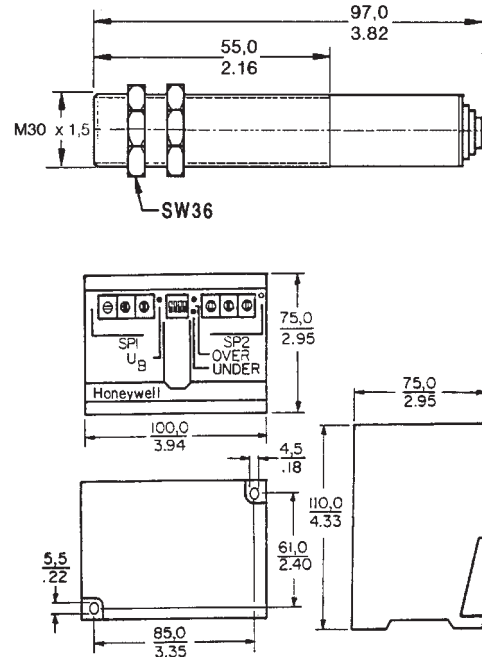
2-Piece 30 mm Diameter

Precision Switching, Analog, Digital BCD, Hexadecimal Outputs

WIRING DIAGRAM



MOUNTING DIMENSIONS (For reference only)



Proximity

ACCESSORIES

	Catalog Listing	Features
Mounting clamp	43178389-030	Allows mounting to flat surface
Beam deflector	43192871-001	Allows right angle mounting (approx. dim. 50 x 170 mm)
Focusing beam deflector	43192871-002	Reduces beam angle by approximately 50%
Compact deflector	66195116-001	Allows right angle mounting (approx. dim. 35 x 52 mm)

REPLACEMENT LISTINGS

Sensor Head	942A4M-2D-K220S
Amplifier	942-M0A-2D-1G1-220S
Straight Connector (cable not included)	66195074-001

942 SERIES ULTRASONIC CROSS REFERENCE

Obsolete Listing	Replacement Listing	Comments
942-M88 942-M88-LF	942-M96	Sensor head, includes connector
942-M3A-2D-1G1	942-M0A-2D-1G1-220S	Amplifier

Ultrasonic Sensors



Precision Digital 18 mm Diameter

945 Series

FEATURES

- Background suppression
- Sealed to IP 65
- Fixed or adjustable setpoint control
- Temperature compensation over 0 to 50°C (32 to 122°F)
- Inhibit/synchronization input
- Stainless steel or plastic housings

ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Setpoint	Output Type	Catalog Listing
18 mm dia. Plastic  90,7 g (3.2 oz.)	100 - 500 (3.9 - 19.68)	Fixed @ 400 mm (15.75 in.) ± 20 mm**	PNP, N.O.	945-F4Y-AD-001
			NPN, N.O.	945-F4Y-AD-002
	100 - 200 (3.9 - 7.87)	Fixed @ 200 mm (7.87 in.) ± 20 mm**	PNP, N.O.	945-N4Y-AD-001
			NPN, N.O.	945-N4Y-AD-002
200 - 500 (7.87 - 19.68)	Setpoint adjustment within sensing range	PNP, N.O.	945-F4Y-AD-001-180E	
		PNP, N.O.	945-F4Y-AD-001-300E	
18 mm dia. Stainless Steel  136 g (4.8 oz.)	100 - 500 (3.9 - 19.68)	Setpoint adjustment within sensing range	PNP, N.O.	945-L4Y-AD-001
			NPN, N.O.	945-L4Y-AD-002
	100 - 200 (3.9 - 7.87)	Setpoint adjustment within sensing range	PNP, N.O.	945-S4Y-AD-001
			NPN, N.O.	945-S4Y-AD-002

* Standard target is 120 mm square of mild steel perpendicular to ultrasonic beam.

**External setpoint adjustment wiring possible.

SPECIFICATIONS

SENSING CHARACTERISTICS

Catalog Listings	945-F4Y-AD-001 945-F4Y-AD-002 945-L4Y-AD-001 945-L4Y-AD-002	945-N4Y-AD-001 945-N4Y-AD-002 945-S4Y-AD-001 945-S4Y-AD-002	945-F4Y-AD-001-180E	945-F4Y-AD-001-300E
Max. Sensing Distance	500 mm (19.66 in.)	200 mm (7.87 in.)	500 mm (19.66 in.)	180 mm (7.09 in.)
Min. Sensing Distance	100 mm (3.9 in.)	100 mm (3.9 in.)	200 mm (7.87 in.)	70 mm (2.76 in.)
Beam Angle	10°	10°	8°	8°
POWER SUPPLY				
Supply Voltage	19 - 30 VDC			
Supply Current	<30 mA without load		<25 mA without load	
Circuit Protection	Reverse polarity			
OUTPUT CHARACTERISTICS				
Load Current	0 - 100 mA			
Hysteresis	~ 10 mm			
Switching Frequency	30 Hz	60 Hz	25 Hz	60 Hz
Repeatability	± 0.5 mm or 0.3% or reading			± 0.2 mm or 0.2% or reading
Setpoint Adjustment	(Fixed or External Circuit) or 4 Turn Potentiometer			
Circuit Protection	Short Circuit			
ENVIRONMENTAL				
Operating Temperature	0 to 50°C (32 to 122°F)			
Storage Temperature	0 to 70°C (32 to 150°F)			
Sealing	IP 65			
SPECIAL FEATURES				
Hold Input	Stops transmission and reception when input is connected to 0 VDC. Last output will be stored until input is disconnected			
Synchronization Input	Avoids mutual interference from several sensors. (External synchronization unit is required. See Accessories)			
LED Indicator	Illuminates when sensor detects target			

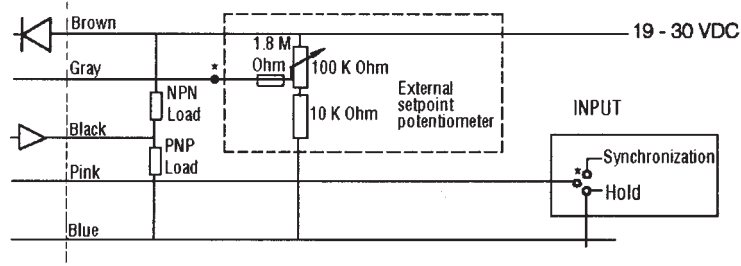
Ultrasonic Sensors

Precision Digital 18 mm Diameter

945 Series

WIRING DIAGRAMS

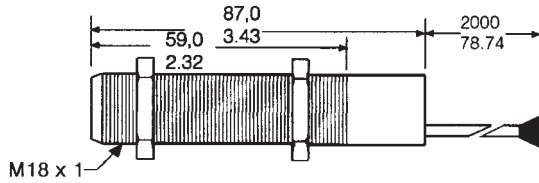
945-F/N Series



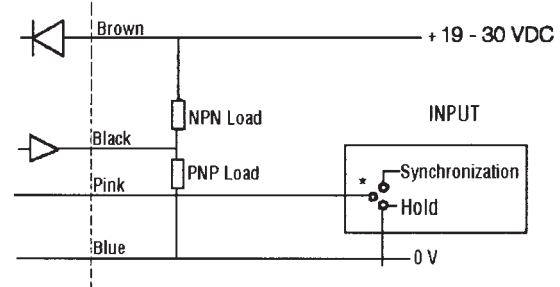
*Normal operation with no connection

MOUNTING DIMENSIONS (For reference only)

945-F/N Series plastic Housing

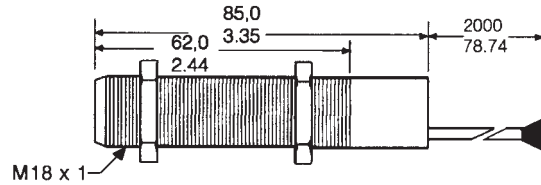


945-L/S Series



*Normal operation with no connection

945-L/S Series Stainless Steel Housing



ACCESSORIES

	Catalog Listing	Features
24 VDC Power supply, relay output, 110 VAC input	FF-MADB24RB	See page B102 for more information
24 VDC Power supply, ON/OFF delay, 110 VAC input	FF-MADC24RB	See page B102 for more information
Synchronization unit	55000001	Controls up to 100 sensors
Mounting clamp, 18 mm housing	43178389-018	Allows mounting to a flat surface
Beam deflector	43192871-003	Allows right angle mounting (approx. dim. 50 x 170 mm)
Focusing beam deflector	43192871-004	Reduces beam angle by approximately 50%

Proximity

Ultrasonic Sensors




Precision Analog 18 mm Diameter

945 Series

FEATURES

- Background suppression
- Sealed to IP 65
- Adjustable sensitivity
- Temperature compensation over 0 to 50°C (32 to 122°F)
- Inhibit/synchronization input
- Stainless steel or plastic housings

ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Analog Output	Catalog Listing
18 mm dia. Plastic  90,7 g (3.2 oz.)	150 - 600 (5.9 - 23.6)	1.5 - 6 V	945-F4Y-AD-1C0-180E
	60 - 200 (2.36 - 7.87)	1.8 - 6 V	945-F4Y-AD-1C0-300E
18 mm dia. Stainless Steel  136 g (4.8 oz.)	100 - 600 (3.9 - 23.6)	1 - 6 V	945-L4Y-AD-1C0
18 mm dia. Plastic with Stainless Steel or Plastic External Head 	150 - 600 (5.9 - 23.6)	1.5 - 6 V	945-E3Y-AD-1C0-180E (M18 x 1 stainless steel sensor head)
	30 - 150 (1.18 - 5.9)	0.9 - 4.5 V	945-G3Y-AD-1C0-300E (M12 x 1 plastic sensor head)

SPECIFICATIONS

Catalog Listings	945-F4Y-AD-1C0-180E	945-F4Y-AD-1C0-300E	945-L4Y-AD-1C0	945-E3Y-AD-1C0-180E	945-G3Y-AD-1C0-300E
Max. Sensing Distance	600 mm (23.6 in.)	200 mm (7.87 in.)	600 mm (23.6 in.)	600 mm (23.6 in.)	150 mm (5.9 in.)
Min. Sensing Distance	150 mm (5.9 in.)	60 mm (2.36 in.)	100 mm (3.9 in.)	150 mm (5.9 in.)	30 mm (1.18 in.)
Beam Angle	8°	8°	10°	8°	8°
POWER SUPPLY					
Supply Voltage	19 - 30 VDC				
Supply Current	<20 mA without load				
Circuit Protection	Reverse polarity				
OUTPUT CHARACTERISTICS					
Load Current	10 mA max.				
Switching Frequency	10 Hz	20 Hz	10 Hz	10 Hz	20 Hz
Repeatability	< ± 0.3% of reading				
Linearity	<0.2%				
Output Adjustment	4 turn potentiometer				
Circuit Protection	Short Circuit				
ENVIRONMENTAL					
Operating Temperature	0 to 50°C (32 to 122°F)				
Storage Temperature	0 to 70°C (32 to 158°F)				
Sealing	IP 65				
SPECIAL FEATURES					
Hold Input	Stops transmission and reception of sensor when input is connected to 0 VDC. Analog output would be zero VDC				
Synchronous Input	Avoids mutual interference from several ultrasonic sensors (external synchronization unit is required; see accessories)				
LED Indicator	Illuminates when sensor detects a target				

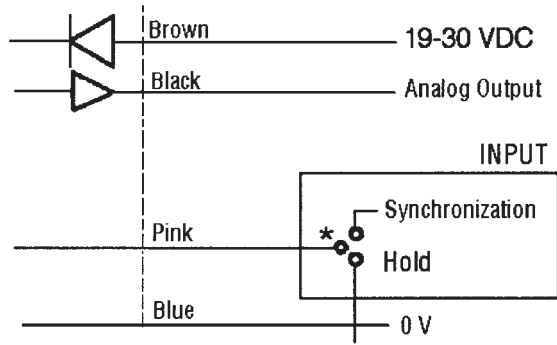
Ultrasonic Sensors

Precision Analog 18 mm Diameter

945 Series

WIRING DIAGRAMS

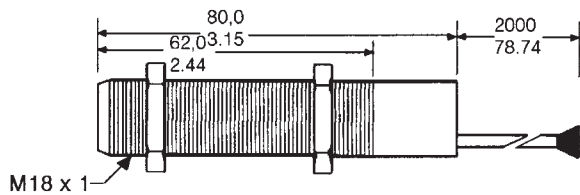
945-F/L, 945-E/G Series



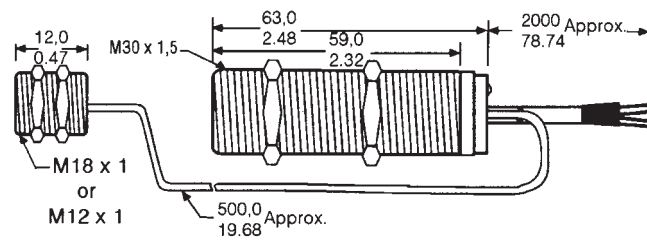
*Normal operation with connection to 19-30 VDC

MOUNTING DIMENSIONS (For reference only)

945-F/L Series Housing



945-E/G Series with External Head



Proximity

ACCESSORIES

	Catalog Listing	Features
Synchronization unit	55000001	Controls up to 100 sensors
Mounting clamp, 18 mm housing	43178389-018	Allows mounting to flat surface
Beam deflector	43192871-003	Allows right angle mounting (approx. dim. 50 x 170 mm)
Focusing beam deflector	43192871-004	Reduces beam angle by approximately 50%

Ultrasonic Sensors

946 Series

Teachable 30 mm Diameter Precision Digital Outputs

FEATURES

- Two independent setpoints
- Teach-in programming
- N.O., N.C. window characteristic possible



ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Termination**	Digital Output	Catalog Listing
30 mm (1.18 in.) Stainless Steel	800 - 6000 (31.5-236)	Connector	PNP	946-A4V-2D-001-65E
	200 - 1000 (7.87-39.4)	Connector	PNP	946-A4V-2D-001-175E
	60 - 300 (2.36-11.8)	Connector	PNP	946-A4V-2D-001-400E

* Standard target is 120 mm thick square of mild steel perpendicular to ultrasonic beam.

**Includes 2 meter cable with straight connector.

SPECIFICATIONS

SENSING CHARACTERISTICS

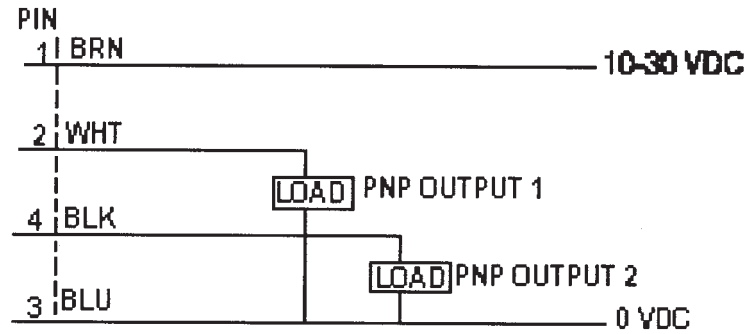
Catalog Listings	946A4V-3D-001-65E	946-A4V-2D-001-175E	946-A4V-2D-001-400E
Max. Sensing Distance	6000 mm (236 in.)	1000 mm (39.4 in.)	300 mm (11.8 in.)
Min. Sensing Distance	800 mm (31.5 in.)	200 mm (7.87 in.)	60 mm (2.36 in.)
Beam Angle	5°		
POWER SUPPLY			
Supply Voltage	10 - 30 VDC		
Supply Current	<25 mA without load		
Circuit Protection	Reverse polarity		
OUTPUT CHARACTERISTICS			
Load Current	0 - 200 mA		
Hysteresis	≤3.2%		
Switching Frequency	1 Hz	5Hz	15 Hz
Repeatability	≤ 0.1% of reading		
Setpoint Adjustment	Programmable with probe coded plug		
Circuit Protection	Short Circuit		
ENVIRONMENTAL			
Operating Temperature	-25 to 70°C (-13 to 150°F)		
Storage Temperature	-40 to 85°C (-40 to 185°F)		
Sealing	IP 65		
SPECIAL FEATURES			
LED Indicator	RED - Illuminates when object is not recognized, probe coded plug withdrawn or short circuited YELLOW - Illuminates when indicating output function or output status GREEN - Illuminates when target is recognized during "teach mode" or normal operation		

Ultrasonic Sensors

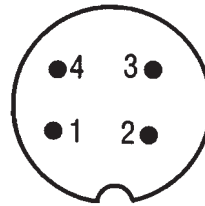
946 Series

Teachable 30 mm Diameter
Precision Digital Outputs

WIRING DIAGRAMS



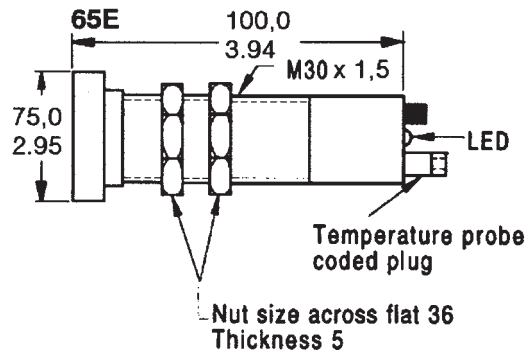
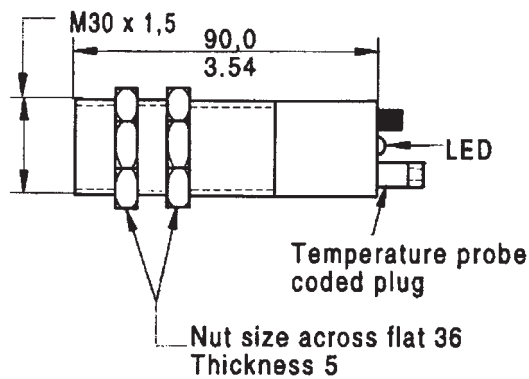
4-pin DC
MICRO CONNECTOR
(M12 x 1)



PIN	COLOR
1	BROWN
2	WHITE
3	BLUE
4	BLACK

MOUNTING DIMENSIONS (For reference only)

175E/400E



Proximity

ACCESSORIES

	Catalog Listing	Features
2 Meter cable with straight connector*	804000A09M020	Used for wiring to connector
2 Meter cable with right angle connector	804001A09M020	Used for wiring to connector
24 VDC Power supply, relay output, 110 VAC input	FF-MADB24RB	See page B102 for more information
24 VDC Power supply, ON/OFF delay, 110 VAC input	FF-MADC24RB	See page B102 for more information

*Supplied with sensor.

Ultrasonic Sensors

946 Series

Teachable 30 mm Diameter Precision Analog Outputs

FEATURES

- Voltage and current output
- Teach-in programming
- Measuring range up to 6000 mm (236 inches)



ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Termination	Analog Output	Catalog Listing
30 mm (1.18 in.) Stainless Steel	800 - 6000 (31.5-236)	Cable	4 - 20 mA 0 - 10 VDC	946-A4V-2D-2C0-65E
	500 - 4000 (19.7-157.5)	Cable	4 - 20 mA 0 - 10 VDC	946-A4V-2D-2C0-85E
	200 - 1000 (7.87-39.4)	Cable	4 - 20 mA 0 - 10 VDC	946-A4V-2D-2C0-175E
	60 - 500 (2.36-19.7)	Cable	4 - 20 mA 0 - 10 VDC	946-A4V-2D-2C0-380E

* Standard target is 120 mm thick square of mild steel perpendicular to ultrasonic beam.

SPECIFICATIONS

SENSING CHARACTERISTICS

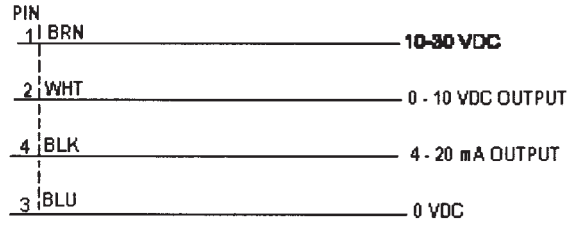
Catalog Listings	946-A4V-3D-2C0-65E	946-A4V-2D-2C0-85E	946-A4V-2D-2C0-175E	946-A4V-2D-2C0-400E
Max. Sensing Distance	6000 mm (236 in.)	4000 mm (157.5 in.)	2000 mm (78.74 in.)	500 mm (19.7 in.)
Min. Sensing Distance	800 mm (31.5 in.)	500 mm (19.7 in.)	200 mm (7.87 in.)	60 mm (2.36 in.)
Beam Angle	5°			
POWER SUPPLY				
Supply Voltage	10 - 30 VDC			
Supply Current	<33 mA without load			
Circuit Protection	Reverse polarity			
OUTPUT CHARACTERISTICS				
Switching Frequency	2 Hz	3.3 Hz	10 Hz	28.6 Hz
Repeatability	≤ 0.1% of reading			
Linearity	≤ 0.1%			
Setpoint Adjustment	Programmable with probe coded plug			
Min. Load Resistance (VDC)	1000 Ohms (0 - 10 VDC Output)			
Max. Load Resistance (mA)	500 Ohms (4 - 20 mA Output)			
Slope of Output	Positive or Negative; Programmable with Probe Coded Plug			
Circuit Protection	Short Circuit			
ENVIRONMENTAL				
Operating Temperature	-25 to 75°C (-13 to 167°F)			
Storage Temperature	-40 to 85°C (-40 to 185°F)			
Sealing	IP 65			
SPECIAL FEATURES				
LED Indicator	RED - Illuminates when object is not recognized, probe coded plug withdrawn or short circuited YELLOW - Illuminates when indicating output function or output status GREEN - Illuminates when target is recognized during "teach mode" or normal operation			

Ultrasonic Sensors

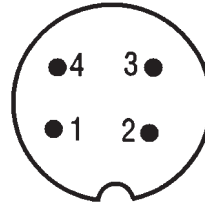
946 Series

Teachable 30 mm Diameter Precision Analog Outputs

WIRING DIAGRAM



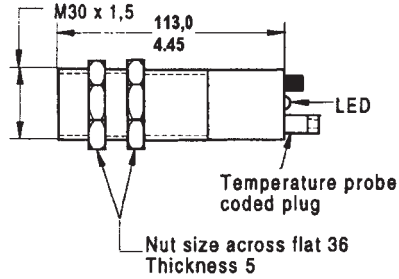
4-pin
MICRO CONNECTOR
(M12 x 1)



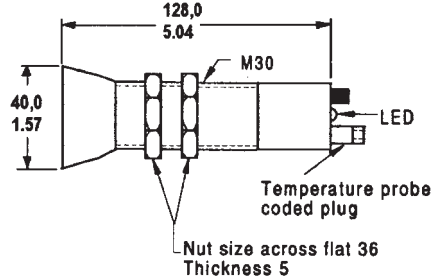
PIN	COLOR
1	BROWN
2	WHITE
3	BLUE
4	BLACK

MOUNTING DIMENSIONS (For reference only)

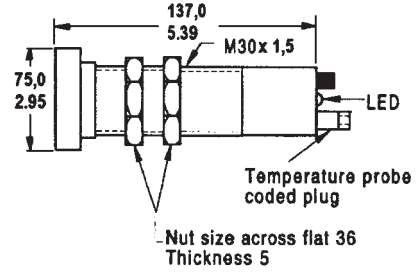
175E/380E



85E



65E



ACCESSORIES

	Catalog Listing	Features
2 Meter cable with straight connector*	804000A09M020	Used for wiring to connector
2 Meter cable with right angle connector	804001A09M020	Used for wiring to connector

*Supplied with sensor

Proximity

Precision Limit Switch Style Analog and Digital Switching

FEATURES

- **Background suppression**
- Sealed to IP 65
- 200 to 1500 mm (7.87 to 59.05 in.) range
- Die cast zinc limit switch style housing
- Temperature compensated, $\pm 1\%$
- Analog output proportional to sensor-to-target distance
- Field adjustable analog output slope
- Two independently adjustable digital setpoints, PNP N.O. outputs
- Inhibit input for multiple sensor synchronization



ORDER GUIDE

Sensor Package Style	Sensing Range* mm (in.)	Output Type	Catalog Listing
Limit switch 454,4 g (16 oz.)	200 - 1500 (7.87 - 59.05)	PNP, two independent N.O. outputs	941-C2V-2E-001
		1.3 - 10 VDC Analog	941-C2V-2E-1C0

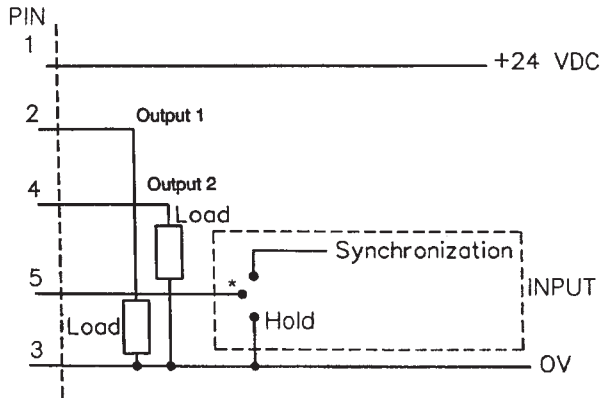
SENSING SPECIFICATIONS

Catalog Listings	941-C2V-2E-001	941-C2V-2E-1C0
Max. Sensing Distance	1500 mm (59.05 in.)	1500 mm (59.05 in.)
Min. Sensing Distance	200 mm (7.87 in.)	200 mm (7.87 in.)
Beam Angle	10°	
POWER SUPPLY		
Supply Voltage	20 - 48 VDC	
Supply Current	<35 mA without load	
Circuit Protection	Reverse polarity	
OUTPUT CHARACTERISTICS		
Load Current	0 - 100 mA	10 mA max.
Switching Frequency	10 Hz	6.6 Hz
Repeatability	± 1 mm	± 1 mm
Dead Zone Adjustment	Digital Switch, 200 - 1100 mm, 100 mm increments	
Repeatability	± 1 mm	
Sensitivity Adjustment	4 turn potentiometer	
Setpoint Adjustment	4 Turn Potentiometer, 200 - 1500 mm	
Slope Adjustment		4 Turn Potentiometer, 5 - 10 mV/mm
Linearity		< 1%
Circuit Protection	Short Circuit	
ENVIRONMENTAL		
Operating Temperature	0 to 70°C (32 to 158°F)	
Storage Temperature	-15 to 70°C (+5 to 158°F)	
Sealing	IP 65	
SPECIAL FEATURES		
Hold Input	Stops transmission and reception when input is connected to 0 VDC. Last digital output will be stored until input is disconnected. Analog output will be zero.	
Synchronization Input	Avoids mutual interference from several sensors. (External synchronization unit is required. See Accessories)	
LED Indicator	RED - Illuminates when sensor detects target	
	YELLOW (SP1 or SP2) - Illuminates when sensor detects target at setpoint distance	
	GREEN - Illuminates when sensor is connected to power supply	

Precision Limit Switch Style Analog and Digital Switching

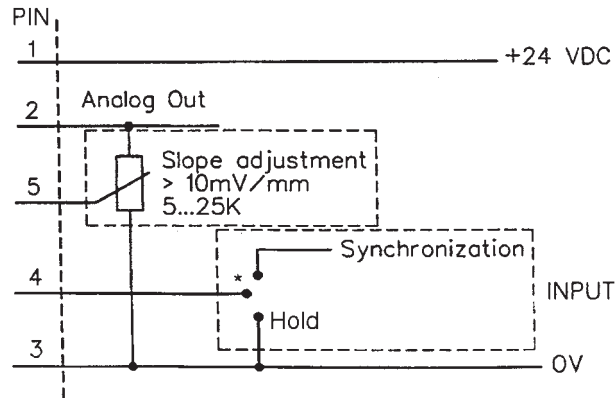
WIRING DIAGRAM

941C2V-2E-001



*Normal operation with no connection

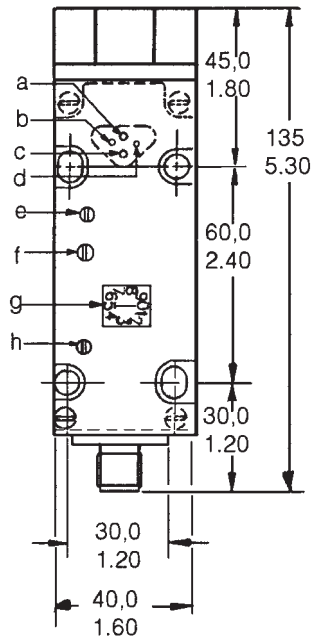
941-C2V-2E-1C0



*Normal operation with no connection

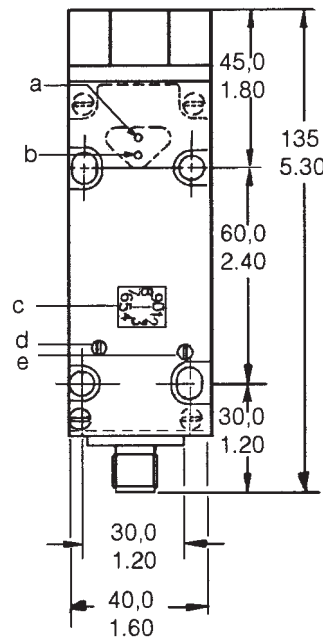
MOUNTING DIMENSIONS (For reference only)

941C2V-2E-001



- a LED echo (RED)
- b LED SP1 (YELLOW)
- c LED VDC (GREEN)
- d LED SP2 (YELLOW)
- e Adjustment setpoint SP1
- f Adjustment setpoint SP2
- g Adjustment dead zone
- h Adjustment receive sensitivity

941-C2V-2E-1C0



- a LED echo (RED)
- b LED VDC (GREEN)
- c Adjustment dead zone
- d Adjustment receive sensitivity
- e Adjustment slope



ACCESSORIES

	Catalog Listing	Feature
2 meter cable with straight connector	RKT5-612/2M	Used for wiring to connector
5 meter cable with straight connector	RKT5-612/5M	Used for wiring to connector
2 meter cable with right angle connector	RKWT5-612/2M	Used for wiring to connector
5 meter cable with right angle connector	RKWT5-612/5M	Used for wiring to connector
24 VDC POWER supply, Relay output, 110 VAC input	FF-MADB24RB	See page B102 for more information
24 VDC Power supply, On/Off delay, 110 VAC input	FF-MADC24RB	See page B102 for more information