SUPERPROX® Ultrasonic Proximity Sensors

Extended-range Proximity Sensing

- **Self-contained, 12 mm, threaded barrel or flat-profile housing**

- **Extended sensing range of 102 mm (4")**

- **Field programmable capability**

- **All-material, proximity sensing capability**

The world's first 12 mm and flat-profile, fast response, multi-material ultrasonic, proximity sensor… the efficient solution to close-up sensing

Use the highly versatile SUPERPROX® Model SM300 series of proximity sensors as a replacement for inductive proximity sensors and fixed-field photoelectric sensors. Its long range, small size, fast response, performance, reliability, and low cost, offers a simple, easy to use,once-and-for-all solution to many of the proximity sensing problems encountered daily in almost every industry.

The SM300 proximity sensor provides reliable detection of objects up to 102 mm (4") from the sensor face, performance unmatched by other proximity sensors of the same size or larger. At this distance, the sensor is safely out of harms way, that is an especially important cost savings benefit. Easy to install, the SM300 is available in two different housing styles: the 12 mm threaded barrel or the flat-profile housing both available in ULTEM® plastic. As with all SUPERPROX® sensors, cable and connector styles are available.

The SM300 is inherently capable of automatically detecting all materials regardless of color, shape, and composition (transparent or opaque, liquid or solid) including clear glass, mirrors, wood, powder, ink, ferrous and nonferrous metal, plastics, and objects that change colors. While some sensors require adjustment (through the use of a sensitivity potentiometer) to the material they are detecting, the SM300 detects most materials automatically. With protection ratings of NEMA 4X (indoor use only) and

IP67, the sensor resists most acids and bases and is compatible with many chemicals, cleaning solutions, and chemical-based products. The SM300 sensor series is CE certified.

These are just a few of the benefits of this new, small, multi-material, extended-range proximity sensor from the world leader in ultrasonic sensing technology.

The applications suited to the SM300 proximity sensor are as broad as the benefits just mentioned. And because of the sensor's versatility, it is a solid candidate for a large number of y proximity sensing and non-contact switching needs in the plant. The SM300 can detect positive stop and true home positions for servo-control systems and tool and parts presence in automated CNC centers and assembly equipment. It is an ideal solution for sensing part and pin presence and punch-through verification in stamping dies. Other applications include die open and close detection in stamping, plastic injection molding, die casting applications, and many other applications where traditional proximity sensing methods cannot reliably detect the large variety of materials running through the process or they are limited by sensing range.

Operation

The SM300 series is a self-contained, pulse-echo, proximity sensing device that both transmits and receives sonic energy within an operating distance of

6 mm (0.25") to 102 mm (4"). The sensor combines the latest piezoelectric and microprocessor technology for the best possible performance in almost any sensing application.

This 500 kHz proximity sensor operates on 12 to 24 VDC and is equipped with both sinking (NPN)

and sourcing (PNP) outputs. The sensor has two status LEDs: a green LED indicates "power on" when no object is present, and an amber LED indicates object presence, regardless of output state (N.O. or N.C.). Just one LED is illuminated at any given time.

During operation, the sensor transmits to and receives sonic pulses from objects in front of it without interruption. A discriminating microprocessor makes it possible for the sensor to accept only those pulse echoes received from objects within the fixed sensing window limits and ignore all other objects. An object is detected when it is within the fixed sensing window.

SUPERPROX® PROXIMITY SENSORS

How does it work?

During setup and operation, the SM300 series sensor continually and accurately measures the elapsed time of every pulse echo reception after each pulse transmission. The transmitted pulse starts a time clock to register the elapsed time for the received pulse echoes. Given the elapsed time, the sensor software calculates the distance traveled to the object or surface and back to the sensor, using the formula, $D = TVs/2$, where D = distance from the sensor to the object; T = elapsed time between the pulse transmission and its echo reception; Vs = the velocity of sound, approximately 1100 feet per second.

While the sensor is in operation, the calculated distance (D) between the sensor and the object is compared to the distances associated with the fixed window limits. These limits are shown in the illustration above as Dwi and Dwo.
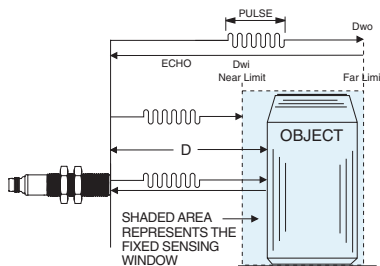
If D is within these limits, an output is generated. The output remains on until the echo does not return or it returns from outside the window limits.

Mounting & Setting up the SM300 Proximity Sensor

The SM300 series proximity sensor should be mounted in a bracket that allows it to be adjusted for proper alignment with the object. Set up for optimum object sensing and sensitivity merely involves positioning the sensor so the sonic beam is aligned with and perpendicular to the surface of the object being detected and the object is at or near the center of the sensing window. Once the sensor is mounted, no other adjustments are required.
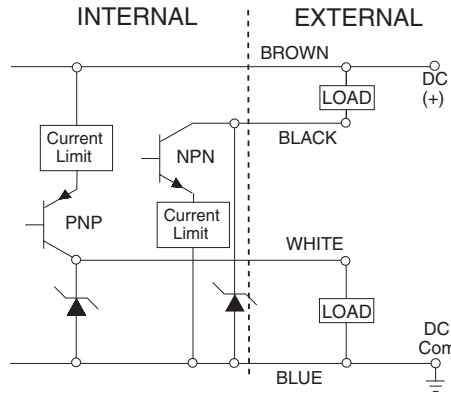
Note: Small objects are best detected at 38 mm (1.5").

Electrical Wiring

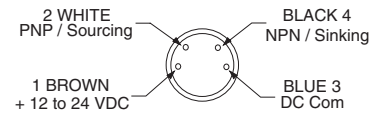The sensor cable must be run in conduit, free of any AC power or control wires.
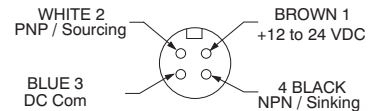
Outputs

NPN Sinking and PNP Sourcing
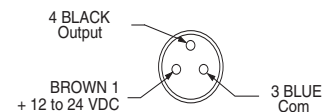

Cable Style Wire Assignments

Connector Style Pin Assignments

SM350

Note: Sensor view: Pico connector

SM380

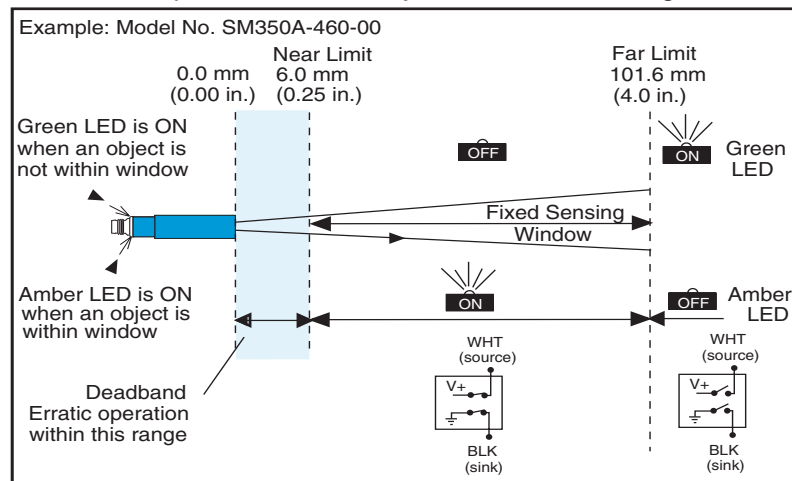

Note: Sensor pigtail view: Micro connector

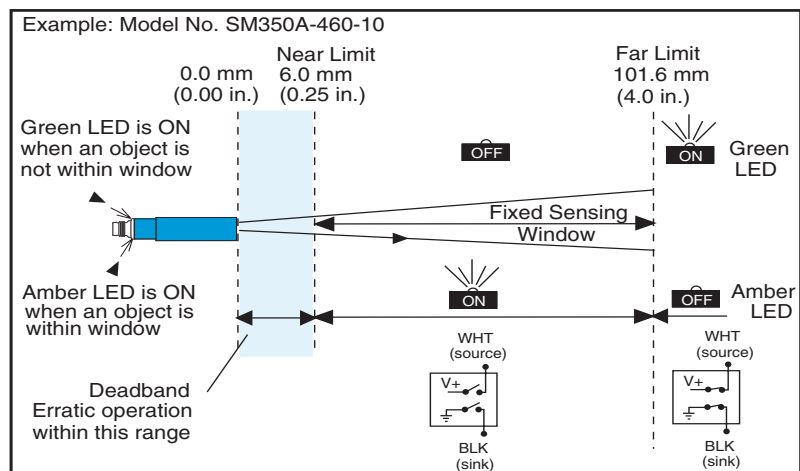**SM330/SM340**

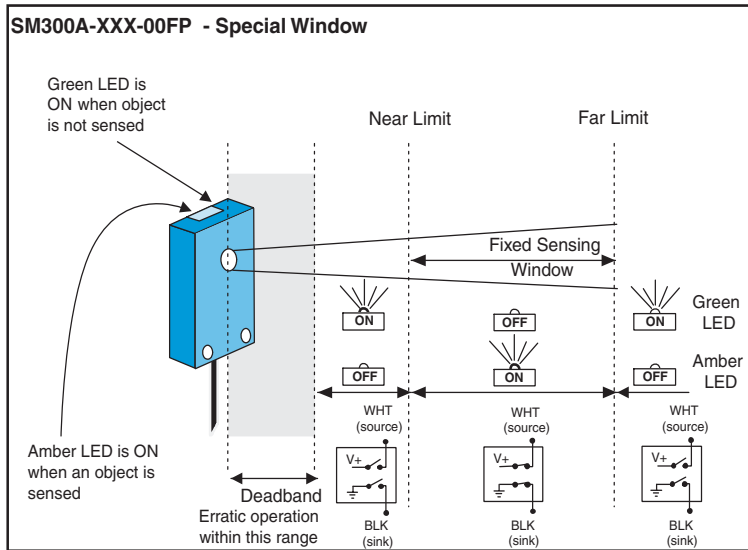Note: Sensor view: Pico connector
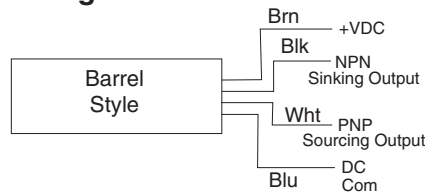
Normally Open Output
The sensor output is on with the object in the fixed sensing window.

Normally Closed Output
The sensor output is off with the object in the fixed sensing window.

SM300A-XXX-00FP - Special Window

Model Reference Guide - SM300 Series

Use the guide below to ensure the correct model number is specified for the application. Please note that not all sensor model combinations are listed.

EXAMPLE MODEL: SM3 5 0 A - 2 28 - 00

Ultrasonic Miniature Proximity Series

Power/Connection Type
0...12 to 24 VDC / Cable style
3...12 to 24 VDC / 3-pin "Pico" connector w/PNP output
4...12 to 24 VDC / 3-pin "Pico" connector w/NPN output
5...12 to 24 VDC / 4-pin "Pico" connector
6...12 to 24 VDC / 4-pin "Pico" connector - output pins reversed
8...12 to 24 VDC / 4-pin "Micro" connector
9...12 to 24 VDC / 4-pin "Micro" connector - output pins reversed
Flat-profile sensors with a connector and threaded barrel sensors with a "Micro" connector have a 152 mm (6") pigtail

Sensing Function
0...Proximity - No on/off delay

Design Level
A...Applies to all models

Sensing Range (Far Limit)
2...50.8 mm (2.0")
3...67.2 mm (3.0")
4...101.6 mm (4.0")

Sensing Window (Distance from Near Limit to Far Limit)
Note: Window should be less than range
04...6.4 mm (0.25")
08...13 mm (0.5")
12...19 mm (0.75")
16...25.4 mm (1.0")
28...44.5 mm (1.75")

32...50.8 mm (2.0")
44...70 mm (2.75")
60...95.3 mm (3.75")

Functionality
00...N.O. output
10...N.C. output

Options
...Absence of designator indicates no options

Housing Types
...No designator indicates standard ULTEM®* plastic -12 mm barrel housing
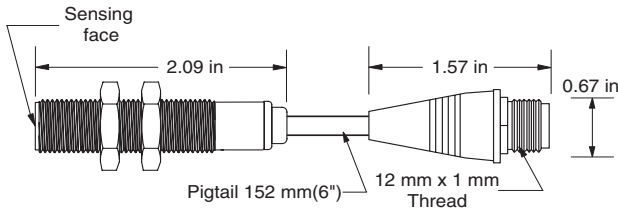FP...ULTEM® Flat-profile housing

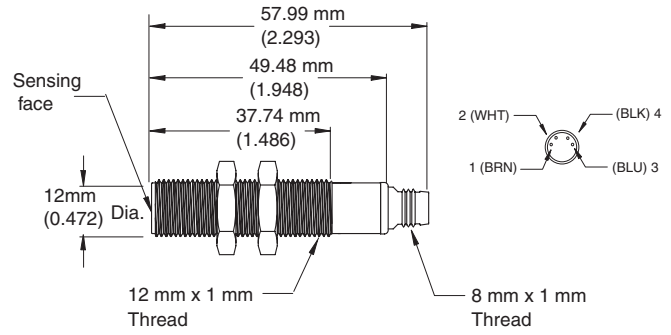*ULTEM® is a registered trademark of the General Electric Company.

Dimensions

Barrel Cable Micro Style
(ULTEM® Plastic) SM380A-XXX-XX

Sensing face

2.09 in
1.57 in
0.67 in
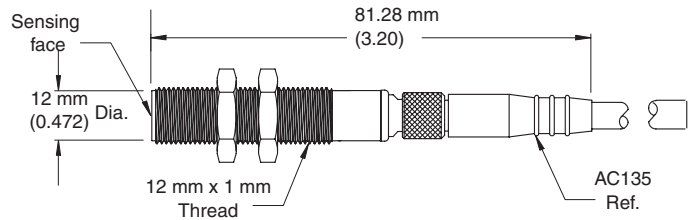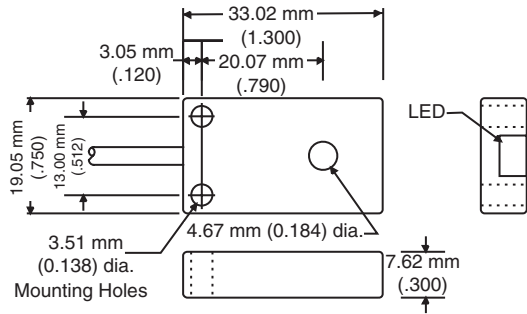
Pigtail 152 mm(6")
12 mm x 1 mm Thread

Barrel Connector Style
(ULTEM® Plastic) SM350A-XXX-XX

Sensing face

57.99 mm (2.293)
49.48 mm (1.948)
37.74 mm (1.486)

12mm (0.472) Dia.

2 (WHT)   (BLK) 4
1 (BRN)   (BLU) 3

12 mm x 1 mm Thread
8 mm x 1 mm Thread

Flat-profile Cable/Connector Style
(ULTEM® Plastic) SM300A-XXX-XXFP

33.02 mm (1.300)
3.05 mm (.120)
20.07 mm (.790)

19.05 mm (.750)
13.00 mm (.512)

LED

3.51 mm (0.138) dia. Mounting Holes
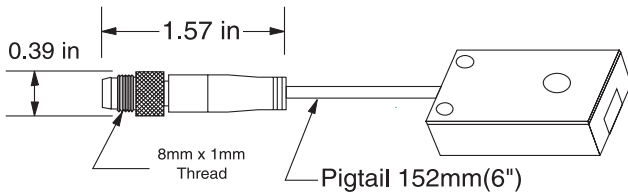4.67 mm (0.184) dia.
7.62 mm (.300)

Sensing face

81.28 mm (3.20)

12 mm (0.472) Dia.

12 mm x 1 mm Thread
AC135 Ref.

Flat-profile Pico Connector Style
(ULTEM® Plastic) SM330FP, SM340FP, SM350-XX-XXXFP

0.39 in
1.57 in

8mm x 1mm Thread
Pigtail 152mm(6")

Sensing face

70.10 mm (2.76)

12 mm (0.472) Dia.

12 mm x 1 mm Thread
AC134 Ref.
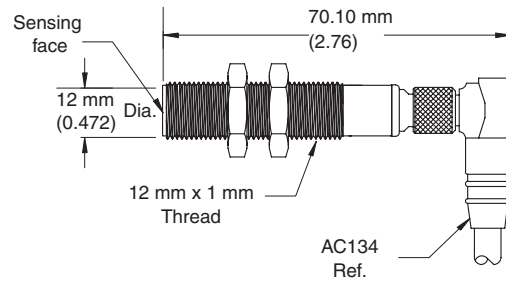
Flat-profile Micro Connector Style
(ULTEM® Plastic) SM380-XXX-XXFP

0.67 in
1.57 in

12mm x 1mm Thread
Pigtail 152mm(6")
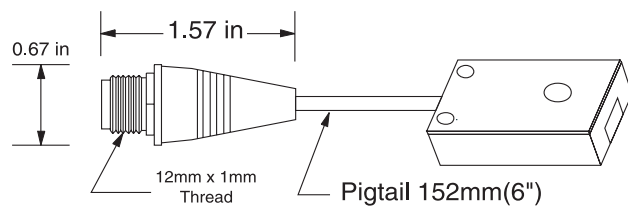
Accessories

AC130 Straight, M12 micro, 4-conductor, connector/cable assembly, 5 m (16') (for barrel and flat-profile micro sensors)

1 2
4 3
4-POLE FEMALE CONNECTOR
12mm DIE-CAST ZINC, EPOXY COATING (E COAT)

STRAIGHT CONNECTOR HEAD: WOODHEAD SERIES 8032X
BLACK REF.
SHIELD NOT CONNECTED AT CONNECTOR END
HYDE PARK CABLE (4-cond.) 5m LONG, BLACK
STRIP-BACK JACKET AND FOIL 2"

3 — BLUE
4 — BLACK
1 — BROWN
2 — WHITE

AC134

Right-angle, M8 pico, 4-conductor cable/ connector assembly, 5 m (16').

Right-angle connector head
Woodhead p/n 404000A1M050

5 m (16') long
4 conductor cable

8 mm Die Cast Zinc
Epoxy coating (E COAT)

Connector
Pin Assignments

4 (BLK) (WHT) 2
3 (BLU) (BRN) 1

AC135

Straight, M8 pico, 4-conductor cable/ connector assembly, 5 m (16').

Straight connector head
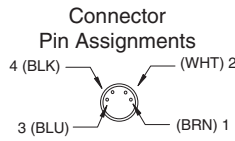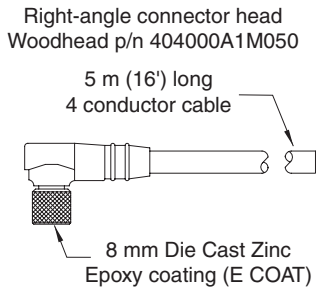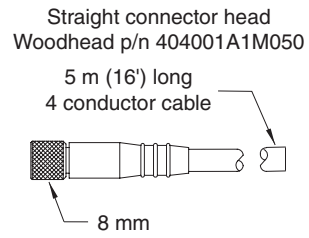Woodhead p/n 404001A1M050

5 m (16') long
4 conductor cable

8 mm

AC141

Right-angle, M8 pico, 3-conductor cable/ connector assembly, 5 m (16') (for barrel connector-style sensors)

Right-angle connector head

5 m (16') long
4 conductor cable

8 mm Nickel plated brass

Connector
Pin Assignments

4 (BLK)
1 (BRN) (BLU) 3
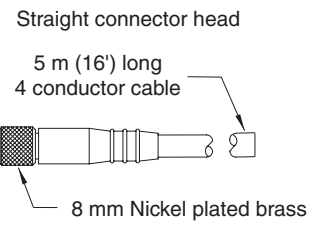
AC142

Straight, M8 pico, 3-conductor cable/connector assembly, 5 m (16') (for barrel connector-style sensors)

Straight connector head

5 m (16') long
4 conductor cable

8 mm Nickel plated brass

AC235

Right-angle, stainless, mounting bracket (for 12 mm barrel sensors)

4.8mm +0.4mm/-0.0mm TYP.
(0.188 +0.015/-0.000 TYP.)
7.9mm (0.312)
25.4mm (1.000)
12.7mm (0.500)
R 3.4mm (R 0.094) TYP.
5.6mm (0.220)
R 3.2mm (R 0.125) TYP.
11.1mm (0.437)

22.4mm (0.880)
11.2mm (0.440)
R 11.2mm (R 0.440)
30.2mm (1.190)
12.5mm (0.493)
12.1mm (0.488)
19.0mm (0.750)

2.3mm (0.090)
1.5mm (0.06)

AC236

Stainless and polyamide conveyor-rail clamp/ bracket set (for 12 mm barrel sensor)
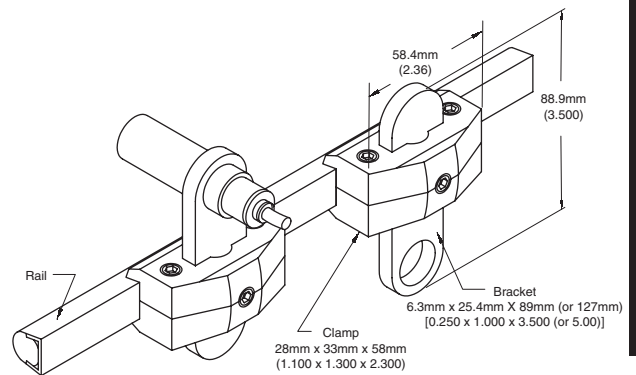
58.4mm (2.36)
88.9mm (3.500)
Rail
Bracket
6.3mm x 25.4mm X 89mm (or 127mm)
[0.250 x 1.000 x 3.500 (or 5.00)]
Clamp
28mm x 33mm x 58mm
(1.100 x 1.300 x 2.300)

AC237

Straight, stainless, mounting bracket (for 12 mm barrel sensors)

22.4mm (0.880)
11.2mm (0.440)
R 11.2mm (R 0.440)
51.9mm (2.045)
12.7mm (0.500)
12.5mm (0.493)
12.1mm (0.488)
40.8mm (1.608)
R 2.9mm TYP. (R 0.084)
11.1mm (0.437)
R 3.2mm TYP. (R 0.125)
4.8mm (0.188)
5.6mm (0.219)
2.3mm 0.090

AC246

Right-angle, stainless, mounting bracket (for flat-profile style prox sensors)

.075 in
.514 in
.118 in
.175 in
1.125 in
.138 in 4 slots
.512 in
1.125 in
.750 in
.563 in
.200 in
.512 in
.119 in

AC247

Stainless and polyamide conveyor-rail clamp/bracket set (for flat-profile sensor)

3.18 mm (0.125")
88.9 mm (3.50")
25.4 mm (1.0")
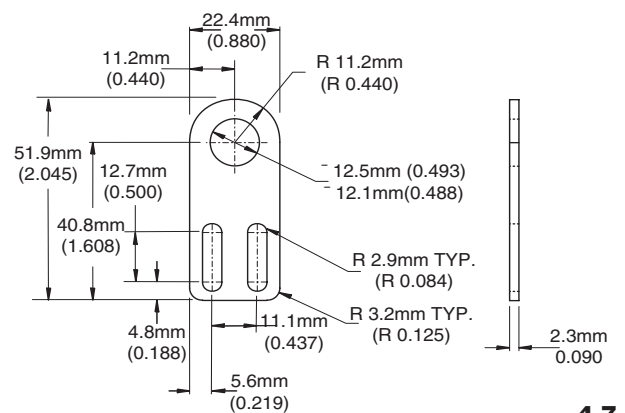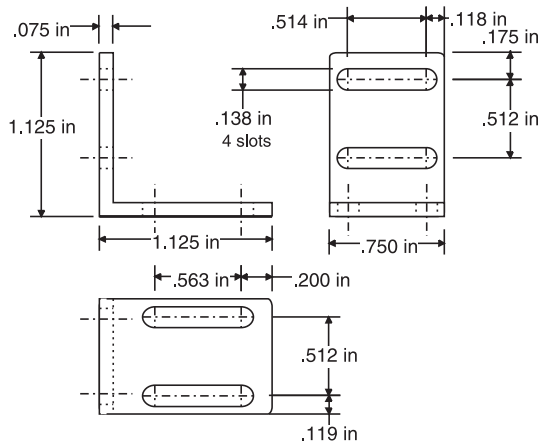
Clamp
28 mm x 33 mm x 542 mm
(1.10 x 1.30 x 2.30)
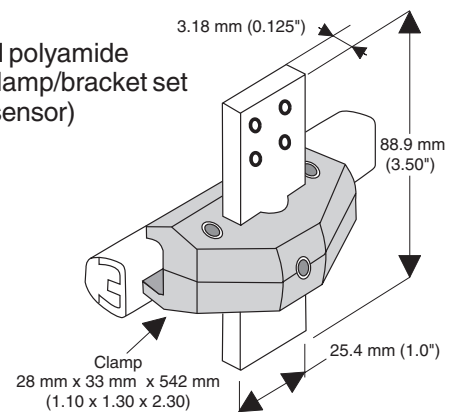
General Specifications

Sensing [T_A = 20° C (68° F)]

Sensing Range:6.4 mm (0.25") to 102 mm (4.0")
(large flat objects) Highest sensitivity
over the range 38.1 mm (1.5") to 102 mm
(4.0")
Sonic Frequency: 500 kHz
Minimum-size Detection: 2.5 mm (0.098") diameter
rod or 1.0 mm (0.039") wide flat bar at a
distance of 38 mm   (1.5")
Note: Smaller object may not be detected at
closer distances
Maximum Angular Deviation: ± 8° on a 100 mm x
100 mm (4" x 4") flat target at a distance
of 89 mm (3.5") (4" range flat-profile)
Sonic Cone Profile: see beam plot on page 4-2
Limit Position Accuracy: ± 1.6 mm (0.062") max.
Repeatability: ± 0.7 mm (0.027") or better

Power Requirements

Supply Voltage: 12VDC to 24VDC ± 10%,
regulated supply
Current Consumption: 25 mA max.
(excluding load)
Power Consumption: 0.5 W max. (excluding load)

Output

Sinking Output (NPN):
Maximum on-state voltage: 0.75 V @ 100 mA
Maximum load current: 100 mA
Maximum applied voltage: 30 VDC
Sourcing Output (PNP):
Maximum on-state voltage drop: 1.10 V @
100mA
Maximum load current: 100mA
Output voltage: V_{Supply} - 1.10 V @ 100mA

Response Time

2.0 ms on/ 2.0 ms off (2" range barrel unit)
3.0 ms on/ 3.0 ms off (2" range flat-profile unit)
4.0 ms on/ 4.0 ms off (4" range flat-profile unit)

Indicators

Green LED: Illuminated if power applied and
no object detected
Amber LED: Illuminated if object is detected
within the window,regardless of output polarity
(N.O./N.C.) style.
Note:Green and amber LEDs are never
illuminated simultaneously

Connections

Cable Style Models: 28 AWG, foil shield,
lead-free, PVC jacket 4-conductor, 3M (10') long
Connector Style Models: 8 mm, circular 4-pole,
male Flat-profile pigtail 152 mm (6.0") long
micro-connector

Protection

Power Supply: Current-limited over-voltage, ESD,
reverse polarity
Outputs: Current-limited over-voltage, ESD,
reverse polarity, over-current

Environmental

Operating Temperature Range:
-30° to 70°C (-22° to 152°F) @ 12V supply
-30° to 65°C (-22° to 149°F) @ 24V supply
Storage Temperature Range:
-40° to 100°C (-40° to 212°F)
Operating Humidity: 100%
Protection Ratings: NEMA 4X (indoor use
only), IP67
Chemical Resistance: Resists most acids and
bases, including most food products.

Agency Approvals

CE Mark: CE conformity is declared to:
EN60947:1998 (proximity sensors)
EN61010-1 (general safety)
EMC: FCC 47 CFR Part 15 Class A (USA)
EN5022:1994 / A2:1997 Class A ITE (EU)
VCCI Class A ITE (Japan)
ASNZS 3548:1995 / CISPR 22 Class A ITE (Australia)
Declaration of Conformity available upon request

Construction

Dimensions:
Barrel
Cable Model: 12 mm (0.472") dia. x 1 mm-6g
threaded housing x 53.3 mm (2.10") long
Connector Model: 12 mm (0.472") dia. x 1
mm-6g threaded housing x 55 mm (2.17")
long; Overall length,including right angle,
connector/cable assembly: 67.6 mm (2.66")
Flat-profile
Cable/Connector Model: 33.0 mm (1.3") H x
7.62 mm (0.3") W x 19.05 mm (0.75")L
Housing: Shock and vibration resistant
Case: ULTEM® plastic (FDA Approved)
Transducer Face: Epoxy
Sensor Cable: Lead-free, PVC jacketed, black
LED light ring: Polycarbonate

* ULTEM® is a registered trademark of The General Electric Co.

Accessories

Model AC130, Straight, M12 micro, 4-conductor,
connector/cable assembly, 5 m (16'), for micro
connector sensors
Model AC132, Right-angle, M12 micro, 4-conductor,
connector/cable assembly, 5 m (16'), for flat-
profile connector-style sensors
Model AC134, Right-angle, M8 pico, 4-conductor,
connector/cable assembly, 5m (16') for barrel and
flat profile connector-style prox sensors
Model AC135, Straight, M8 pico, 4-conductor,
connector/cable assembly, 5m (16') for barrel and
flat-profile connector-style prox sensors
Model AC137, Nano-to-micro pigtail adapter cable
for barrel connector-style prox sensors
Model AC138, Nano-to-micro pigtail adapter cable,
output pins reversed for barrel connector-style
prox sensors
Model AC141, Right-angle, M8 pico, 3-conductor,
connector/cable assembly, 5 m (16') for flat-profile
connector-style sensors
Model AC142, Straight, M8 pico, 3-conductor,
connector/cable assembly, 5 m (16") for flat-profile
connector-style sensors
Model AC235, Right-angle, stainless, mounting
bracket for barrel connector-style prox sensors
Model AC236, Stainless and polyamide conveyor-
rail clamp/bracket set for barrel connector-style
prox sensors
Model AC237, Straight, stainless, mounting bracket
for barrel connector-style prox sensors
Model AC242, 18 mm to 12 mm hex mounting
adapter
**Model AC243**, 30 mm to 12 mm hex mounting
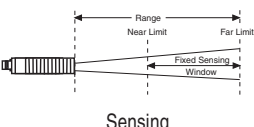adapter
Model AC246, Right-angle, stainless, mounting
bracket for flat-profile style prox sensors
Model AC247, Stainless and polyamide conveyor-
rail clamp/bracket set for flat-profile style prox
sensors

See page 7-1 for accessory photos.

SM300 Series
Proximity

Model No.	Power Version 12/24 VDC	Cable	Connector	Range	Window	Epoxy (Transducer)	12 mm ULTEM®	Flat-profile	N.O. output	N.C output	Notes
SM300A-228-00	■	■		50.8 mm (2.0")	44.5 mm (1.75")	■	■		■		
SM300A-228-10	■	■		50.8 mm (2.0")	44.5 mm (1.75")	■	■			■	
SM300A-228-00FP	■	■		50.8 mm (2.0")	44.5 mm (1.75")	■		■	■		
SM300A-416-00FP	■	■		101.6 mm (4.0")	25.4 mm (1.0")	■		■	■		
SM300A-460-00FP	■	■		101.6 mm (4.0")	95.3 mm (3.75")	■		■	■		
SM330A-460-00FP	■		■	101.6 mm (4.0")	95.3 mm (3.75")	■		■	■		3-pin "PICO" (8 mm) connector with PNP output only
SM340A-460-00FP	■		■	101.6 mm (4.0")	95.3 mm (3.75")	■		■	■		3-pin "PICO" (8 mm) connector with NPN output only
SM350A-228-00	■		■	50.8 mm (2.0")	44.5 mm (1.75")	■	■		■		4-pin "PICO" (8 mm) connector
SM350A-228-10	■		■	50.8 mm (2.0")	44.5 mm (1.75")	■	■			■	4-pin "PICO" (8 mm) connector
SM380A-228-00	■		■	50.8 mm (2.0")	44.5 mm (1.75")	■	■		■		4-pin "MICRO" (12 mm) connector
SM380A-460-00	■		■	101.6 mm (4.0")	95.3 mm (3.75")	■	■		■		4-pin "MICRO" (12 mm) connector
SM350A-228-00FP	■		■	50.8 mm (2.0")	44.5 mm (1.75")	■		■	■		4-pin "PICO" (8 mm) connector
SM350A-416-00FP	■		■	101.6 mm (4.0")	25.4 mm (1.0")	■		■	■		4-pin "PICO" (8 mm) connector
SM350A-460-00FP	■		■	101.6 mm (4.0")	95.3 mm (3.75")	■		■	■		4-pin "PICO" (8 mm) connector
SM350A-460-10FP	■		■	101.6 mm (4.0")	95.3 mm (3.75")	■		■		■	4-pin "PICO" (8 mm) connector
SM380A-228-00FP	■		■	50.8 mm (2.0")	44.5 mm (1.75")	■		■	■		4-pin "MICRO" (12 mm) connector
SM380A-460-00FP	■		■	101.6 mm (4.0")	95.3 mm (3.75")	■		■	■		4-pin "MICRO" (12 mm) connector

All possible sensor configurations are not listed here.

SUPERPROX® PROXIMITY SENSORS