

Model SM505 Series



SUPERPROX® Ultrasonic Proximity Motion Sensors

Rate & Stopped Motion Sensing



In contrast to other jam and gap-type sensors which stop machine processes upon sensing a back-to-back, no-gap condition, this SUPERPROX® microprocessor-based series (Model SM505 through Model SM575) of ultrasonic motion sensors is rate sensitive. Even with a back-to-back, no-gap condition, the operator can, through the use of a rate potentiometer, set the speed below which the output switches off, causing the particular machine under control to stop. Another potentiometer enables the operator to set the time delay desired to restart the particular machine under control once the resumed container speed is at or above the set rate. This time delay feature prevents the output from switching on prematurely when the container movement is momentarily at or above the set rate.

Available in either AC or DC models, these self-contained sensors can be positioned throughout the packaging line and easily configured to automatically control the synchronized starting and stopping of conveyor lines and the starting and stopping of the machines in the system. By allowing the machines to run longer before shutdown due to a line backup, and to start earlier once the

movement begins, the result is a smoother, more efficient container handling system.

These sensors can be used in either single-file or mass-wide conveyor operations with all types of containers. As with all SUPERPROX® sensors, a simple push-button is used to set the limits within which the container motion is monitored and detected. In single-file applications, container motion is monitored as soon as a back-to-back, no-gap condition exists. In mass-wide applications, container motion is monitored when a container moves laterally to within 8 in. of the SUPERPROX® sensor.

Introduction

This SUPERPROX® sensor series detects the movement of either plastic, glass, or metal containers as small as 38 mm (1-1/2") in diameter on single file and mass conveyors. By using the unique "window" sensing feature with two potentiometers and a background target on the opposite side of the container, movement is reliably detected. The container pass line nearest the sensor and background target are the sensing references respectively for setting a foreground and background sensing window.

- **Easy push-button setup for the specific application**
- **Rate adjustments:**
Single file,
30 to 1200 CPM;
Mass wide,
5 to 200 CPM
- **Non contact sensing range up to 2 m (79")**
- **SUPERPROX® housing meets NEMA 4X and IP67 industry standards**
- **CE certified**
- **AC-powered model ETL listed**

SUPERPROX® PROXIMITY
SENSORS

Control Compartment

A unique feature available to the user of these sensors is the facility to quickly set up each sensor for a specific motion sensing application. The sensor is configured through three slide switches, two potentiometers, and one push-button (See Figure 2) located inside a water-tight control compartment on the sensor. To access the controls, remove the small square cover on the back of the sensor. Simply loosen the two flat-head cover screws and insert a small-blade screwdriver in either the top or bottom slot to remove the cover. A short plastic tether prevents separation of the cover from the sensor. NOTE: The switch settings may require changing for the intended application.

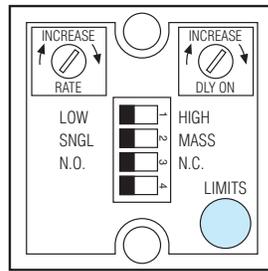


Figure 2

The sensor output switches ON after the back-to-back line or mass of containers has been detected moving at or above the setting of the RATE potentiometer for a delay time period set by the DELAY ON potentiometer (See Page 4-55). The sensor output also switches ON should the background target be detected for the delay time period as a result of containers moving out from between the sensor and background target.

Single-File Conveyor Sensing Mode

The maximum distance between the sensor and background target on the opposite side of a single-file conveyor cannot exceed 254 mm (10"). The overall clearance between the container and conveyor side rails should not be more than 10 mm (3/8"). When a back-to-back line of containers is located between the background target and sensor, the sensor output switches OFF upon detecting container motion either stopped or at a minimum rate (See Figure 3).

Mass Conveyor Sensing Mode

The maximum distance between the sensor and background target on the opposite side of a mass conveyor cannot exceed 1 m (39"). When a mass of containers is within 204 mm (8") or less from the foreground sensing window, the sensor output switches OFF upon detecting container motion either stopped or at a minimum rate (See Figure 4).

Sensor Configuration Switches

Switch 1 configures the sensor to operate in either a low or high sensitivity mode. Place this switch in the LOW position for sensing container motion on single file conveyors. Place the switch in the HIGH position for sensing container motion on mass conveyors.

Switch 2 configures the sensor to detect container motion on either a single file or mass conveyor. Place this switch in the SNGL position for sensing motion on a single file conveyor over a 254 mm (10") sensing range. Place the switch in the MASS position for sensing container motion on a mass conveyor over a 1 m (39") sensing range.

Switch 3 selects the operating mode for the sensor output to be either normally open (N.O.) or normally closed (N.C.).

Switch 4 not used.

Sensor Limits Setup Push-button

First, during installation make sure the sensor face is mounted in line and as parallel as possible with the background target sensing surface on the opposite side of the conveyor. Second, before setting the sensing window limits, adjust the single turn RATE and DELAY ON potentiometers to the fully CCW position.

To set the background and foreground sensing window limits, simply move containers away from between the sensor and background target and press the LIMITS push-button once. This sets the background window limits and switches the sensor output OFF during the limit setup. While the LIMITS push-button is depressed, the multicolored LED located on top of the sensor is amber. Upon release of the push-button, the LED flashes amber indicating that the foreground window limits need to be set within 30 seconds. To set the foreground window limits,

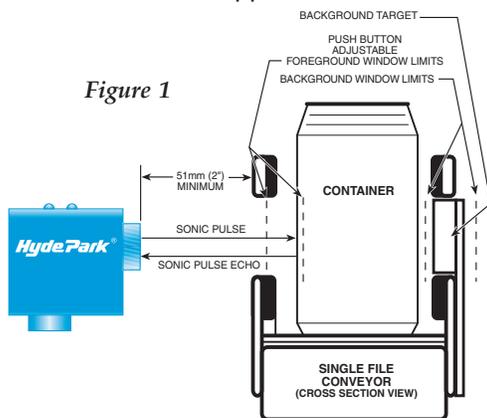


Figure 1

NOTE: Objects placed within the 51 mm near range will cause erratic operation.

Container Motion Sensing Function

The solid state output in the SUPERPROX container motion sensors switches OFF when a back-to-back line or mass of containers is detected moving below the setting of the RATE potentiometer (See Page 4-55).

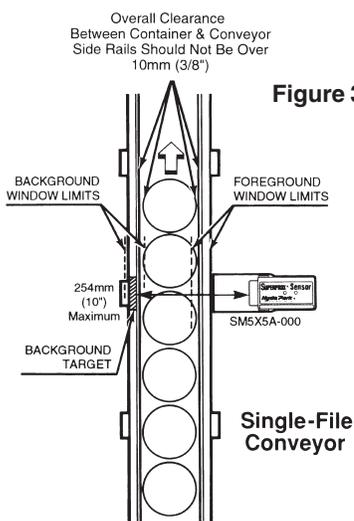


Figure 3

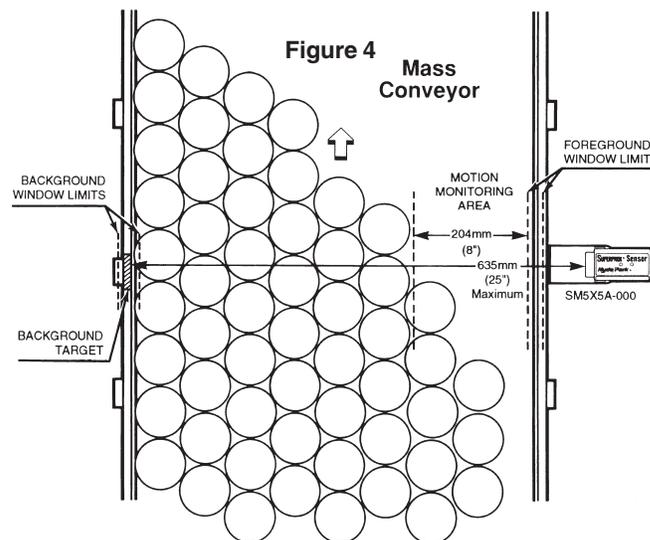


Figure 4 Mass Conveyor

place a container on the conveyor against the rail nearest to the sensor with the main body area directly in front of the sensor and press the LIMITS push-button once. Again, while the push-button is depressed, the LED is amber. Upon release of the push-button, the LED turns green indicating the background and foreground window limits have been successfully set. If 30 seconds elapse before the foreground window limits are set, the limits revert back to the previous settings.

At the same time, the sensor output switches from OFF to ON, placing the sensor into the operational mode, ready to use. When power is off or interrupted, the limits are retained in a nonvolatile memory.

The background and foreground window limits can be set up in reverse order. To set the limits in reverse order, place a container on the conveyor against the rail nearest to the sensor with the main body area directly in front of the sensor and press the LIMITS push-button once. This sets the foreground window limits and switches the sensor output OFF during the limit setup. While the LIMITS push-button is depressed, the multicolored LED, located on top of the sensor, is amber. Upon release of the push-button, the LED flashes amber indicating that the background window limits need to be set within 30 seconds. Move containers away from between the sensor and background target and press the LIMITS push-button once. Again, while the push-button is depressed, the LED is amber. Upon release of the push-button, the LED turns red indicating the foreground and background window limits have been successfully set. At the same time, the sensor output switches from OFF to ON, making the sensor operational.

If in setting the limits the echo from either the background target or container is too weak or distorted, the LED flashes red for 10 seconds (or until the button is pressed again) indicating the limit setting was not accepted by the sensor. Attempt to set both limits again with the container and background target surfaces parallel to the face of the sensor.

RATE Adjustment

The RATE potentiometer sets the minimum threshold rate at which the sensor output switches either OFF or ON, depending whether there is a decrease or an increase in the container motion rate. A CW rotation increases the rate setting of the single turn RATE potentiometer. The output switches OFF when containers are moving below the setting of the RATE potentiometer. The

output switches ON after container movement resumes at/or above the setting of the RATE potentiometer for a delay-on time period. The rate adjustment range for sensing minimum container motion on single file of mass conveyor is determined by the Switch 2 position. With Switch 2 in the SNGL position, the rate adjustment range is 30 to 1200 CPM (See Figure 5). With Switch 2 in the MASS position, the rate adjustment range is 5 to 200 CPM (See Figure 6). Initially, set the RATE potentiometer fully CCW to the minimum rate position. After the background and foreground sensing window limits have been set, the RATE potentiometer can be adjusted to the appropriate setting by slowly turning the potentiometer CW with containers moving at the optimum line speed in the application.

DELAY ON Adjustment

The DELAY ON potentiometer sets the minimum delay time before the output switches from OFF to ON after container movement resumes at or above the setting of the RATE potentiometer. A CW rotation increases the delay setting of the single turn DELAY ON potentiometer. The delay-on adjustment prevents the output from switching ON prematurely when container movement resumes momentarily at or above the setting of the RATE potentiometer. The delay-on time adjustment range is .05 to 10 seconds.

Initially, set the DELAY ON potentiometer fully CCW to the minimum delay-on time position. After the RATE potentiometer has been set, the delay-on time can be set at the DELAY ON potentiometer for the appropriate delay time before the sensor output switches ON in the application.

Rate Potentiometer

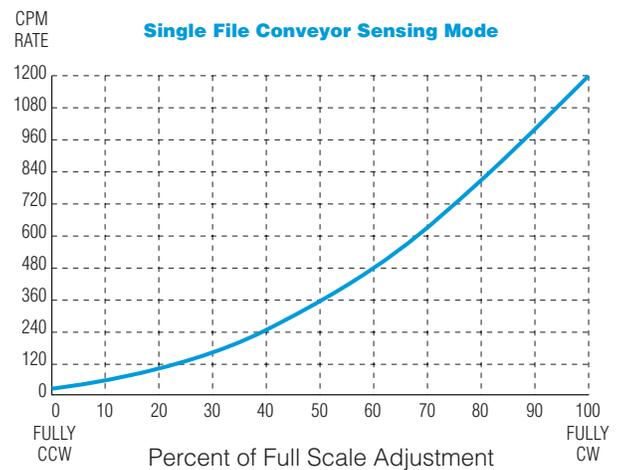


Figure 5

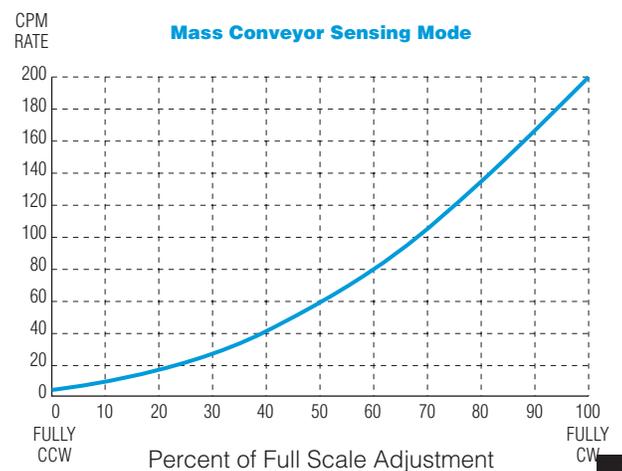


Figure 6

Multicolored LED Indicator During Limit Setup

Setting Limits For The Background 1st & Foreground 2nd

Prior to pressing LIMITS push-button for setting the background limits without containers on conveyor between the sensor and background target:

- Red or Amber - Sensing background target, ready for background limits setup.
- Off - Background target either not aligned with sensor or beyond sensing range.

Press and release LIMITS push-button:

- Flashing Amber - Background limits accepted; waiting for foreground limits setup within 30 seconds.

- Flashing Red - Background limits not accepted; verify background target aligned with sensor and within sensing range before repeating background limits setup (flashing red LED lasts for 10 seconds or until the pushbutton is pressed again).

Place a container on conveyor with the container directly in front of the sensor before pressing LIMITS push-button for setting the foreground limits.

Press and release LIMITS push-button:

- Green - Foreground limits accepted; sensor is ready for detecting container motion.
- Flashing Red - Foreground limits not accepted; verify the container is centered and parallel with sensor face (flashing red LED lasts for 10 seconds or until the push-button is pressed again). Move container away from sensor, press and release LIMITS pushbutton for flashing amber LED. Place the container directly in front of sensor again, press and release LIMITS push-button for green LED display.

Setting Limits For The Foreground 1st & Background 2nd

Prior to pressing LIMITS push-button for setting the background limits with a container on conveyor and directly in front of the sensor:

- Green or Amber - Sensing container, ready for foreground limits setup.
- Off - not sensing container, container not centered or parallel with the sensor face.

Press and release LIMITS push-button:

- Flashing Amber - Foreground limits accepted, waiting for background limits setup within 30 seconds.
- Flashing Red - Foreground limits not accepted; verify the container is centered and parallel with sensor face before repeating foreground limits setup (flashing red LED lasts for 10 seconds or until the push-button is pressed again).

Electrical Wiring

Sensor wires must be run in conduit free of any AC power or control wires.

Sensor Wire Colors

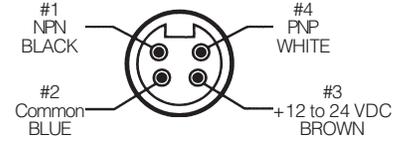
	Cable Style	Connector Style
DC Models		
(+) 12 to 24 VDC	RED	BROWN
NPN/Sinking Output	WHITE	BLACK
PNP/Sourcing Output	GREEN	WHITE
Common	BLACK	BLUE
AC Models*		
100 to 240 VAC	BROWN	BROWN
Switch Line Side	BLACK	BLACK
Switch Load Side	WHITE	WHITE
Neutral	RED	BLUE

*WARNING

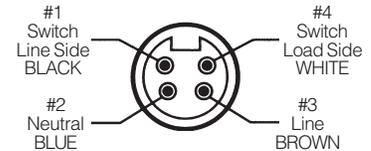
No cables are alike. Verify that connector pin outs and cable conductor colors match up with the wiring illustrations shown in the operating instructions.

View of Plug on Connector Style Sensors

DC Power Models



AC Power Models



Model Reference Guide - SM505 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 available.

EXAMPLE MODEL:

SUPERPROX® Product Series

SM5 0 5 A - 1 00 - FS N S 3

Power/Connection Type

0...12 to 24 VDC / cable style 5...12 to 24 VDC / connector style
 2...100 to 240 VAC / cable style 7...100 to 240 VAC / connector style

Sensing Function

5...Proximity - motion

Design Level

A...Applies to all DC-powered models
 B...Applies to all AC-powered models

Sensing Range

0...51 to 635 mm (2 to 25")
 1...51 to 1 m (2 to 39")

Functionality

00...Standard Proximity - motion

Special Features

...No letter indicates standard sensor with no special features
 FS...Fluorosilicone transducer face
 AA...Remote limit setup (available on cable models only.)
 AB...RS232, 4-digit/2-decimal place output (available on cable models only.)
 AD...Limits push-button disabled
 AE...RS232, 5-digit/3-decimal place output (Available on cable models only.)
 AF...No LEDs

Housing Types

...No letter indicates standard ULTEM® plastic housing
 N...NORYL® Dairy 3A gray plastic housing

Remote Type

...No letter indicates standard coupler
 R...Right-angle sensing head with armor cable
 S...Straight sensing head with armor cable

Remote Cable Length

...No number indicates standard coupler
 1...254 mm (10")
 2...508 mm (20")
 3...762 mm (30")
 4...1016 mm (40")

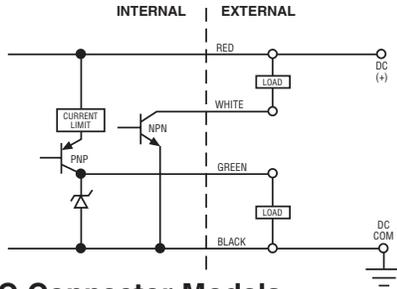
Armored (standard) or PVC cable (specify P after number)

5P...1270 mm (50") Available in PVC cable only
 6P...1524 mm (60")

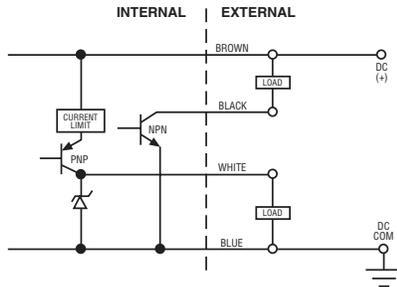
* ULTEM® and NORYL® are registered trademarks of The General Electric Company.

Outputs

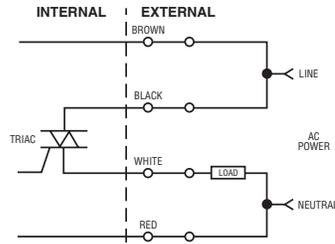
DC Cable Models



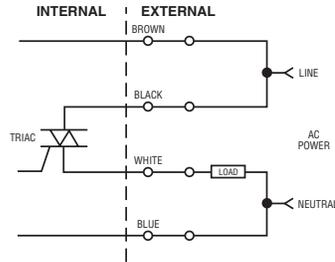
DC Connector Models



AC Cable Models

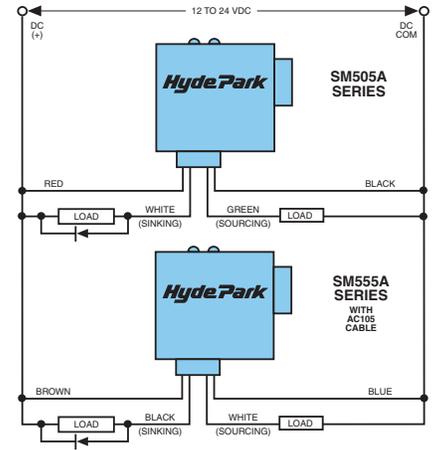


AC Connector Models

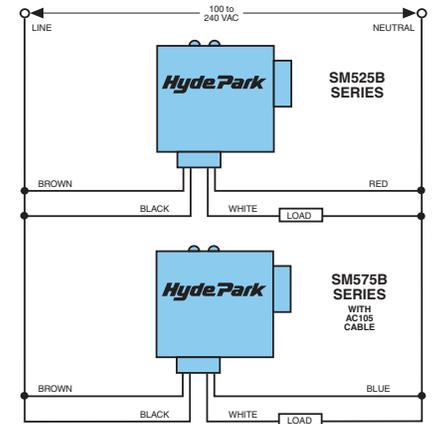


Sensor Wire Connections

DC Cable Models

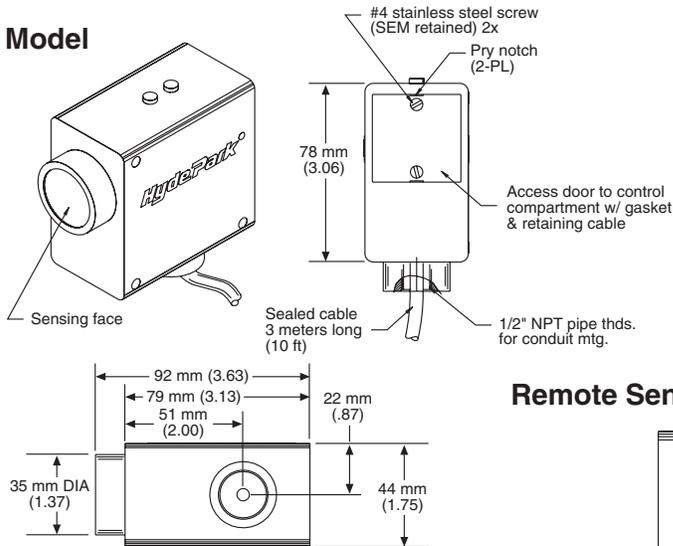


AC Cable Models

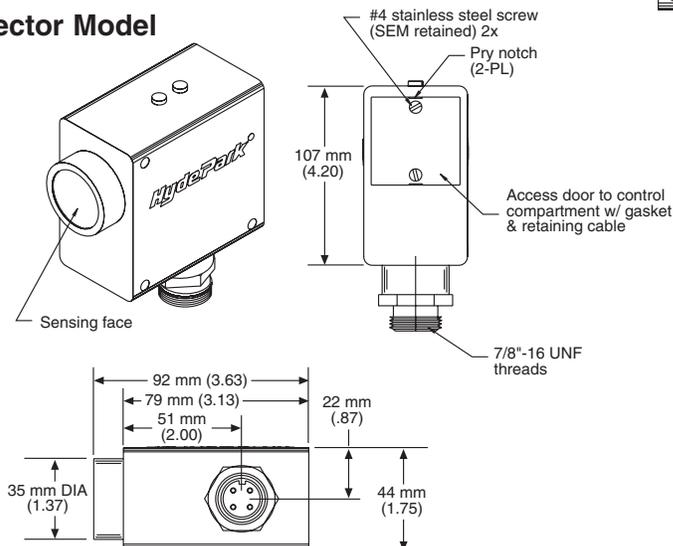


Dimensions

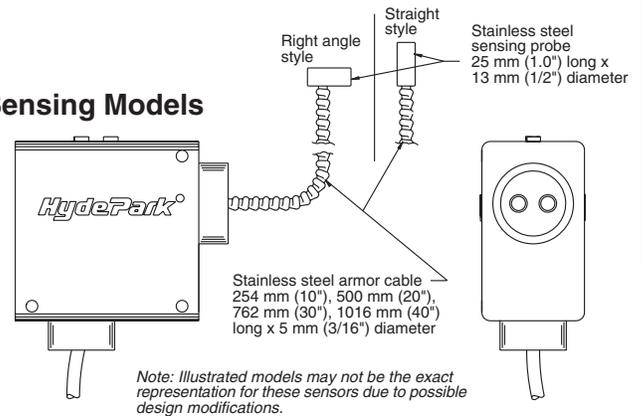
Cable Model



Connector Model



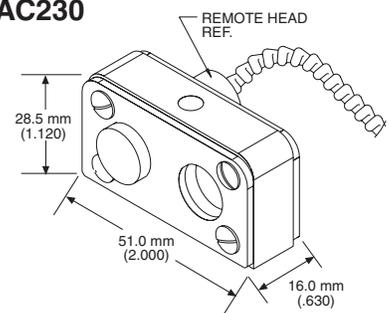
Remote Sensing Models



Note: Illustrated models may not be the exact representation for these sensors due to possible design modifications.

Mounting Accessories

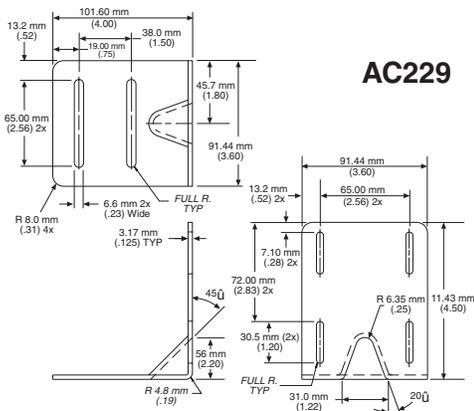
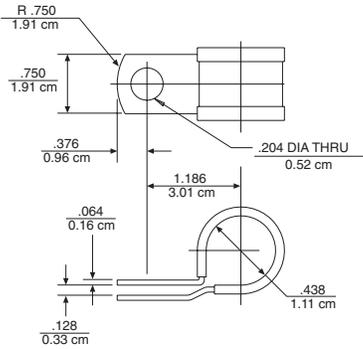
AC230



SUPERPROX® PROXIMITY SENSORS

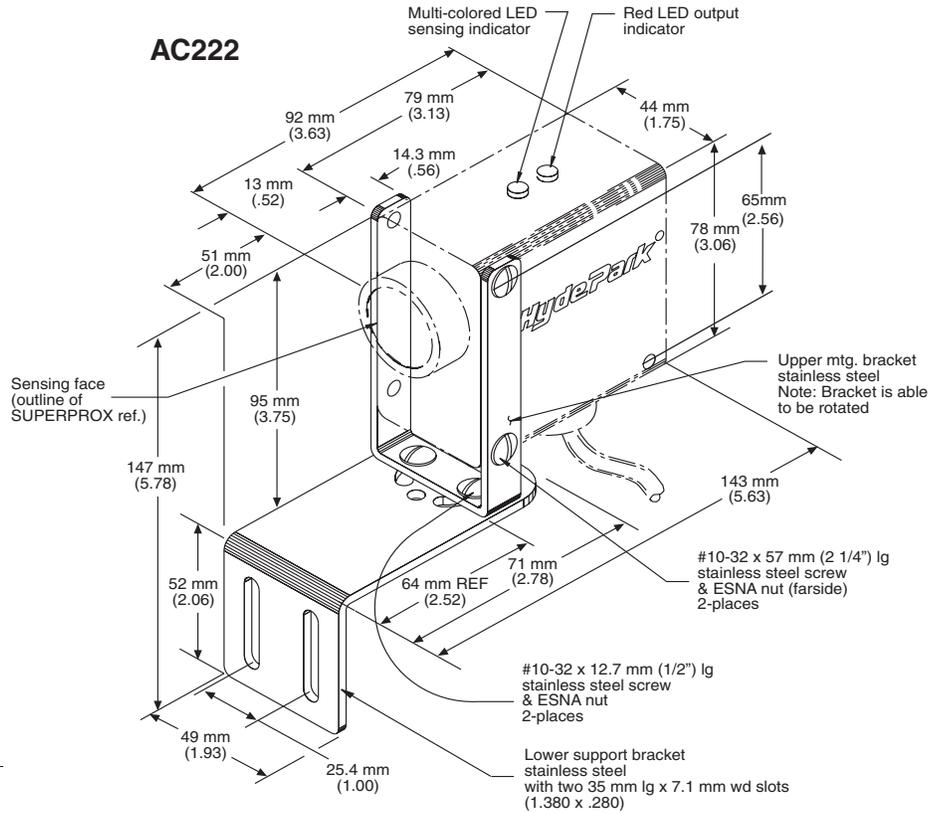
Mounting Accessories

AC213



AC229

AC222



General Specifications

Sensing

Range:
51 to 1 m (2 to 39")
Sonic Frequency: 200 kHz

Power Requirements

DC Models:
12 to 24 VDC \pm 10% @ 80 mA, 2 W max.,
excluding output load (regulated supply)
AC Models:
100 to 240 VAC, 50/60 Hz, @ 30 mA, 7.5 VA
max., excluding load

Outputs

DC Models:
NPN Sinking: Switch selectable N.O./N.C.
Sinking on-state voltage drop:
Maximum 0.25 volts @ 60 mA
Sinking load current:
Maximum 100 mA
Sinking output voltage:
Maximum applied 30 VDC
PNP Sourcing: Switch selectable N.O./N.C.
Sourcing output current:
Maximum 100 mA
Current limit protected to less than 160 mA
AC Models:
Triac, switch selectable N.O./N.C.
Maximum continuous load current: 1 Amp
Maximum applied output voltage: 260 VAC
Maximum off-state leakage current: less than
50 μ A (100% PLC/AC input interface compatibility)

Response Time

"On" 100 ms, "Off" 100 ms

Indicators

Multicolored (Amber, Red, Green)
LED: Indicates limits setup and operational modes
Red LED: Indicates sensor output; illuminated
when output is in an active (on) state.

Connections

Cable Style Models:
DC: 24 AWG, PVC jacket, 4-conductor,
3 meters (10') long, standard
AC: 20 AWG, PVC jacket,
4-conductor, 3 meters (10') long,
standard
Connector Style Models:
DC: 4-pin, "mini" style
AC: 4-pin "mini" style

Protection

Power Supply: current-limited over-voltage, ESD,
reverse polarity, fused on AC model
Outputs: current-limited over voltage,
ESD, over-current, fused TRIAC on AC model

Environmental

Operating Temperature Range:
0° to 50°C (32° to 122°F)
Storage Temperature Range:
-40° to 100°C (-40° to 212°F)
Operating Humidity: 100%
Protection Ratings: NEMA 4X, IP67
Chemical Resistance: Resists most acids and
bases, including most food products.
Fluorosilicone transducer face is available to
provide resistance to aromatic and petroleum-
based hydrocarbons.

Agency Approvals

CE Mark: CE conformity is declared to:
EN61010-1: 1990 including amend. No. 1:1992
EN55011 Group 1 Class A, EN50082-1.
Declaration of conformity available upon request.

AC Models SM520/570 carry the ETL safety label.

Construction

Dimensions (overall)
92 mm (3.625") L x 44 mm (1.75") W x
91 mm (3.58") H
Housing:
Case: ULTEM®* (FDA approved)
Optional: NORYL®* (USDA-Dairy 3A
Sanitary Standards compliant)
Transducer Face: Silicone rubber
(FDA approved)
Optional: Fluorosilicone rubber
Sensor Cable: PVC jacket
LED: Polycarbonate

* ULTEM® and NORYL® are registered trademarks of The
General Electric Co.

Accessories

- Model AC105**, Straight, 7/8-16 mini, 4-conductor,
mating connector cable, 4 m (12'), for connector
style sensors
- Model AC105-50**, Straight, 7/8-16 mini, 4-conductor,
mating connector cable, 15 m (50'), for connector
style sensors
- Model AC213**, Stainless and Teflon, remote sensing
probe mounting bracket
- Model AC222**, Standard, stainless mounting bracket
assembly, slotted for vertical adjustment
- Model AC229**, Stainless, plate-style, right-angle,
mounting bracket, with base slotted for forward
reverse adjustment and side slotted for sensor
adjustment
- Model AC230**, Three-piece, stainless, mounting
bracket assembly with O-ring mount for sensor
models with remote heads.

See page 7-1 for accessory photos.

Selection Chart

SM505 Series Proximity Motion Sensing

Model No.	Power		Connection		Sensing Range			Transducer Style		Materials				Special Features			
	100-240 VAC	Version	12-24 VDC	Cable	Connector	Style	1 m (39")	635mm (25")	Standard	Remote	Rt. Angle	Straight	Silicone*		Fluorosilicone*	ULTEM®*	NORYL®*
SM505A-000			■	■			■	■					■		■		
SM505A-100			■	■			■	■					■		■		
SM525B-000	■			■			■	■					■		■		
SM525B-100	■			■			■	■					■		■		
SM555A-000			■		■		■	■					■		■		
SM555A-000 R4			■		■		■	■		■(40°)			■		■		
SM555A-100			■		■		■	■					■		■		
SM575B-000	■				■		■	■					■		■		
SM575B-100	■				■		■	■					■		■		
SM575B-100 R4	■				■		■	■		■(40°)			■		■		

• = Most commonly stocked sensors

* = See definition in *Sensing Terms*.

All possible sensor configurations are not listed here.

