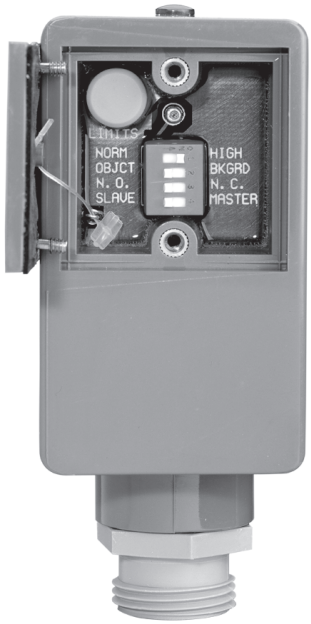
Model SM504 Series

SUPERPROX® Ultrasonic Proximity Sensors

Synchronized/ Gate-controlled Sensing

CE



- *Allows sensors to operate in close proximity*
- *Detects objects at specific points within adjustable "window" limits*
- *Makes profiling and positioning applications possible*
- *A push-button sets window limits*
- *Operating range up to 2 m (79")*
- *CE certified*

Sensing full or empty case conditions is greatly simplified with these SUPERPROX® sensor models. Other typical applications include sensing height differentiation, detecting object surfaces in specific areas, and performing on-demand and automation-control sensing functions.

The SUPERPROX® Model SM504B (cable style) and Model SM554B (connector style) series of ultrasonic, proximity sensors, when used in a set, provide for external control of the pulsing of all the sensors. A setup switch in these sensors, designated "Master" and "Slave," selects the operating technique to either simultaneously synchronize or gate the transmit and receive cycles of a multiple sensor set. This unique concept is an effective solution for applications such as: full or empty case inspecting, on-demand controlled sensing or inspecting, in-case container counting, automation control sensing, object-in-area sensing, down container sensing, differential height inspecting, and more.

The synchronized technique is designed for applications requiring continuous "curtain" sensing over a wide area. Synchronized sensing allows any number of sensors to be operating close together, thus eliminating any possible adverse ultrasonic signal interference between the sensors.

Controlled or multiplexed sensing of multiple objects, locations or surfaces is accomplished using the gated technique. With this technique, PLS and PLC output switches or other sensing devices may be used to trigger or gate a sensor set. Depending on the applications, a set of these sensors is used with an isolated switching device to prevent possible false sensor outputs due to changing foreground object conditions.

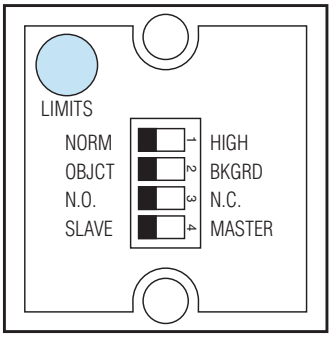
Like other SUPERPROX® sensors, these models have the capability to detect objects at specific points within adjustable "window" limits, thus making profiling and positioning applications possible. A push-button sets the window limits. The sensors carry the CE Mark and are epoxy sealed in a tough plastic housing to resist harsh, wet, or dirty environments typically associated with the above applications. The housing meets NEMA 4X (indoor use only) and IP67 industry standards. A Dairy 3A compliant housing is available as an option. These sensors have operating ranges of 51 to 635 mm (2 to 25"), 51 to 1 m (2 to 39") and 120 mm to 2 m (4.7 to 79") and are available in 12 to 24 VDC model versions.

Control Compartment

A unique feature available to the user of these sensors is the ability to quickly set up each sensor for a specific application. The sensor is configured through four slide switches and a push-button

(See Figure 1) 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 1



Sensor Configuration Switches

Switch 1 configures the sensor to operate in either a normal or high sensitivity mode. Place this switch in the NORM position for sensing liquid or solid materials. Place the switch in the HIGH position for sensing soft or porous materials that will absorb some of the ultrasonic energy.

Switch 2 configures the sensor to operate in either an object or background sensing mode. Place this switch in the OBJCT position to perform a sensing function for receiving the reflected ultrasonic energy directly off an object. Place this switch in the BKGRD position to perform a break-beam sensing function for receiving the reflected ultrasonic energy directly off a fixed background target.

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

Switch 4 configures the sensor to perform either a slave or master operating function. See Synchronized Sensing and Gate-controlled Sensing descriptions for selecting the proper switch position.

Synchronized Sensing

Synchronized sensing is a unique feature of this sensor that enables reliable "curtain" sensing or inspecting over a wide area by using multiple sensors in a set. Synchronized sensing allows these sensors to be operated close together, thus eliminating any possible adverse ultrasonic signal interference between the sensors.

Any number of these sensors can be operated together to perform a synchronized sensing function. It is accomplished by simply connecting together the external control wire lead from all the sensors in the set as shown in the illustration on the next page. One of the connected sensors must operate with setup Switch 4 in the "Master" position and the other connected sensors must operate with setup Switch 4 in the "Slave" position. The designated "Master" sensor continuously synchronizes the transmit and receive cycles of all the connected sensors as a result of this configuration.

Model Reference Guide - SM504 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: **SM5 5 4 B - 4 00 - AF**

SUPERPROX® Product Series

Power/Connection Type (DC only)
0...12 to 24 VDC / cable style
5...12 to 24 VDC / connector style

Sensing Function
4...Proximity - Synchronized/Gate-controlled

Design Level
A…Applies to discontinued models with NPN sinking output only
B…Applies to models with NPN sinking and PNP sourcing outputs

Sensing Range
0...51 to 635 mm (2 to 25")
1...51 to 1 m (2 to 39")
4...120 mm to 2 m (4.7 to 79")

Functionality
00...Standard Proximity
05...Default Window: ±0.5"
44...Default Window: ±0.1"
67...Switch selectable, 1 or 2 echo hit recognition with high gain

Special Features
...No letter indicates standard sensor with no special features
FS...Fluorosilicone transducer face
AA...Remote limit setup (Available on DC 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 couopler
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")
6P...1524 mm (60")
Available in PVC cable only

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

Gate-controlled Sensing

Gate-controlled sensing is another unique feature that enables this sensor to perform periodic sensing of multiple objects or locations. Depending on the application, one or a set of these sensors is used with an isolated switching device for preventing possible false sensor outputs due to changing foreground object conditions. Devices such as SUPERPROX® sensors, programmable limit switches or other proximity sensor switches with an open-collector, current sinking output are typically used to perform the isolated gate-switch or "Master" sensor function.

Gate-controlled sensing is accomplished by connecting the external control wire lead from each sensor to the DC supply voltage common through the isolated switch as shown in the illustration on the next page. Each connected sensor must operate with setup Switch 4 in the "Slave" position. In this configuration, the sensors simultaneously transmit and receive ultrasonic energy only when the gate device is switched to the ON or CLOSED state. When the gate device is switched back to the OFF or OPEN state, the sensor outputs are latched from changing state until the next gate-switch cycle.

Sensor Limits Setup Push-button

First, during installation make sure the sensor face is as parallel as possible to the surface of the material being detected.

To set the limits, simply place an object at the desired distance from the sensor for one limit and press the LIMITS push-button once. This sets the first limit and switches the sensor output to an inactive state 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 second limit needs to be set within 30 seconds. Place an object at the desired position for the second limit 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 flashes amber momentarily and then turns green to indicate acceptance of both limits. If 30 seconds elapse before the second limit is set, the limits revert back to the previous settings.

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

If in setting either limit the echo from the object 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, being careful to keep the object surface parallel to the face of the sensor.

Minimum allowed distance between any two setup limits is 13 mm (1/2"). The multicolored LED flashes RED after the press and release of the LIMITS push-button for the second limit setting if the distance between the limit settings is less than 13 mm. The multicolored LED continues flashing RED either until the LIMITS push-button is pressed and released once for the first limit setting or until 10 seconds have elapsed. Pressing and releasing the LIMITS push-button once reinitiates the limit setup sequence. If 10 seconds elapse before the LIMITS push-button is pressed and released for the second limit setup, the limits revert back to the previous settings.

A special feature provides an automatic 13 mm (1/2") window limits setup function. Simply place an object within the sensing range of the sensor and press the LIMITS push-button twice in succession without moving the object. A limit is set on a line 1/4" in front and back of the object surface nearest the sensor.

Multicolored LED Indicator During Limit Setup

Prior to pressing LIMITS push-button:

- Off - Sensing no object or object is outside of the sensing range
- Red - Sensing an object out side the set limits
- Green - Sensing an object inside the set limits

LIMITS push-button depressed for first time:

- Amber - sensing a good object surface condition
- Red - Sensing no object or a poor object surface condition

LIMITS push-button released for first time:

- Flashing Amber - First limit accepted,waiting for second limit
- Flashing Red - First limit not accepted; retry setting limit

LIMITS push-button depressed for second time:

- Amber - Sensing a good object surface condition
- Red - Sensing no object or a poor object surface condition

LIMITS push-button released for second time:

- Green or Red - Second limit accepted
- Green or Amber - Second limit accepted
- Flashing Red - Second limit not accepted; retry setting both limits

Multicolored LED Indicator in Operational Mode

- Off - Sensing no object or object is outside the sensing range
- Red - Sensing as object outside the set limits
- Green - Sensing an object inside the set limits

Red LED Indicator in Operational Mode

The red LED serves as a visual indicator for the sensor output. The LED is illuminated when the output is in an active (ON) state. Note: Indicator is not provided on all models.

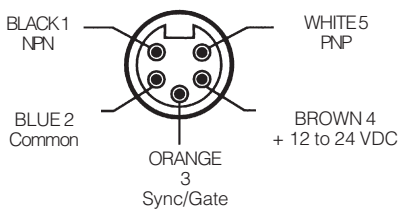
Electrical Wiring

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

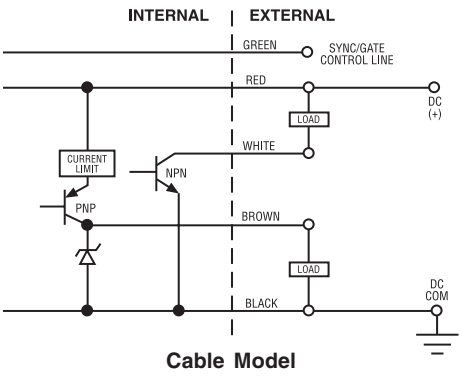
Sensor Wire colors

	Cable Style	Connector Style
(+)12 to 24 VDC	RED	BROWN
NPN/Sinking Output	WHITE	BLACK
PNP/Sourcing Output	BROWN	WHITE
Sync/Gate Control	GREEN	ORANGE
DC Common	BLACK	BLUE

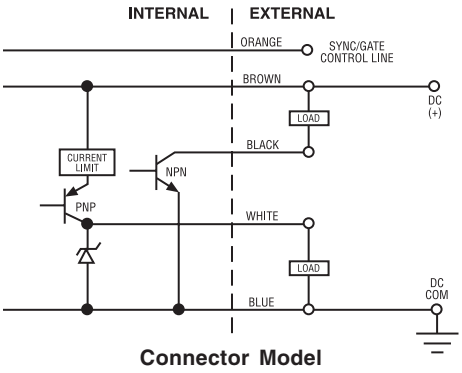
View of Plug on Connector Style Sensor



Outputs

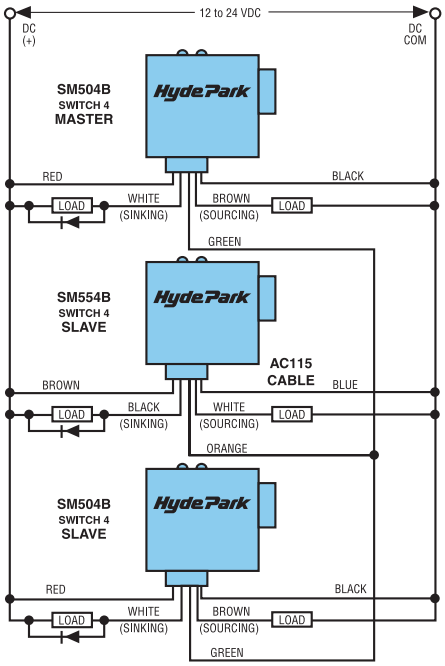


Cable Model

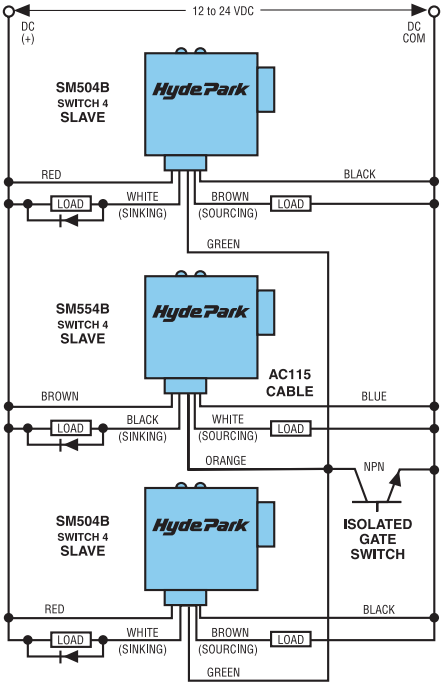


Connector Model

Synchronized Sensing Connections

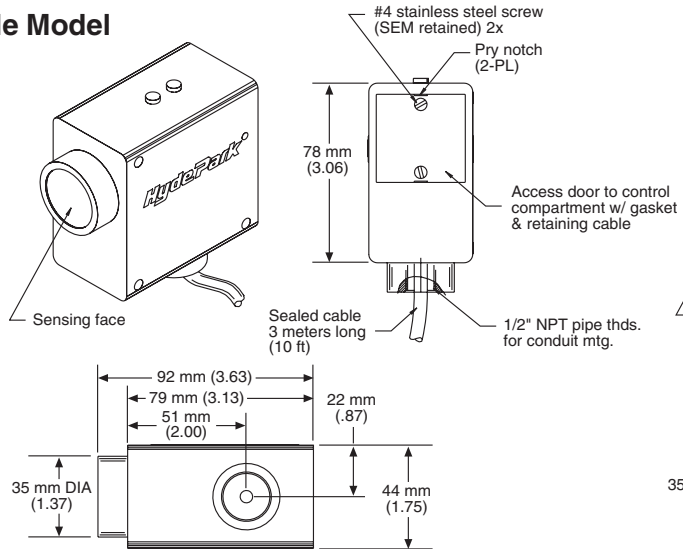


Gate-controlled Sensing Connections

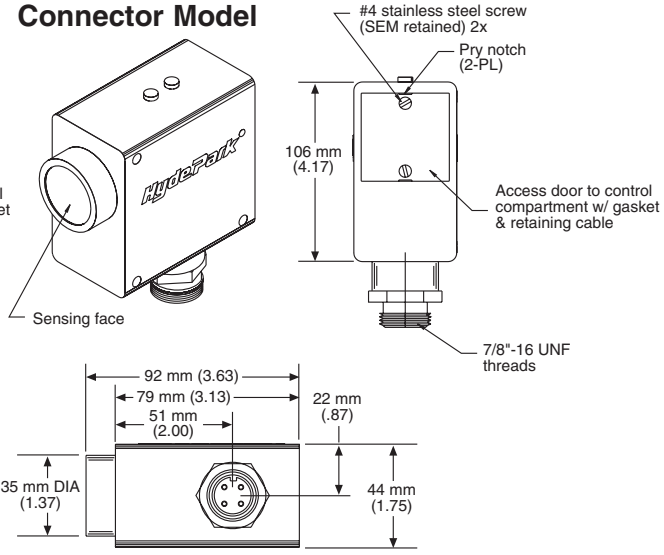


Dimensions

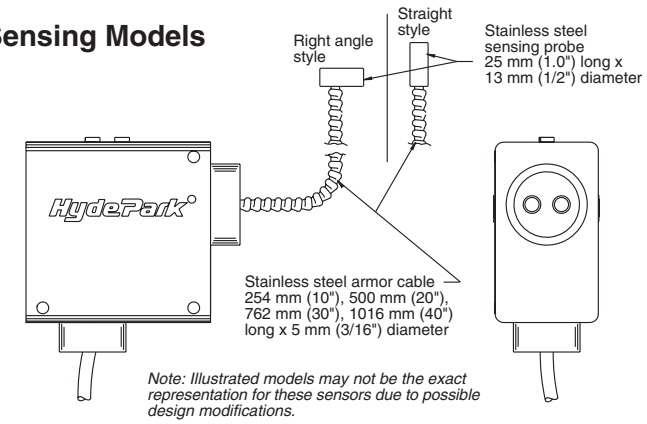
Cable Model



Connector Model



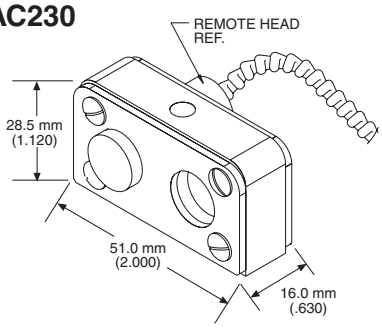
Remote Sensing Models



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

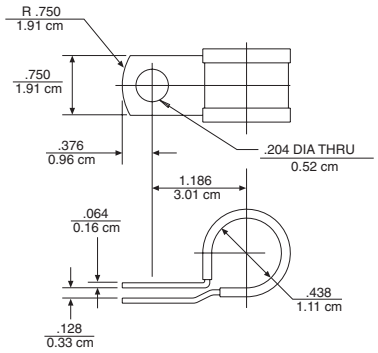
Mounting Accessories

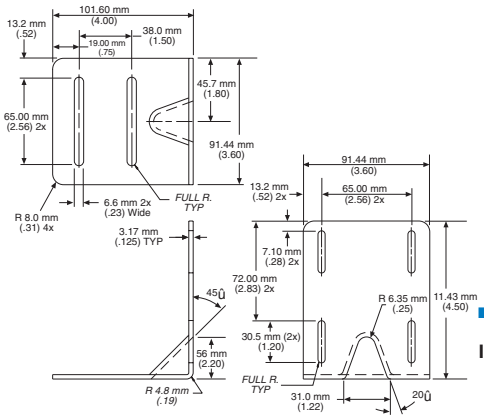
AC230



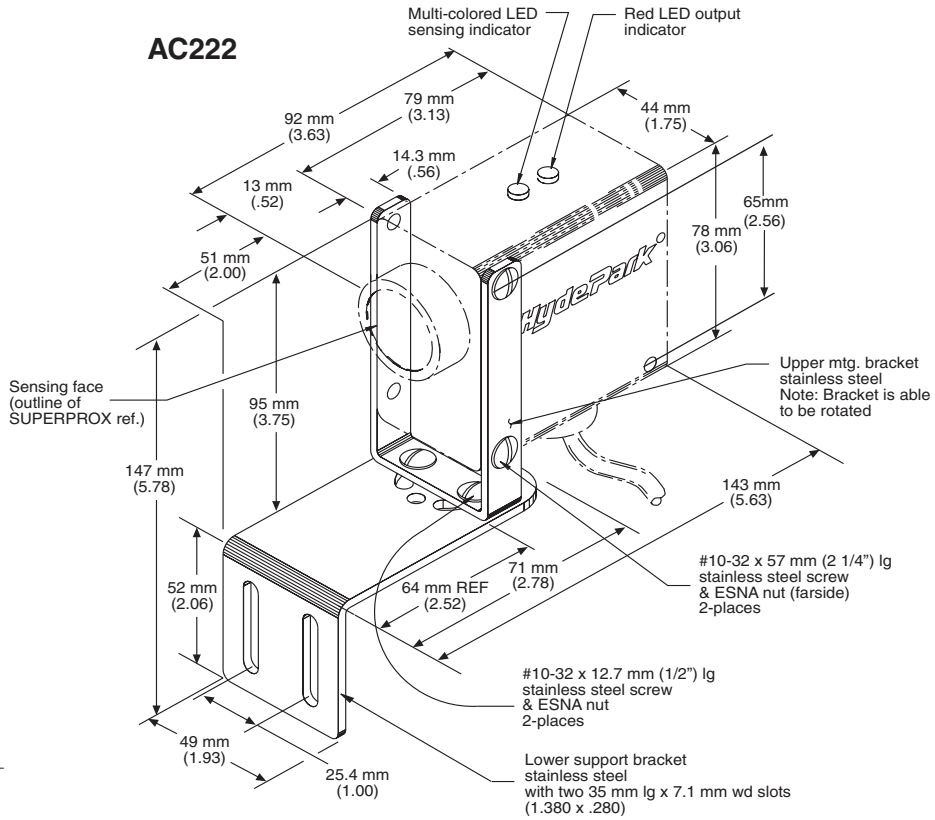
Mounting Accessories

AC213





AC222



General Specifications

Sensing

Ranges:
- 51 to 1 m (2 to 39")
- 120 mm to 2 m (4.7 to 79")

Sonic Frequency: 200 kHz

Power Requirements

DC Models:
- 12 to 24 VDC ± 10% @ 80 mA, 2 W max., excluding output load (regulated supply)

Output/Input

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

Input:
- Input voltage range: 0 to 30 VDC
- Vin-high, minimum: 2.5 V
- Vin-low, maximum: 1.4 V
- Input current maximum: 0.76 mA

Response Time

"On" 10 ms, "Off" 10 ms to "On" 30 ms, "Off" 30 ms, depending upon model

Indicators

Multicolored (Amber, Red, Green) LED: Indicates limits setup and operational modes

Red LED: Visual indicator for sensor output; illuminated when output is in an active (On) state.

Connections

Cable Style Models:
- DC: 24 AWG, PVC jacket, 5-conductor, 3 meters (10') long, standard

Connector Style Models:
- DC: 5-pin "mini" style

Protection

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

Outputs, Input: current-limited over voltage, ESD, over-current.

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 (indoor use only), 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 Ger Electric Co.

Accessories

Model AC115, Straight, 7/8-16 mini, 5-conductor, mating connector cable, 4 m (12'), for Model SM554B-XXX series connector-style prox sensors with alarms

Model AC115-50, Straight, 7/8-16 mini, 5-conductor, mating connector cable, 15 m (50'), for Model SM554B-XXX series connector-style prox sensors with alarms

Model AC213, Stainless and Teflon, remote sensing probe mounting bracket

Model AC222, Standard, stainless mounting bracket assembly, slotted for vertical adjustment

Model AC226, Stainless and polyamide conveyor-rail clamp/bracket set

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

SM504 Series

Proximity Synchronized & Gate-controlled Sens-

Model No.	Power Version: 12-24 VDC	Connection Style: Cable	Connection Style: Connector	Sensing Range: 2m(79")	Sensing Range: 1 m (39")	Sensing Range: 635mm (25")	Sensing Range: Standard	Transducer Style: Rt. Angle	Transducer Style: Remote Straight	Materials: Transducer: Silicone*	Materials: Transducer: Fluorosilicone*	Materials: Housing: ULTEM®*	Materials: Housing: NORYL®*	Special Features: Default Window	Notes
SM504B-000•	■	■				■	■			■		■			
SM504B-000 AA	■	■				■	■			■		■			Remote limit setup
SM504B-005 AA	■	■				■	■			■		■		±0.5"	Remote limit setup
SM504B-067	■	■				■	■			■		■			Switch selectable, 1 or 2 echo, hit recognition with high gain
SM504B-100•	■	■			■		■			■		■			
SM504B-100 R3	■	■			■			■ (30")		■		■			
SM554A-067	■		■			■	■			■					Switch selectable, 1 or 2 echo, hit recognition with high gain
SM554B-000•	■		■			■	■			■		■			
SM554B-000 S4	■		■			■			■ (40")	■		■			
SM554B-005	■		■			■	■			■		■		±0.5"	
SM554B-044	■		■			■	■			■		■		±0.1"	
SM554B-067	■		■			■	■			■		■			Switch selectable, 1 or 2 echo, hit recognition with high gain
SM554B-100•	■		■		■		■			■		■			
SM554B-105	■		■		■		■			■		■		±0.5"	
SM554B-400 AF	■		■	■			■			■		■			No LEDs

• = Most commonly stocked sensors
* = See definition in *Sensing Terms*.
All possible sensor configurations are not listed here.