VIRTU™

Ultrasonic Proximity Sensors

- *Sensing range of 50.8 mm (2") up to 508 mm (20")*
- *Dual-mount flat-profile body style and 18 mm barrel*
- *Sinking (NPN) or sourcing (PNP) output available*
- *Rugged duty design for harsh enviroments*
- *Simple remote push-button accessory available for teaching of sensing limits*
- *NEMA 4X (indoor use only), IP67*
- *CE certified*

The next generation compact ultrasonic proximity sensor outperforming many other sensor types in both application and cost.

The new Virtu™ ultrasonic sensor developed by Hyde Park features sensing ranges from 50.8 mm (2") up to 508 mm (20"). This versatile, powerful proximity sensor mostly sells for under $100, a price breakthrough for superior ultrasonic technology.

Virtu's dual-mount body style, with its M18 x 1 threaded snout 0.89" long and a 1.49" rectangular body for a total length of only 2.38", and tough VALOX® housing make it not only ideal for many OEM applications but also an unfailing performer for an array of packaging applications, including food and beverage. Available in cable or connector style, Virtu is the first sonic compact sensor to offer a dual mounting feature. It operates on 12 to 24 VDC and provides either a sinking (NPN) or a sourcing (PNP) output. Virtu also has teach-in window capability, and no downtime is required for sensor recalibration when colors, materials, or shapes change.

With protection ratings of NEMA 4X (indoor use only) and IP67, this CE certified sensor is resistant to dust, 100% humidity, most acids and bases, and high pressure wash-downs that often leave water buildup on the sensing face. This sleek sensor is virtually impervious to the effects of splashing food, caustic cleaning solutions, and changing light conditions or colors. Shielding and filtering make the fully encapsulated sensor resistant to radiated or conducted energy.

Operation

The Virtu Model VM series is a self-contained, pulse-echo, proximity sensing device that both transmits and receives sonic energy within a 508 mm (20") maximum sensing range. Operating on 12 to 24 VDC, and employing the latest piezoelectric and microprocessor technology, Virtu sensors detect only those designated objects within a set "window" and ignore all surrounding sonic interference.

Prior to operation, a simple and easy "teach" function is used to set the sensing window limits through either a remote or inline cable push-button. A near and far limit for a desired sensing window can be set anywhere within the sensing range and may be set to either encompass the full sensing range or be as small as 6 mm (0.25").

The sensor is equipped with a two-color status LED to show the state of the output. When the output is active, the LED is amber, regardless of whether the output is normally open or closed. When the output is not active, the LED is green. The LED also serves to show the sensing status of the sensor.

With a normally open output and an object in the sensing window, the LED will be amber and switch to green when the object leaves the sensing window, switching off the output. With a normally closed output and an object in the sensing window, the LED will be green and switch to amber when the object leaves the sensing window, switching on the output.

Setting the Window Limits

Before operating the sensor, you should teach the sensor the sensing window. The sensing window is the distance between the near and far limits. To teach the limits, press and hold the push-button. The LED fast flashes amber and then after 3 seconds, the LED slowly flashes green indicating the sensor is in teach mode. Release the push-button, and the LED continues slowly flashing green indicating the sensor is waiting for the first limit. Place a target at either limit, and press and release the push-button. While the push-button is pressed with a target present, the LED turns amber indicating a valid echo is being detected. After the first limit is successfully taught, the LED slowly flashes amber indicating the sensor is waiting for the second limit. Place a target at the second limit, then press and release the push-button. While the push-button is pressed with a target present, the LED turns amber indicating a valid echo is being detected. After the second limit is successfully taught, the two limits are saved in non-volatile memory. The LED fast flashes green for 3 seconds to indicate the limits were successfully saved. The limits can be set in either order.

To teach the default window of 25.4 mm (1.0"), while the sensor is in teach mode requesting the first limit (LED slowly flashing green), place a target parallel to the sensor face at the center of the desired window. Press and release the push-button twice in succession within one second. The LED fast flashes green indicating the limits were successfully saved. This sets the limits 12.7 mm (0.5 in.) in front of and behind the front surface of the target.

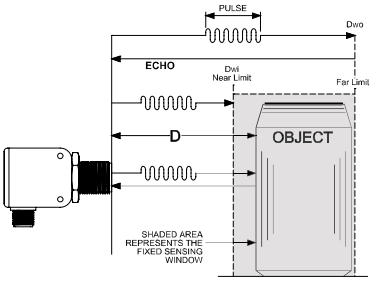
If not using an optional push-button, the process is similar. The white teach wire (pin 2) can be grounded to the blue DC return wire (pin 3) to simulate the pushing of the button. All LED indications and the teach sequence are identical to the previously detailed process.

While setting either limit, if no echo is detected, the LED fast flashes green and amber indicating no object is detected. After 5 seconds, the sensor resumes operation with the old limits. If either limit is not set in 30 seconds, a limit timeout occurs and the LED flashes green and amber for 3 seconds indicating the error. The sensor then resumes operating with the old limits.

How Does It Work?

During teach and operation, the Virtu sensor continually and accurately measures the elapsed time from the first pulse echo received after each pulse transmission. The transmitted pulse begins a time clock to register the elapsed time of the first received pulse echo. Given the elapsed time, the sensor software calculates the distance traveled out 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 = elasped time between the pulse transmission and its first received echo; Vs = the velocity of sound, approximately 335 meters (1100 feet) per second.

During operation, the calculated distance (D) between the sensor and the object is compared to the distances associated with the window limits. These limits are shown in the illustration as Dwi and Dwo. If D is within these limits, an output is activated or deactivated, depending whether normally open or normally closed. The output remains in such state until the echo does not return or it returns from outside the window limits.

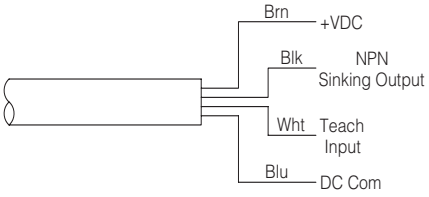


Electrical Wiring

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

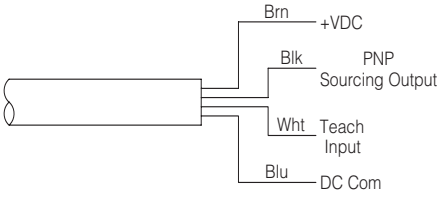
NPN Cable Style Wire

(dual-mount model only)

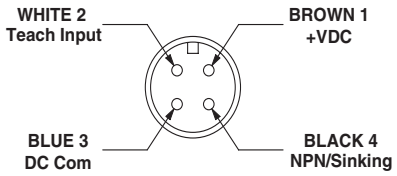


PNP Cable Style Wire

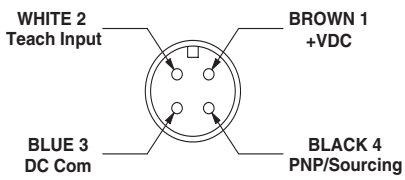
(dual-mount model only)



NPN Discrete Connector Style

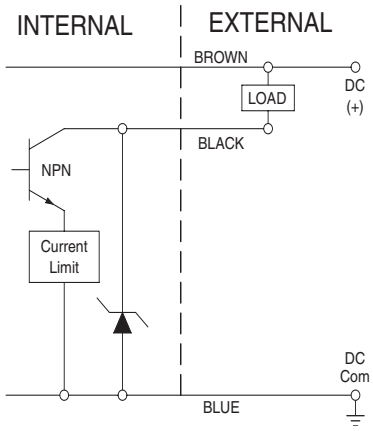


PNP Discrete Connector Style

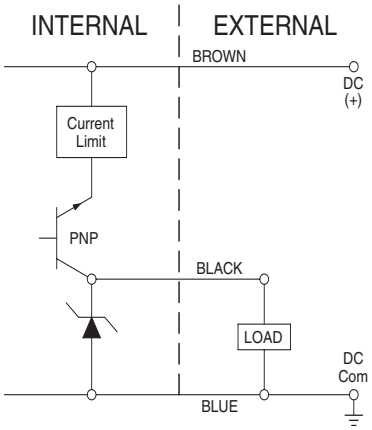


Output Style

NPN Output



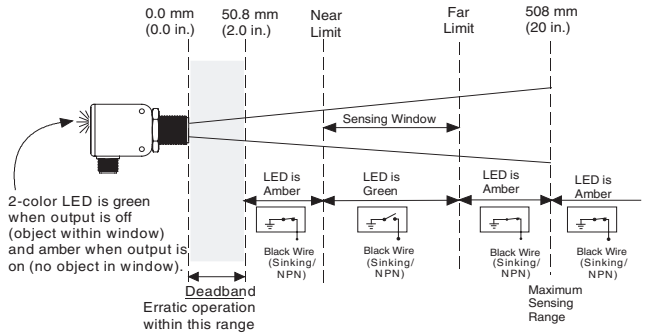
PNP Output



Output Type

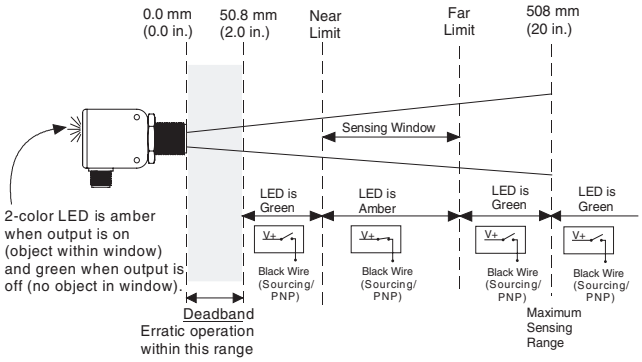
NPN - Normally Closed Output

The sensing window is determined by a teachable near and far limit, which can be set anywhere between the deadband (50.8 mm / 2.0 in) and the maximum sensing range (508 mm / 20 in.). The sensing window is taught using either an inline pushbutton switch or by grounding the teach wire.



PNP - Normally Open Output

The sensing window is determined by a teachable near and far limit, which can be set anywhere between the deadband (50.8 mm / 2.0 in) and the maximum sensing range (508 mm / 20 in.). The sensing window is taught using either an inline pushbutton switch or by grounding the teach wire.



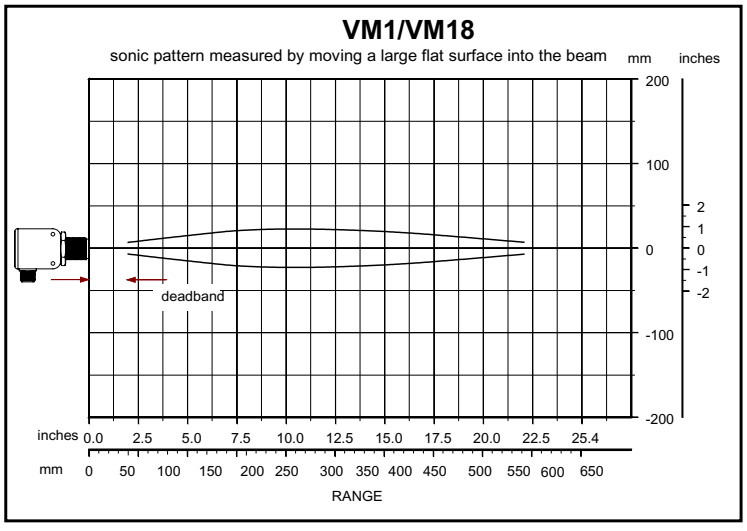
Beam Plots

The following plots, developed from data collected at 20°C and zero air flow, define the boundaries and shape of the sonic beam for the Virtu series sensors.

The boundaries were established using a 10 cm x 10 cm (3.94" x 3.94") "target" positioned parallel to the sensor face. The plot for each sensor series is valid for targets equal to or larger than 10 cm x 10 cm. Beam boundaries are determined by moving the large flat target into the beam while the plane of the target is held perpendicular to the beam axis.

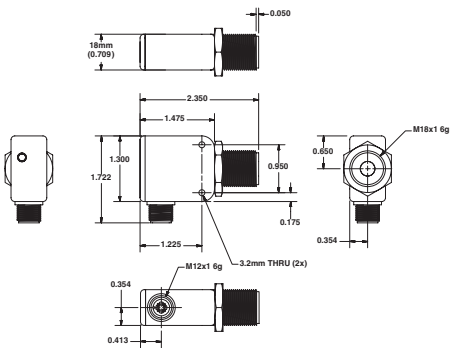
In each sensor series, the plot extends from the end of the "deadband" on the left to the end of the sensing range on the right. The sensor is illustrated in the middle left margin.

These and other plots are available from the SCC upon request.

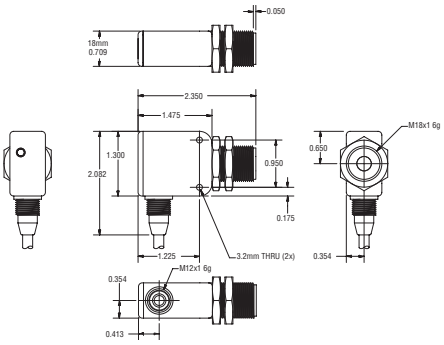


Dimensions

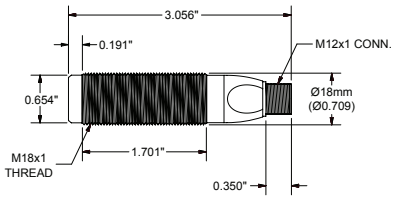
Quick Disconnect Style
(VALOX® Plastic) VM1-XXX-X



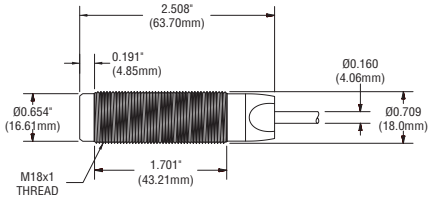
Cable Style
(VALOX® Plastic) VM1-XXX-X



Quick Disconnect Style
(VALOX® Plastic) VM18-XXX-X



Cable Style
(VALOX® Plastic) VM18-XXX-X



Model Reference Guide - VM 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: **VM 1 - P NO -Q**

Ultrasonic Miniature Proximity Series

Model Type
1.... .Dual-mount, flat-profile
18....18 mm barrel

Output Type
N....NPN sinking output
P.... PNP sourcing output

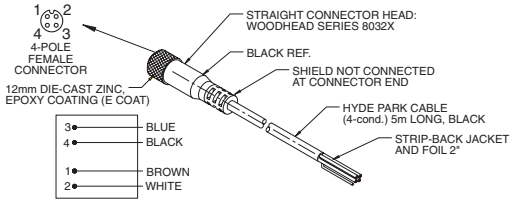
Output Style
NO...Normally open
NC...Normally closed

Connection Types
....No designator indicates 3m (10') cable style connection*
Q....Quick disconnect – 4 pin "micro" connector

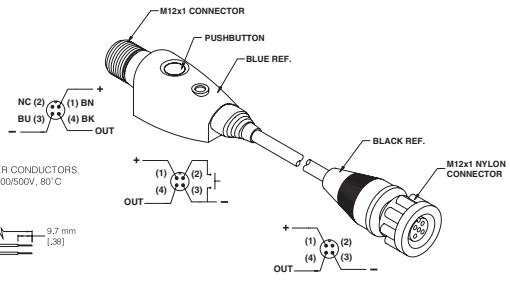
*** only available on the dual-mount body style**

Accessories

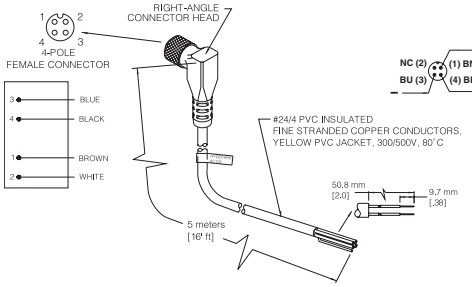
AC130 Straight, M12 micro, 4-conductor, connector/cable assembly, 5 m (16') (for barrel and flat-profile micro sensors)



PB100 In-line accessory push-button for teaching window limits (for Virtu series sensors).



AC132 Right-angle, M12 micro, 4-conductor, connector/cable assembly, 5 m (16') (for flat-profile connector-style sensors)



General Specifications

Sensing [T_A = 20° C (68° F)]

Sensing Range:
50 mm (2") to 508 mm (20") (large flat objects)
Sonic Frequency:
300 kHz
Minimum-size Detection:
2.5 mm (0.098") diameter rod or 1.0 mm (.039") bar at a distance of 200 mm (8")
Note: Smaller object may not be detected at closer distances
Maximum Angular Deviation:
± 5° on a 100 mm x 100 mm (4" x 4") flat target at a distance of 508 mm (20")
Sonic Cone Profile:
see beam plot on page 3-3
Limit Position Accuracy:
± 1.6 mm (0.062") max.
Repeatability:
± 0.7mm (0.027") or better

Power Requirements

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

Output

Sinking Output (NPN Model VM1-NXX):
Maximum on-state voltage:
0.75 V @ 100 mA
Maximum load current:
100 mA
Maximum applied voltage:
30 VDC
Sourcing Output (PNP Model VM1-PXX):
Maximum on-state voltage drop:
1.10 V@100mA
Maximum load current:
100mA
Output voltage:
V_{Supply} - 1.10 V @ 100mA

Input-Teach Setup

Contact Closure (push-button) to common.
Internal 115KW pull-up to 5V
Input Voltage Range
Setup Input Active 0V to 1V
Setup Input Inactive 2.5V to 5V
Max Voltage without Damage -30V to 30V

Response Time

15.0 ms on / 15.0 ms off max

Indicators

Green LED: Illuminated if output is off
Amber LED: Illuminated if output is on
Note: Green and Amber LEDs are never illuminated simultaneously

Connections

Cable style models:
24 AWG, foil shield, lead-free, PVC jacket 4-conductor, 3m (10') long
Connector style models:
12 mm, circular 4-pole, male micro connector

Protection

Power Supply:
Current-limited over-voltage, ESD, reverse polarity
Output:
Current-limited over-voltage, ESD, reverse polarity
Input:
Current-limited over-voltage, ESD, reverse polarity

Environmental

Operating Temperature Range:
-30° to 70°C (-22° to 152°F)
Storage Temperature Range:
-40° to 85°C (-40° to 185°F)
Operating Humidity:
100% non-condensing
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 (snout):
18 mm (0.709") x 1 mm - 6g thread x 22.23 mm (0.875") long
Flat-profile:
43.74 mm (1.722") x 18 mm (0.709") x 59.69 mm (2.354")
Overall length:
59.69 mm (2.354")
Housing:Shock and vibration resistant
Dual-mount style:
VALOX® plastic (FDA Approved)
18 mm barrel style:
PBT
Transducer Face:
Epoxy
Sensor Cable:
PVC jacketed, black
LED:
Polycarbonate

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

Accessories

Model PB100, Inline push-button switch (for teaching window)
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 micro connector sensors
Model AC228, Right-angle bracket

See page 7-1 for accessory photos

Selection Chart

VM Series Proximity

Model No.	Power Version 12/24 VDC	Conn. Style: Cable	Conn. Style: Quick Disconnect	Sensing: Range	Sensing: Window	Materials: Transducer: Epoxy	Materials: Housing: VALOX	Materials: Housing: PBT	Outputs: Type: NPN sinking	Outputs: Type: PNP sourcing	Outputs: Style: Normally open	Outputs: Style: Normally closed	Notes
VM1-NNO	■	■		508 mm (20")	Teachable	■	■		■		■		
VM1-NNC	■	■		508 mm (20")	Teachable	■	■		■			■	
VM1-NNO-Q	■		■	508 mm (20")	Teachable	■	■		■		■		
VM1-NNC-Q	■		■	508 mm (20")	Teachable	■	■		■			■	
VM1-PNO	■	■		508 mm (20")	Teachable	■	■			■	■		
VM1-PNC	■	■		508 mm (20")	Teachable	■	■			■		■	
VM1-PNO-Q	■		■	508 mm (20")	Teachable	■	■			■	■		
VM1-PNC-Q	■		■	508 mm (20")	Teachable	■	■			■		■	
VM18-PNO-Q	■	■		508 mm (20")	Teachable	■	■			■	■		
VM18-PNC-Q	■		■	508 mm (20")	Teachable	■	■		■	■		■	
VM18-NNO-Q	■		■	508 mm (20")	Teachable	■	■		■		■		
VM18-NNC-Q	■	■		508 mm (20")	Teachable	■			■			■	