VIRTU™ Analog Ultrasonic Sensors

- **Auto Slope, direct and inverse output versions**
- **Sensing range of 50.8 mm (2") up to 508 mm (20")**
- **Dual-mount flat-profile and 18 mm barrel body styles**
- **Rugged duty design for harsh environments**
- **Simple remote push-button accessory available for teaching of sensing limits**
- **NEMA 4X (indoor use only), IP67**
- **CE certified**

The next generation of compact ultrasonic analog sensors that outperforms many other sensor types in all types of applications.

The new Virtu™ Analog ultrasonic sensor developed by Hyde Park features sensing ranges from 50.8 mm (2") up to 508 mm (20").

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 15 to 24 VDC. Virtu™ also has teach-in window capability, and no downtime is required for sensor re-calibration when colors, materials, or shapes change.

With protection ratings of 4X 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™ Analog series is a self-contained, pulse-echo, analog sensing device that both transmits and receives sonic energy within a 508 mm (20") maximum sensing range. Operating on 15 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 in-line 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 three LED's to show the sensing status. The amber LED is off when an object is within the sensing window. The amber LED is on when an object is being sensed within the range of the sensor. The orange LED indicates the relative value of the analog output and varies in intensity according to the output. The higher the cur-

rent or voltage output, the brighter the orange LED.

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 amber LED fast flashes and then after holding the push-button for three seconds, the green LED slowly flashes indicating the sensor is in teach mode. Release the push-button, and the green LED continues slowly flashing indicating the sensor is waiting for the first limit. Place a target at the distance corresponding to the analog minimum (0 V or 4 mA), then press and release the push-button. While the push-button is pressed with a target present, the amber LED turns on indicating a valid echo is being detected. After the first limit is taught successfully, the amber LED slowly flashes indicating the sensor is waiting for the second limit. Place a target at the distance corresponding to the analog maximum (10 V or 20 mA), then press and release the push-button. While the push-button is pressed with a target present, the amber LED turns on indicating a valid echo is being detected. After the second limit is taught, the two limits are saved in non-volatile memory. The green LED fast flashes for 3 seconds to indicate the limits were successfully saved.

While setting either limit, if no echo is detected, the green and amber LED fast flashes 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 time out occurs, the LED flashes green and amber for 3 seconds indicating the error. The sensor then resumes operating with the old limits.

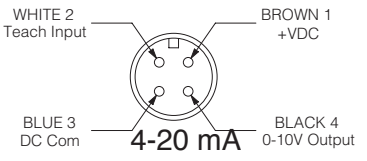
If not using an optional push-button, the process is similar. The white teach wire (pin 2) can be grounded to the blue DC return wire (pin 3) to simulate the pushing of the button. All LED indications and the teach sequence is identical to the previously detailed process.

How Does It Work?

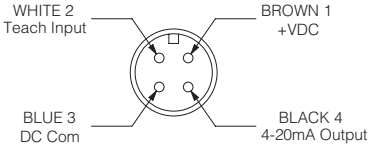
During teach and operation, the Virtu™ sensor continually and accurately measures the elapsed time from the first pulse echo received after each pulse transmission. The transmitted pulse begins a time clock to register the elapsed time of the first received pulse echo. Given the elapsed time, the sensor 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 = elapsed 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 between the sensor and the analog span limits. These limits are shown in the illustration as Dwi and Dwo. If D is at or within the analog span limits, an output value for D, relative to the analog span limits is generated.

Micro Connector Style
0-10 V

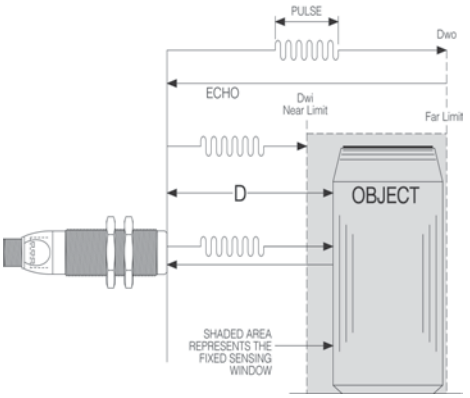


4-20 mA



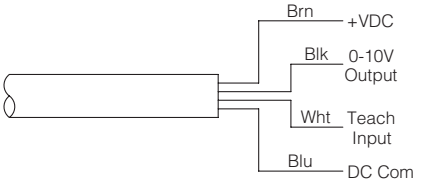
Electrical Wiring

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

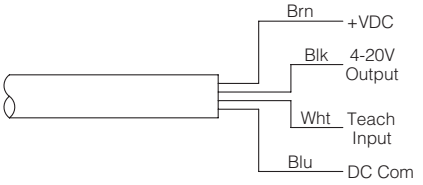


Cable Style Model

0-10V

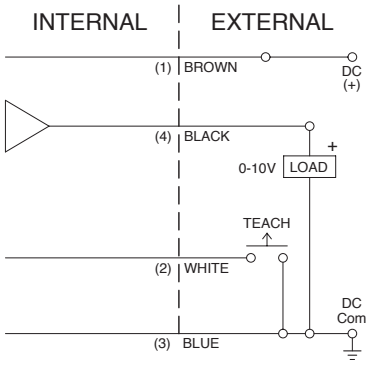


4-20 mA

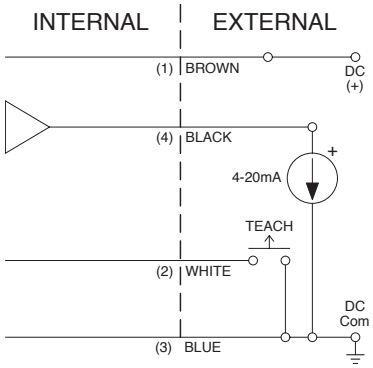


Output Style

0-10 V Output

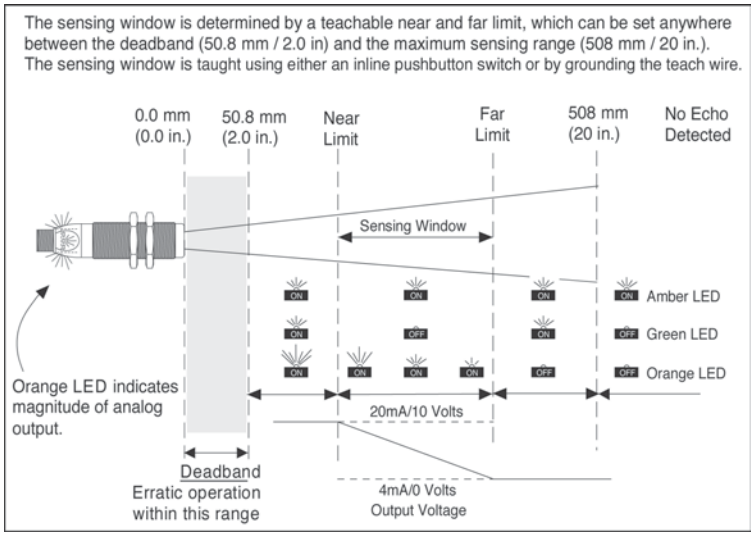


4-20 mA Output

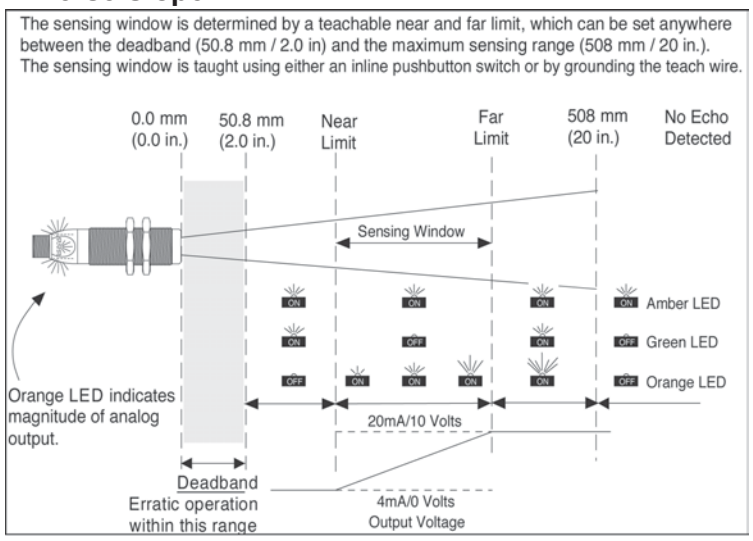


Output Type

Direct Slope



Inverse Slope



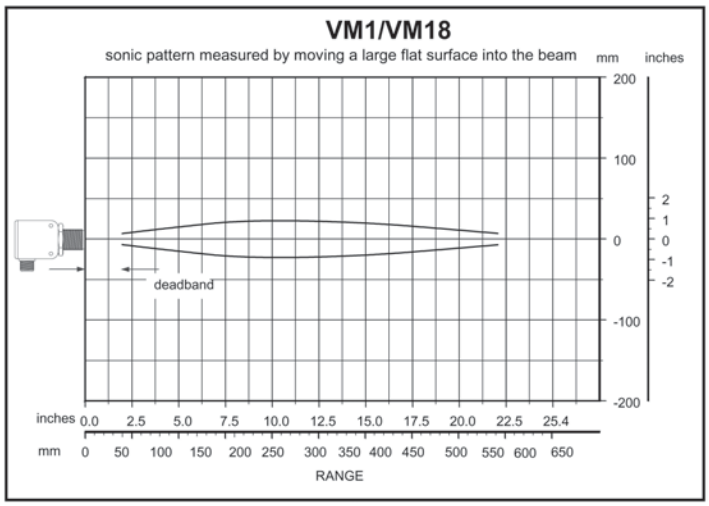
Beam Plots

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.

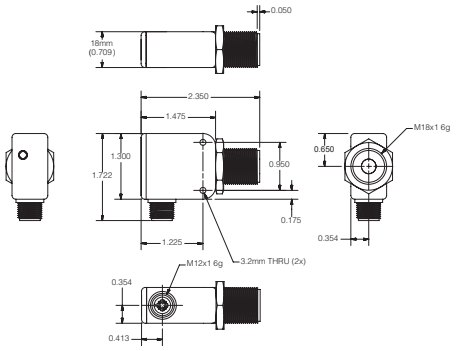
In each sensor series, the plot extends from the end of the "deadband" on the left to the end of the sensing range on the right. The sensor is illustrated in the middle left margin.

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

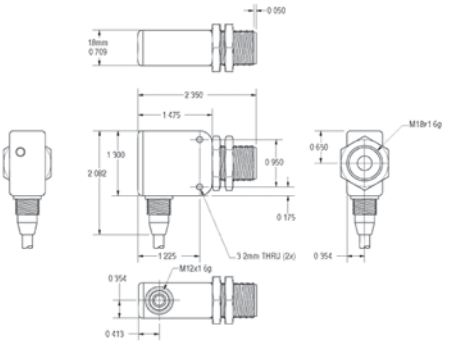


Dimensions

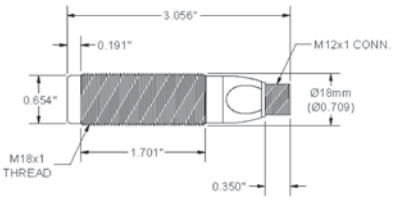
Quick Disconnect Style
(VALOX® Plastic) VM1-XXX-X



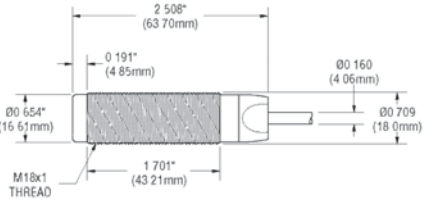
Cable Style
(VALOX® Plastic) VM1-XXX-X



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

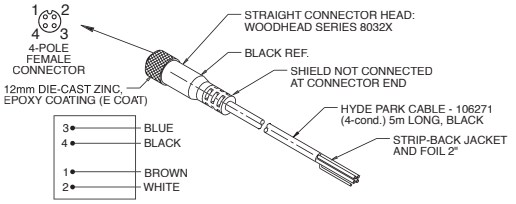


Cable Style
(VALOX® Plastic) VM18-XXX-X

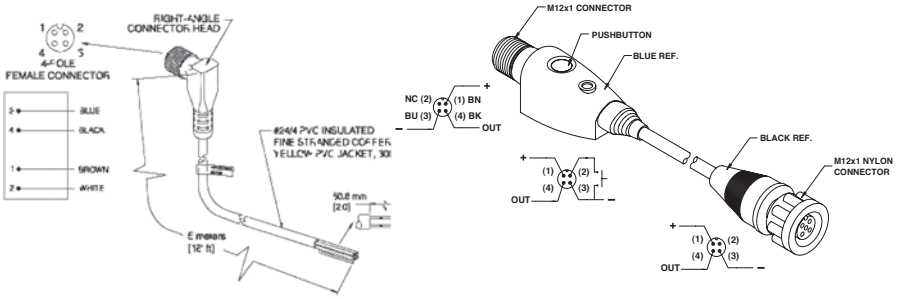


Accessories

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)] -Large Flat Target
Range: 50.8 mm (2.0 in.) to 508 mm (20 in.)
Maximum plane-reflector angle: ±5°
Sonic Cone Angle: See beam plot

Window-edge accuracy: ±1.27 mm (0.050 in.) @ constant temperature

Minimum object size Rod: 2.5 mm (0.098in) at 254.0 mm (10.0") range, 0°tilt
Factory Set sensing window 50.8 mm (2.0 in.) to 508 mm (20 in.)
Temperature Compensation Temperature Compensated

Power Requirements:
Supply Voltage: +15 to 24 VDC (±10%) @ 40 mA max (including output load)
Protection: ESD and reverse-polarity

Analog Output:

CA Models:
Output Range: 4-20 milliamps
Load resistance: 10 to 350 ohms
Protection: ESD and short circuit

VA Models
Output Range: 0-10 volts
Load resistance: 2K ohms minimum
Protection: ESD and short circuit

Pushbutton Input:
Active voltage level: < 1.0 volt
Inactive voltage level: > 2.5 volts
Activation On/Off time: > 25 ms (3 seconds to arm for limit setup)

Response Time: 50 ms to 95% of final output value

Indicators:
Green LED: Off when object is within range
Amber LED: On when object is within window
Red LED: Intensity varies directly with output magnitude

Connections
Cable style models: (VM1 only)
24 AWG, foil shield, lead-free, PVS jacket
4-conductor, 3m (10') long
Connector style models:
12mm, circular 4-pole, male micro connector

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

Environmental:

Operating Temperature: -30°C to 70°C (-22°F to 158°F)

Storing Temperature Range: -40°C to 85°C (-40°F 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.

Accessories

Model PB100, In-line 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.

Standard Model Reference Guide - Virtu™ Analog Series

The following models represent normal functionality and analog minimum output state both on loss-of-echo and at power up.

VM1-VA
VM1-VA-Q
VM18-VA-Q

VM1-CA
VM1-CA-Q
VM18-CA-Q

EXAMPLE MODEL: **VM1- VA- Q**

Analog Ultrasonic Series

Model Type

1.....Dual Mount

18...18 mm Barrel

Output Type

V.....Voltage output (0-10 VDC default)

C.....Current output (4-20 mA default)

Output Style

A.....Auto slope (default)

Connection Type

....No designator indicates 3 m (10') cable style connection

Q....Quick disconnect - 4-pin M12 "Micro" connector

Enhanced Reference Guide - Virtu™ Analog 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. Enhanced models are programmed for a particular application. These sensors are available at a different cost premium compared to the standard models.

EXAMPLE MODEL: VM1-VA3000- Q

Analog Ultrasonic Series

Model Type

1.....Dual Mount

18...18 mm Barrel

Output Type

V...Voltage output (0-10 VDC default)

C...Current output (4-20 mA default)

Output Style

A...Auto slope (default)

I.....Inverse slope

D...Direct slope

Output State for Loss of Echo & Power-up State

0...Analog minimum

1...Analog maximum

2...Hold on loss-of-echo; analog minimum on power-up

3...Hold on loss-of-echo; analog maximum on power-up

Functionality

000...Normal functionality

001...Foreground suppression only (object mode)

002...Foreground suppression only (background mode)

003...Foreground & background suppression (background mode)

090...Output voltage 2 - 10 VDC

097...TAU = 32, Burst count =5, Loss-of-echo =300 cycles (1.5 sec)

098...TAU = 16, 240 ms response, 50 cycles Loss-of-echo delay - 250 ms

099...TAU = 8, 120 ms Response

Options

...No designator indicates no option

AD...Teach function disabled

Connection Type

…No designator indicates 3 m (10') cable style connection

Q...Quick disconnect - 4-pin M12 "Micro" connector

Selection Chart

VM Analog Series

Model No.	Power Version 12/24 VDC	Quick Disconnect	Materials: Transducer Housing: Epoxy	Materials: Transducer Housing: VALOX	Materials: Transducer Housing: PBT	Outputs: Type: Analog Minimum	Outputs: Type: Analog Maximum	Outputs: Type: Hold on loss-of-echo, analog minimum on power-up	Outputs: Type: Hold on loss-of-echo analog maximum on power-up	Functionality: Normal functionality	Functionality: Foreground suppression (object mode)	Functionality: Foreground suppression (background mode)	Functionality: Foreground & background suppression (background mode)	Notes
VM1-VA-Q	■	■	■	■		■				■				
VM1-VA0001-Q	■	■	■	■		■					■			
VM1-VA0002-Q	■	■	■	■		■						■		
VM1-VA0003-Q	■	■	■	■		■							■	
VM1-VA1000-Q	■	■	■	■			■			■				
VM1-VA1001-Q	■	■	■	■			■				■			
VM1-VA1002-Q	■	■	■	■			■					■		
VM1-VA1003-Q	■	■	■	■			■						■	
VM1-VA2000-Q	■	■	■	■				■		■				
VM1-VA2001-Q	■	■	■	■				■			■			
VM1-VA2002-Q	■	■	■	■				■				■		
VM1-VA2003-Q	■	■	■	■				■					■	
VM1-VA3000-Q	■	■	■	■					■	■				
VM1-VA3001-Q	■	■	■	■					■		■			
VM1-VA3002-Q	■	■	■	■					■			■		
VM1-VA3003-Q	■	■	■	■					■				■	
VM1-VI-Q	■	■	■	■		■					■			
VM1-VI0001-Q	■	■	■	■		■						■		
VM1-VI0002-Q	■	■	■	■		■							■	
VM1-VI0003-Q	■	■	■	■		■							■	
VM1-VI1000-Q	■	■	■	■			■					■		
VM1-VI1001-Q	■	■	■	■			■						■	
VM1-VI1002-Q	■	■	■	■			■						■	
VM1-VI1003-Q	■	■	■	■			■						■	
VM1-VI2000-Q	■	■	■	■				■		■				
VM1-VI2001-Q	■	■	■	■				■			■			
VM1-VI2002-Q	■	■	■	■				■				■		
VM1-VI2003-Q	■	■	■	■				■					■	
VM1-VI3000-Q	■	■	■	■					■	■				
VM1-VI3001-Q	■	■	■	■					■		■			
VM1-VI3002-Q	■	■	■	■					■			■		
VM1-VI3003-Q	■	■	■	■					■				■	
VM1-VD-Q	■	■	■	■		■					■			
VM1-VD0001-Q	■	■	■	■		■					■			
VM1-VD0002-Q	■	■	■	■		■							■	
VM1-VD0003-Q	■	■	■	■		■							■	
VM1-VD1000-Q	■	■	■	■			■			■				
VM1-VD1001-Q	■	■	■	■			■				■		■	
VM1-VD1002-Q	■	■	■	■			■				■		■	
VM1-VD1003-Q	■	■	■	■			■				■		■	
VM1-VD2000-Q	■	■	■	■				■		■				
VM1-VD2001-Q	■	■	■	■				■			■			
VM1-VD2002-Q	■	■	■	■				■				■		
VM1-VD2003-Q	■	■	■	■				■					■	
VM1-VD3000-Q	■	■	■	■					■	■				
VM1-VD3001-Q	■	■	■	■					■		■			
VM1-VD3002-Q	■	■	■	■					■			■		
VM1-VD3003-Q	■	■	■	■					■				■	

*(The VM1 dual-mount style models are also available in 10' cable length)

VM Analog Series (cont.)

Model No.	Power Version 12/24 VDC	Quick Disconnect	Materials: Transducer Housing: Epoxy	Materials: Transducer Housing: VALOX	Materials: Transducer Housing: PBT	Outputs: Type: Analog Minimum	Outputs: Type: Analog Maximum	Outputs: Type: Hold on loss-of-echo, analog minimum on power up	Outputs: Type: Hold on loss-of-echo analog maximum on power up	Functionality: Normal functionality	Functionality: Foreground suppression (object mode)	Functionality: Foreground suppression (background mode)	Functionality: Foreground & background suppression (background mode)	Notes
VM18-VA-Q	■	■	■		■	■				■				
VM18-VA0001-Q	■	■	■		■		■					■		
VM18-VA0002-Q	■	■	■		■		■						■	
VM18-VA0003-Q	■	■	■		■		■							■
VM18-VA1000-Q	■	■	■		■			■			■			
VM18-VA1001-Q	■	■	■		■				■				■	
VM18-VA1002-Q	■	■	■		■			■					■	
VM18-VA1003-Q	■	■	■		■			■						■
VM18-VA2000-Q	■	■	■		■				■		■			
VM18-VA2001-Q	■	■	■		■				■				■	
VM18-VA2002-Q	■	■	■		■			■					■	
VM18-VA2003-Q	■	■	■		■				■					■
VM18-VA3000-Q	■	■	■		■				■	■				
VM18-VA3001-Q	■	■	■		■				■		■			
VM18-VA3002-Q	■	■	■		■				■			■		
VM18-VA3003-Q	■	■	■		■				■				■	
VM18-VI-Q	■	■	■		■	■					■			
VM18-VI0001-Q	■	■	■		■		■					■		
VM18-VI0002-Q	■	■	■		■	■							■	
VM18-VI0003-Q	■	■	■		■	■								■
VM18-VI1000-Q	■	■	■		■			■			■			
VM18-VI1001-Q	■	■	■		■			■				■		
VM18-VI1002-Q	■	■	■		■			■					■	
VM18-VI1003-Q	■	■	■		■			■						■
VM18-VI2000-Q	■	■	■		■			■		■				
VM18-VI2001-Q	■	■	■		■			■			■			
VM18-VI2002-Q	■	■	■		■			■				■		
VM18-VI2003-Q	■	■	■		■			■					■	
VM18-VI3000-Q	■	■	■		■					■	■			
VM18-VI3001-Q	■	■	■		■					■		■		
VM18-VI3002-Q	■	■	■		■					■			■	
VM18-VI3003-Q	■	■	■		■					■				■
VM18-VD-Q	■	■	■		■	■					■			
VM18-VD0001-Q	■	■	■		■	■					■			
VM18-VD0002-Q	■	■	■		■	■						■		
VM18-VD0003-Q	■	■	■		■	■								■
VM18-VD1000-Q	■	■	■		■			■			■			
VM18-VD1001-Q	■	■	■		■			■				■		
VM18-VD1002-Q	■	■	■		■				■					■
VM18-VD1003-Q	■	■	■				■	■						■
VM18-VD2000-Q	■	■	■			■			■		■			
VM18-VD2001-Q	■	■	■			■			■			■		
VM18-VD2002-Q	■	■	■			■			■				■	
VM18-VD2003-Q	■	■	■		■			■					■	
VM18-VD3000-Q	■	■	■			■				■	■			
VM18-VD3001-Q	■	■	■			■				■		■		
VM18-VD3002-Q	■	■	■		■				■			■		
VM18-VD3003-Q	■	■	■		■				■				■	