

# HRXL-MaxSonar® - WR/WRC™ Series



## High Resolution, IP67 Weather Resistant, Ultra Sonic Range Finder MB7360, MB7367, MB7380, MB7387

The HRXL-MaxSonar-WR/WRC sensor line is the most cost-effective solution for applications where precision range-finding, low-voltage operation, space saving, low-cost, and IP67 weather resistance rating is needed. This sensor component module allows users of other more costly precision rangefinders to lower the cost of their systems without sacrificing performance. Additionally, this sensor line allows cost-sensitive designers to choose this precision sensor as a performance upgrade over other lower performance sensors.

The HRXL-MaxSonar-WR/WRC sensor line provides high accuracy and high resolution ultrasonic proximity detection and ranging in air, with an IP67 weather resistant rating. This sensor line features 1-mm resolution, target-size and operating-voltage compensation for improved accuracy, superior rejection of outside noise sources, internal speed-of-sound temperature compensation and optional external speed-of-sound temperature compensation. The HRXL-MaxSonar-WR/WRC models have a 5-meter range. This ultrasonic sensor detects objects from 1-mm and ranges to objects from 30-cm to maximum range. Objects closer than 30-cm are typically reported as 30-cm. The interface output formats are pulse width, analog voltage, and serial digital in either RS232 (MB7360 series) or TTL (MB7380 series). Factory calibration is standard.

### Precision Ultrasonic Range Sensing

- Range-finding at a fraction of the cost of other precision rangefinders
- Reading-to-reading stability of 1-mm at 1-meter is typical<sup>1</sup>
- Accuracy is factory-matched providing a typical accuracy of 1% or better<sup>1,2</sup>
- Compensation provided for target size variation and operating voltage range
- Internal temperature compensation is standard
- Optional external temperature compensation

### Very Low Power Requirements

- Wide, low supply voltage requirements eases battery powered design
- Low current draw reduces current drain for battery operation
- Fast first reading after power-up eases battery requirements

### Easy to use Component Module

- Stable and reliable range readings and excellent noise rejection make the sensor easy to use for most users
- Easy to use interface with distance provided in a variety of outputs
- Target size compensation provides greater consistency and accuracy when switching targets

- Sensor automatically handles acoustic noise<sup>2,3</sup>
- Small and easy to mount
- Calibrated sensor eliminates most sensor to sensor variations
- Very low-power ranger, excellent for multiple sensor or battery based systems

### Range Outputs

- Pulse width, 1uS/mm resolution
- Analog Voltage, 5-mm resolution
- Serial, 1-mm resolution
- Available in RS232 (MB7360) or TTL (MB7380)

### General Characteristics

- Low cost ultrasonic rangefinder
- Sensor dead zone virtually gone<sup>1</sup>
- Object proximity detection from front sensor face to 5-meters
- Resolution of 1-mm
- Distance sensor from 30-cm to 5-meters
- Excellent<sup>2</sup> Mean Time Between Failure (MTBF)
- Triggered operation yields real-time range data
- Sensor free-run operation uses a 1.5Hz filter, with 133mS measurement and output cycle (7.5 Hz output rate)
- Operating temperature range from -40°C to +65°C
- Operating voltage from 2.7V to 5.5V

- Nominal current draw of 2.3mA at 3.3V, and 3.1mA at 5V
- IP67 Rated

### Applications & Uses

- Snow sensor
- Weather station monitoring
- Tank level measurement
- Bin level measurement
- Proximity zone detection
- People detection
- Robot ranging sensor
- Autonomous navigation distance measuring
- Long range object detection
- Environments with acoustic and electrical noise
- Height monitors
- Auto sizing
- Box dimensions
- Automated factory systems
- This product is not recommended as a device for personal safety

### Notes:

<sup>1</sup> Refer to section that compares WR to WRC on page 10

<sup>2</sup> Users are encouraged to evaluate the sensor performance in their application

<sup>3</sup>By design

## HRXL-MaxSonar®-WR™ Pin Out

**Pin 1- Temperature Sensor Connection:** Leave this pin unconnected if an external temperature sensor is not used. For best accuracy, this pin is optionally connected to the HR-MaxTemp temperature sensor. Look up the HR-MaxTemp (MB7955, MB7956, MB7957, MB7958, MB7959) temperature sensor for additional information.

**Pin 2- Pulse Width Output:** This pin outputs a pulse width representation of the distance with a scale factor of 1uS per mm. Output range is 300uS for 300-mm to 5000uS for 5000-mm. Pulse width output is sent with a value within 0.5% of the serial output.

**Pin 3- Analog Voltage Output:** After the ~50ms power up initialization, the voltage on this pin is set to 0V. Once the sensor receives a range value the voltage on this pin has the voltage corresponding to the latest measured distance. This pin outputs an analog voltage scaled representation of the distance.

The sensors use a scale factor of (Vcc/5120) per 1-mm. The distance is output with a 5-mm resolution. This output voltage is referenced to GND). The analog voltage output is typically within ±5-mm of the serial output.

**Pin 4- Ranging Start/Stop:** This pin is internally pulled high. If this pin is left unconnected or held high, the sensor will continually measure and output the range data. If held low, the HRXL-MaxSonar-WR will stop ranging. Bring high for 20uS or longer to command a range reading.

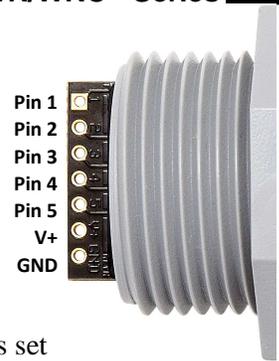
**Real-time Range Data:** When pin 4 is low and then brought high, the sensor will operate in real time and the first reading output will be the range measured from this first commanded range reading. When the sensor tracks that the RX pin is low after each range reading, and then the RX pin is brought high, unfiltered real time range information can be obtained as quickly as every 133mS.

**Filtered Range Data:** When pin 4 is left high on the sensors, the sensors will continue to range every 133mS (7.5Hz read rate), the data output includes a 1.5Hz filter. Both sensors will output the range based on recent range information. The filter does not affect the speed at which data is made available to the user but instead allows for more consistent range information to be presented.

**Pin 5-Serial Output:** The MB7360/MB7367 sensors have an RS232 data format (with 0 to Vcc levels) and the MB7380/MB7387 sensors have a TTL outputs (with 0 to Vcc levels). The output is an ASCII capital “R”, followed by four ASCII character digits representing the range in millimeters, followed by a carriage return (ASCII 13). The maximum distance reported is 5000 for the sensors. The baud rate is 9600, 8 data bits, no parity, with one stop bit (9600-8-N-1). Because the data is presented in a binary data format, the serial output is most accurate .

**V+ Pin 6 - Positive Power, Vcc:** The sensor operates on voltages from 2.7V - 5.5V DC. For best operation, the sensor requires that the DC power be free from electrical noise. (For installations with known dirty electrical power, a 100uF capacitor placed at the sensor pins between V+ and GND will typically correct the electrical noise.)

**GND Pin 7 – Sensor ground pin:** DC return, and circuit common ground.



## Auto Calibration

Each time the HRXL-MaxSonar-WR takes a range reading, it calibrates itself. The sensor then uses this data to range objects. If the temperature, humidity, or applied voltage changes during sensor operation, the sensor will continue to function normally over the rated temperature range while applying compensation for changes caused by temperature and voltage.

## Sensor Operation: Free-Run

When operating in free run mode, the HRXL-MaxSonar-WR sensors are designed to be used in a variety of outdoor, industrial, or indoor environments. Many acoustic noise sources will have little to no effect on the reported range of the HRXL-MaxSonar-WR sensors. Most range readings are accurately reported. If the range readings are affected, the effect is typically less than 5-mm<sup>1</sup>. This allows users to employ real-time ultrasonic distance sensing without the need for additional supporting circuitry or complicated user software.

Part Number Features Chart				
Features	MB7360	MB7367	MB7380	MB7387
Serial RS232	Yes	Yes		
Serial TTL			Yes	Yes
5 Meter	Yes	Yes	Yes	Yes
Compact WRC		Yes		Yes

### Sensor minimum distance - No Sensor Dead Zone

The sensor minimum reported distance is 30-cm (11.8 inches). However, the HRXL-MaxSonar-WR will report targets up to the sensor face (for the WR sensors)<sup>1</sup> and to within 1-mm of the front sensor face (for the WRC sensors)<sup>1</sup>. Targets closer than 300-mm will typically range as 300-mm.

### Sensor Operation from 30-cm to 50-cm

Because of acoustic phase effects in the near field, objects between 30-cm and 50-cm may experience acoustic phase cancellation of the returning waveform resulting in inaccuracies of up to 5-mm. These effects become less prevalent as the target distance increases, and have not been observed past 50-cm. For this reason, users that require the highest sensor accuracy are encouraged to mount the HRXL-MaxSonar-WR farther than 50-cm away from objects.

### Range “0” location

The HRXL-MaxSonar-WR reports the range to distant targets starting from where the threading and nut meet on the sensor housing as shown in the diagram below.

In general, the HRXL-MaxSonar-WR will report the range to the leading edge of the closest detectable object. Target detection has been characterized in the sensor beam patterns.



The range is measured from where the housing meets the threading.



The range is measured from where the housing meets the threading.

**Notes:**

<sup>1</sup> Refer to section that compares WR to WRC on page 10

## Target Size Compensation

Most low cost ultrasonic rangefinders will report the range to smaller size targets as farther than the actual distance. In addition, they may also report the range to larger size targets as closer than the actual distance.

The HRXL-MaxSonar-WR sensor line compensates for target size differences. This means that, provided an object is large enough to be detected, the sensor will report the same distance, typically within 1%<sup>1</sup>, regardless of target size<sup>1</sup>. Smaller targets can have additional detection noise that may limit this feature. In addition, targets with small or rounded surfaces may have an apparent distance that is slightly farther, where the distance reported may be a composite of the sensed object(s). Compensation for target size is applied to all range outputs: pulse width, analog voltage, and serial format output by the sensor.

## Supply Voltage Droop and Charge Compensation

During power up, the HRXL-MaxSonar-WR sensor line will calibrate itself for changes in supply voltage. Additionally, the sensor will compensate if the supplied voltage gradually changes.

If the average voltage applied to the sensor changes faster than 0.5V per second, it is best to remove and reapply power to the sensor.

For best operation, the sensor requires noise free power . If the sensor is used with noise on the supplied power or ground, the readings may be affected. Typically adding a 100uF capacitor at the sensor between the V+ and GND pins will correct most power related electrical noise issues.

## HRXL-MaxSonar®-WR™ Temperature Compensation

### On Board – Internal Temperature Compensation

The speed of sound in air increases about 0.6 meters per second, per degree centigrade. Because of this, each HRXL-MaxSonar-WR is equipped with an internal temperature sensor which allows the sensor to apply compensation for speed of sound changes.

The actual air temperature of the path between the sensor and the target may not match the temperature measured at the sensor electronics. Sensors can be mounted in vertical applications, or applications where the environmental temperature gradient is severe. These users may experience a large temperature measurement error which will affect the sensor accuracy. For example, buildings with a height of 3-meters can have floor to ceiling temperature variations of 5°C or more.

Because of these temperature effects, users desiring the highest accuracy output are encouraged to use a properly mounted external temperature sensor or to manually account for this measurement error.

### HR-MaxTemp, an External Temperature Sensor

Although the HRXL-MaxSonar-WR has an internal temperature sensor; for best accuracy, users are encouraged to use the optional external temperature sensor. On power-up the HRXL-MaxSonar-WR will automatically detect an attached HR-MaxTemp temperature sensor and begin to apply temperature compensation using the external temperature sensor.

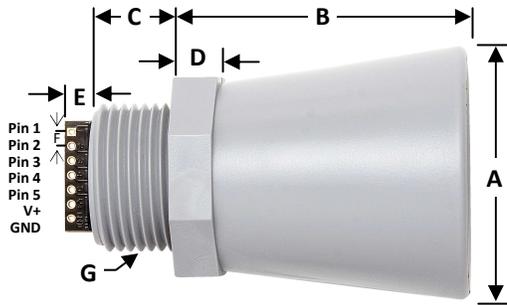
The external temperature sensor allows for the most accurate temperature compensation, by allowing temperature readings to be taken that better reflect the composite temperature of the acoustic ranging path. For best results users are encouraged to connect the temperature sensor midway between the HRXL-MaxSonar-WR and the expected target distance.

**Notes:**

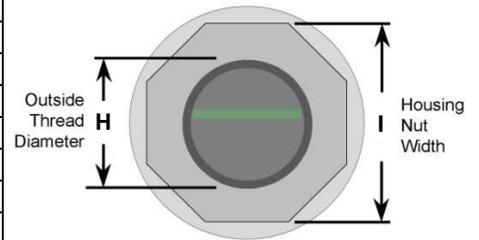
<sup>1</sup> Refer to section that compares WR to WRC on page 10

## HRXL-MaxSonar®-WR™ Mechanical Dimensions

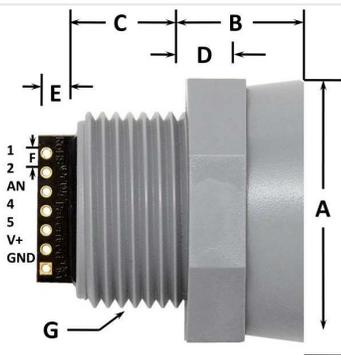
Values Are Nominal



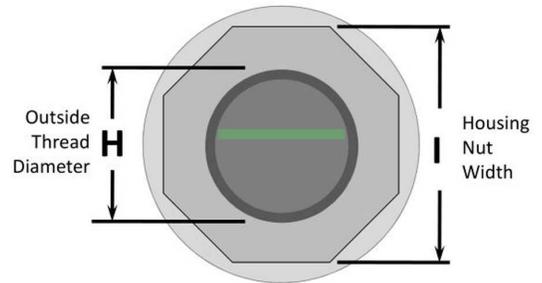
A	1.72" dia.	43.8 mm dia.
B	2.00"	50.7 mm
C	0.58"	14.4 mm
D	0.31"	7.9 mm
E	0.23"	5.8 mm
F	0.1"	2.54 mm
G	3/4"-14 National Pipe Thread Straight	
H	1.032" dia.	26.2 mm dia.
I	1.37"	34.8 mm
Weight, 1.76 oz., 50 grams		



## HRXL-MaxSonar®-WRC™ Mechanical Dimensions



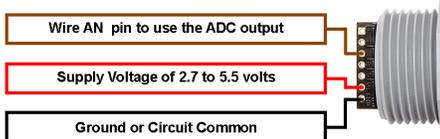
Values are Nominal		
A	1.37" dia.	34.7 mm dia.
B	0.70"	17.9 mm
C	0.57"	14.4 mm
D	0.31"	7.9 mm
E	0.23"	5.8 mm
F	0.1"	2.54 mm
G	3/4" - 14 National Pipe Thread Straight	
H	1.032" dia.	26.2 mm dia
I	1.37"	34.8 mm
Weight, 1.23 oz. , 32 grams		



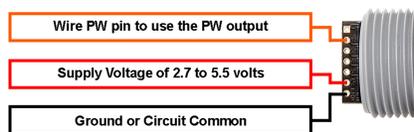
## Independent Sensor Operation

The HRXL-MaxSonar-WR sensors have the capability to operate independently when the user desires. When using the HRXL-MaxSonar-WR sensors in single or independent sensor operation, it is easiest to allow the sensor to free-run. Free-run is the default mode of operation for all of the MaxBotix Inc., sensors. The HRXL-MaxSonar-WR sensors have three separate outputs that update the range data simultaneously: Analog Voltage, Pulse Width, and Serial data. Below are diagrams on how to connect the sensor for each of the three outputs when operating in a single or independent sensor operating environment.

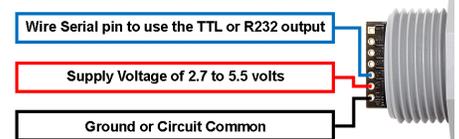
### Analog Output Sensor Operation



### Pulse Width Output Sensor Operation



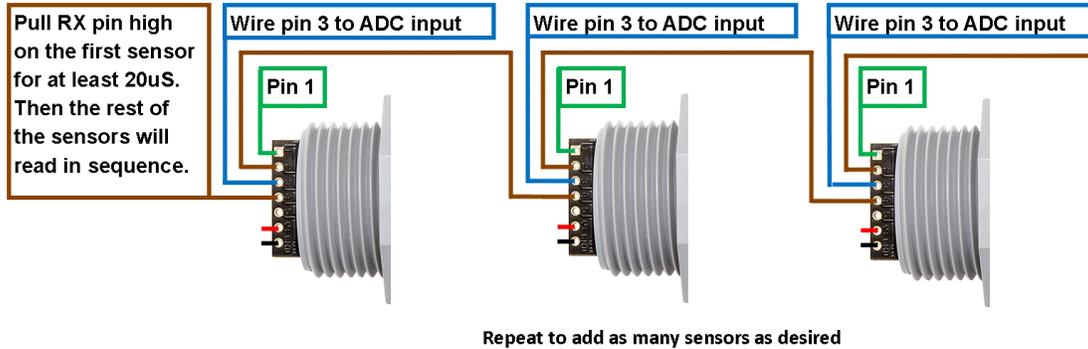
### Serial Output Sensor Operation



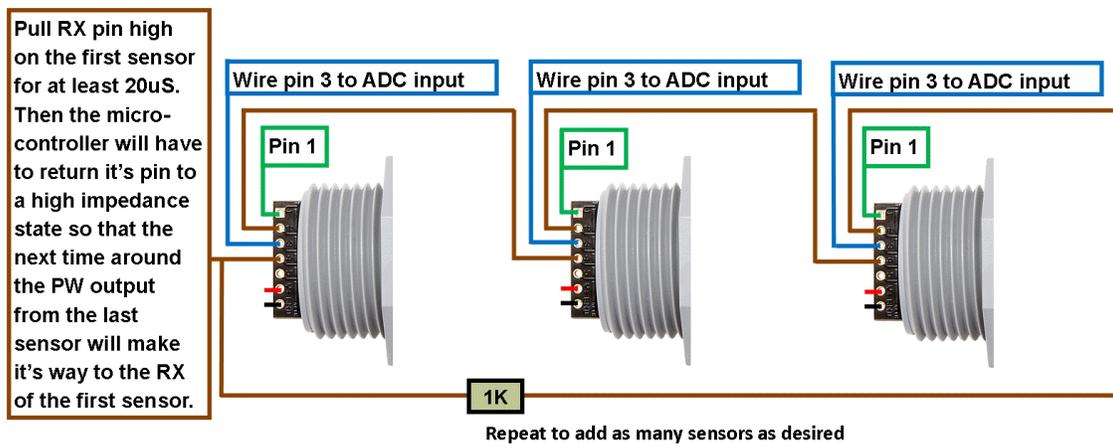
## Using Multiple Sensors in a single system

When using multiple ultrasonic sensors in a single system, there can be interference (cross-talk) from the other sensors. MaxBotix Inc., has engineered a solution to this problem for the HRXL-MaxSonar-WR sensors. The solution is referred to as chaining. Three methods of chaining work well to avoid the issue of cross-talk.

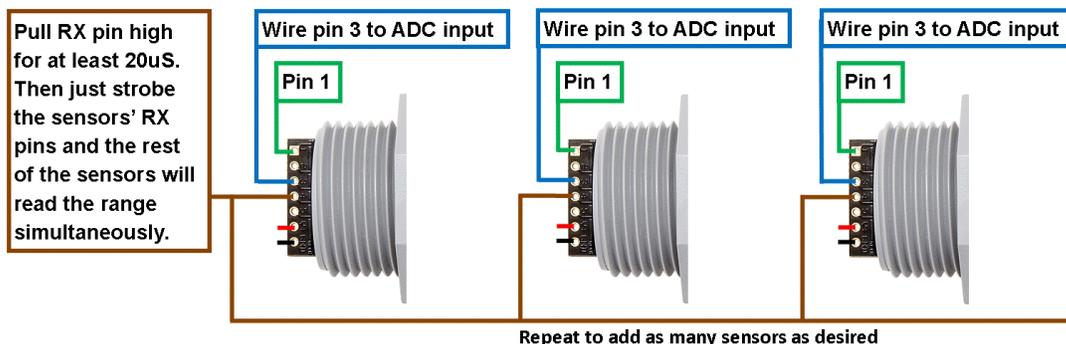
The first method is AN Output Commanded Loop. The first sensor will range, then trigger the next sensor to range and so on for all the sensors in the array. Once the last sensor has ranged, the array stops until the first sensor is triggered to range again. Below is a diagram on how to set this up.



The next method is AN Output Constantly Looping. The first sensor will range, then trigger the next sensor to range and so on for all the sensors in the array. Once the last sensor has ranged, it will trigger the first sensor in the array to range again and will continue this loop indefinitely. Below is a diagram on how to set this up.

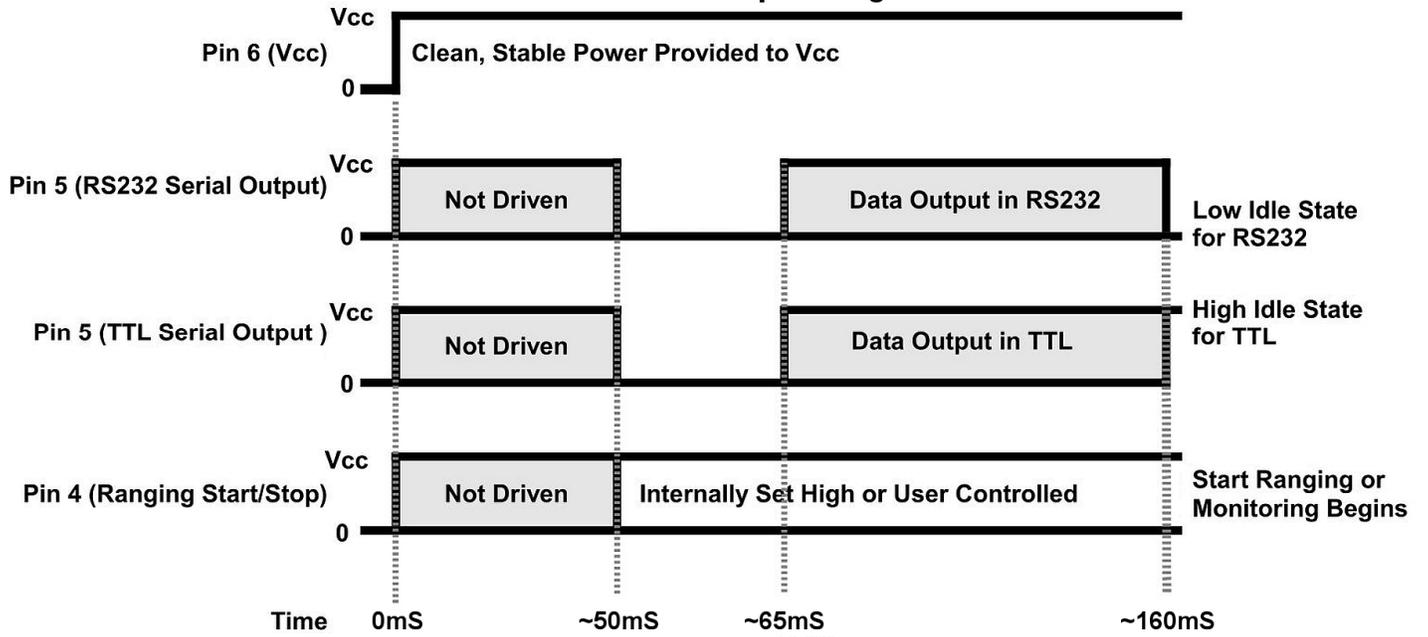


The final method is AN Output Simultaneous Operation. This method does not work in all applications and is sensitive to how the other sensors in the array are positioned in comparison to each other. Testing is recommend to verify this method will work for your application. All the sensors RX pins are connected together and triggered at the same time, causing all of the sensors to take a range reading at the same time. Once the range reading is complete, the sensors stop ranging until triggered next time. Below is a diagram on how to set this up.



Operations and Timing

Power Up Timing



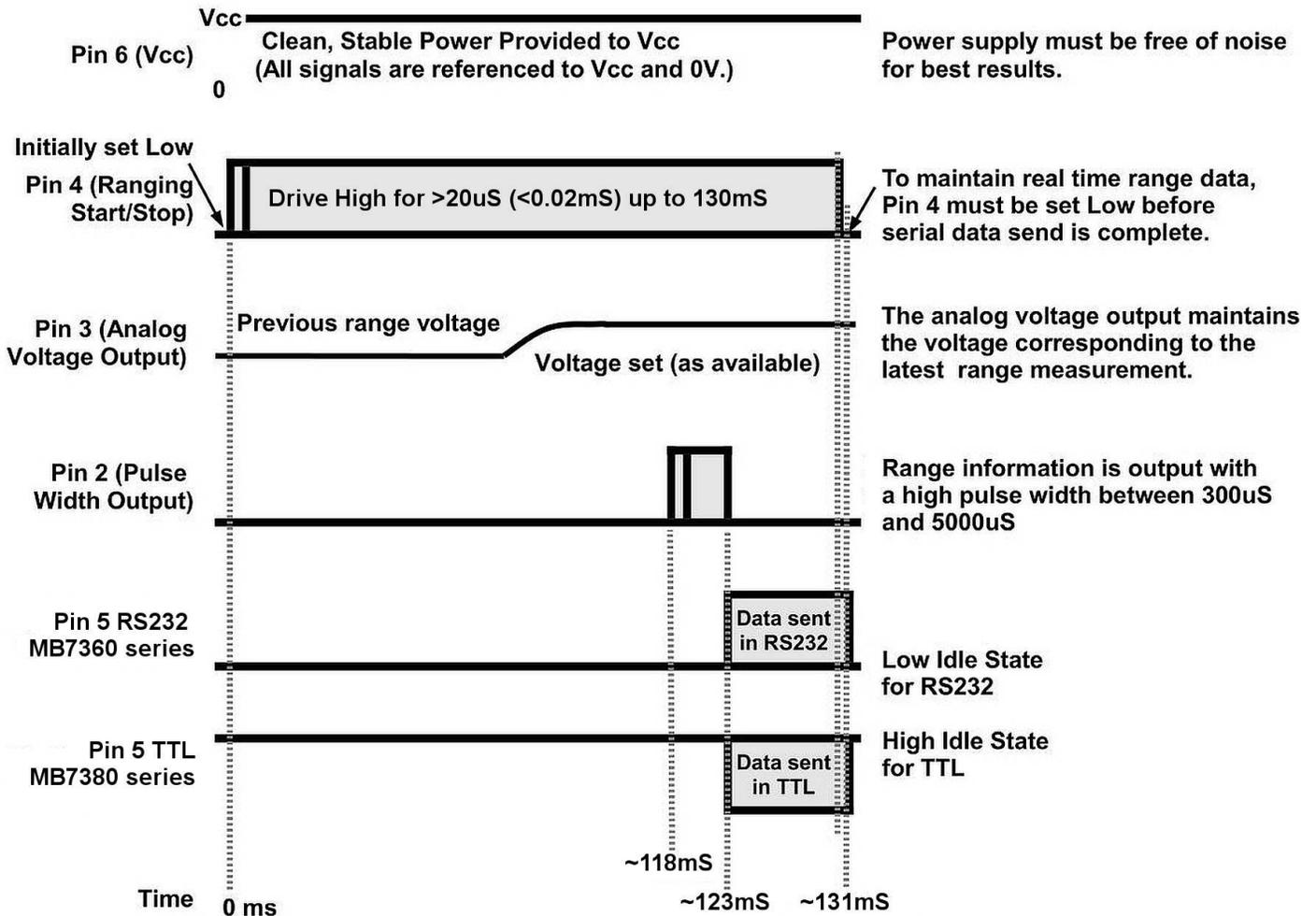
## Operations and Timing Continued

### Real-Time Operation - Triggered

Real-time or triggered operation allows users to take advantage of a few functions unavailable during free run mode. When operating in triggered mode, an unfiltered maximum refresh rate of 7.5Hz can be achieved. This triggered operation allows users to range targets moving away from or closer to the sensor faster than 240mm/s.

Users can enter and remain in the Real-time or Triggered Operation by making sure that after each range cycle, the voltage level on Pin 4 is set low. After the sensor has completed the last reading, then the voltage on Pin 4 is brought high. This starts a brand new range cycle and the HRXL-MaxSonar-WR will output the most recent range data without filtering. Please reference the Real-time Triggered Operation timing diagram for full implementation details.

### Realtime Triggered Operation



Readings during triggered operation are less accurate than the filtered operation by approximately +/- 5-mm. Also, because the range readings are not filtered, noise tolerance can be greatly reduced. Care should be taken to make sure that only one sensor is sampling range at a time.

## Operations and Timing Continued

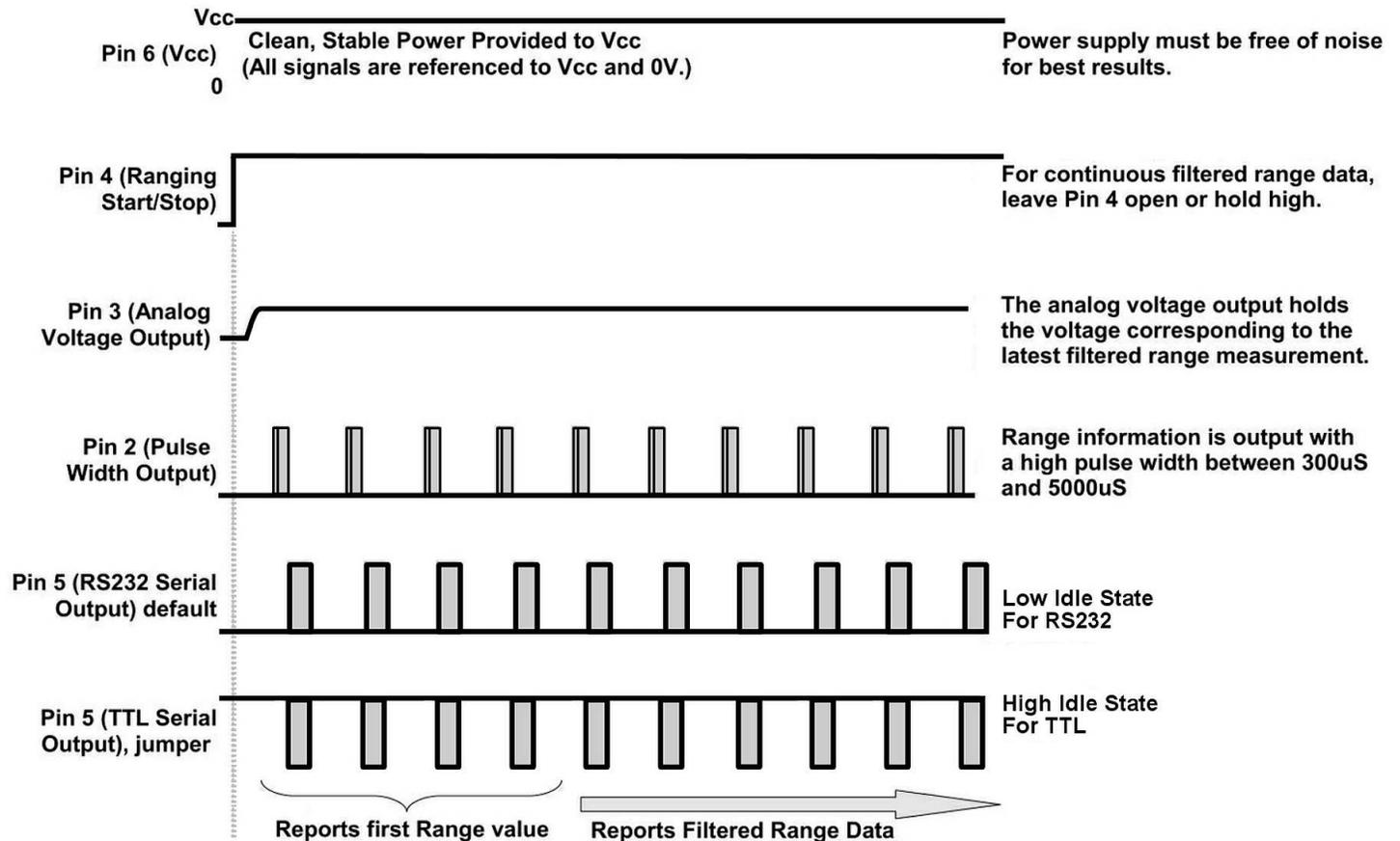
### Sensor Operation: Free-Run

When operating in free run mode, the HRXL-MaxSonar-WR sensors are designed to be used in a variety of outdoor, industrial, or indoor environments. Many acoustic noise sources will have little to no effect on the reported range of the HRXL-MaxSonar-WR sensors<sup>1</sup>. Most range readings are accurately reported<sup>1</sup>. If the range readings are affected, the effect is typically less than 5-mm<sup>1</sup>. This allows users to employ real-time ultrasonic distance sensing without the need for additional supporting circuitry or complicated user software.

### Filtered Operation: Free-Run

The HRXL-MaxSonar-WR use an internal 1.5Hz bandwidth filter to process range data; which reports the latest range every 133mS or 7.5Hz. These filters improve the sensor's performance for accuracy, noise rejection, and reading to reading stability. The filtering in the free-run operation also permits additional acoustic and electrical noise tolerance.

### Filtered Freerun Operation



For detailed reading to reading timing look at Realtime Triggered Operation timing diagram.

When pin 4 is left high, the sensor will continue to range every 133mS (7.5Hz read rate), the data output includes a 1.5Hz filter. The HRXL-MaxSonar-WR sensors will output the range based on recent range information. The filter does not affect the speed at which data is made available to the user but instead allows for more consistent range information to be presented.

**Notes:**  
<sup>1</sup> Refer to section that compares WR to WRC on page 10

## About Ultrasonic Sensors

Our ultrasonic sensors are in air, non-contact object detection and ranging sensors that detect objects within an area. These sensors are not affected by the color or other visual characteristics of the detected object. Ultrasonic sensors use high frequency sound to detect and localize objects in a variety of environments. Ultrasonic sensors measure the time of flight for sound that has been transmitted to and reflected back from nearby objects. Based upon the time of flight, the sensor outputs a range reading.

## HRXL-MaxSonar®-WR™ Beam Patterns

### Background Information Regarding our Beam Patterns

Each HRXL-MaxSonar-WR sensor has a calibrated beam pattern. Each sensor is matched to provide the approximate detection pattern shown in this datasheet. This allows end users to select the part number that matches their given sensing application. Each part number has a consistent field of detection so additional units of the same part number will have similar beam patterns. The beam plots are provided to help identify an estimated detection zone for an application based on the acoustic properties of a target versus the plotted beam patterns.

Each beam pattern is a 2D representation of the detection area of the sensor. The beam pattern is actually shaped like a 3D cone (having the same detection pattern both vertically and horizontally). Detection patterns for dowels are used to show the beam pattern of each sensor. Dowels are long cylindered targets of a given diameter. The dowels provide consistent target detection characteristics for a given size target which allows easy comparison of one MaxSonar sensor to another MaxSonar sensor.

For each part number, the four patterns (A, B, C, and D) represent the detection zone for a given target size. Each beam pattern shown is determined by the sensor's part number and target size.

The actual beam angle changes over the full range. Use the beam pattern for a specific target at any given distance to calculate the beam angle for that target at the specific distance. Generally, smaller targets are detected over a narrower beam angle and a shorter distance. Larger targets are detected over a wider beam angle and a longer distance.

#### People Sensing:

For users that desire to detect people, the detection area to the 1-inch diameter dowel, in general, represents the area that the sensor will reliably detect people.

# MB7360-MB7380 HRXL-MaxSonar®-WR™ Beam Pattern and Uses

The HRXL-MaxSonar-WR product line has a narrow sensor beam and provides reliable long range detection zones.

## MB7360-MB7380

### HRXL-MaxSonar® -WRR/WRT™ Beam Pattern

Sample results for measured beam pattern are shown on a 30-cm grid. The detection pattern is shown for dowels of varying diameters that are placed in front of the sensor.

**A** 6.1-mm (0.25-inch) diameter dowel

**B** 2.54-cm (1-inch) diameter dowel

**C** 8.89-cm (3.5-inch) diameter dowel

**D** 11-inch wide board moved left to right with the board parallel to the front sensor face.

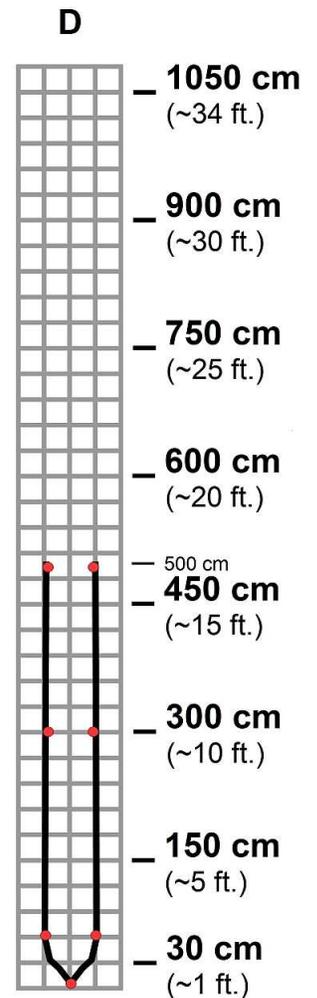
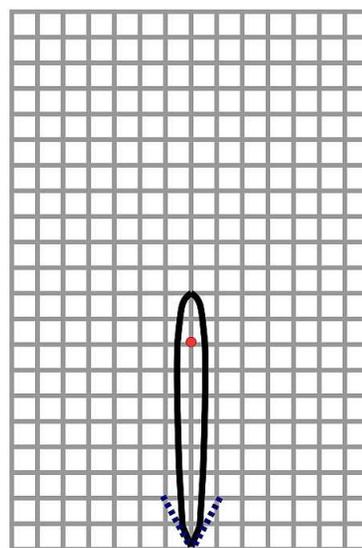
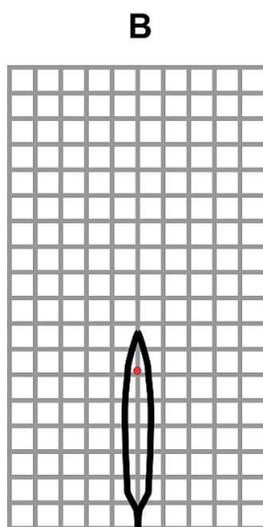
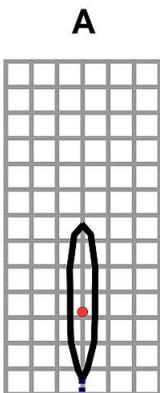
This shows the sensor's range capability.

**Note:** For people detection the pattern typically falls between charts A and B.

■ Partial Detection

— 5.0 V

● 3.3 V



**Beam Characteristics are Approximate**

Beam Pattern drawn to a 1:95 scale for easy comparison to our other products.

### MB7360-MB7380

#### Features and Benefits

- Factory calibrated beam width
- Low operating voltages from 2.7V to 5.5V
- All range outputs are active simultaneously
- High acoustic sensitivity

### MB7360-MB7380

#### Applications and Uses

- Autonomous Navigation
- Robot Ranging Sensor
- Bin Level Measurement
- Tank Level Measurement

# MB7367-MB7387 HRXL-MaxSonar®-WRC/WRCT™ Beam Pattern and Uses

The HRXL-MaxSonar-WRC product line offer a more compact housing for use in applications where there are mounting or weight restrictions.

## MB7367-MB7387

### HRXL-MaxSonar® -WRCR/WRCT™ Beam Pattern

Sample results for measured beam pattern are shown on a 30-cm grid. The detection pattern is shown for dowels of varying diameters that are placed in front of the sensor.

**A** 6.1-mm (0.25-inch) diameter dowel

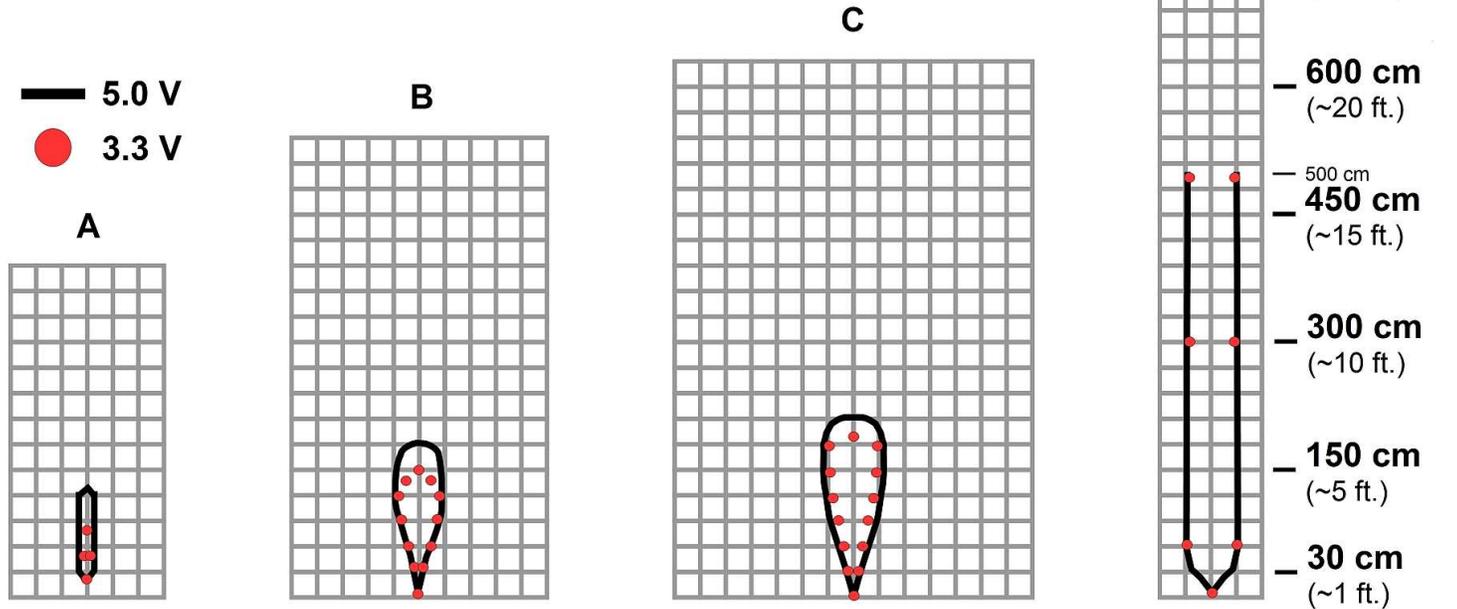
**B** 2.54-cm (1-inch) diameter dowel

**C** 8.89-cm (3.5-inch) diameter dowel

**D** 11-inch wide board moved left to right with the board parallel to the front sensor face.

This shows the sensor's range capability.

**Note:** For people detection the pattern typically falls between charts A and B.



**Beam Characteristics are Approximate**

Beam Pattern drawn to a 1:95 scale for easy comparison to our other products.

### MB7367-MB7387

#### Features and Benefits

- Extra Compact Housing
- Designed for outdoor or indoor environments
- Lightweight, compact, weather resistant design
- Low cost IP67 sensor
- Reliable and stable range data

### MB7367-MB7387

#### Applications and Uses

- Applications with strict mounting conditions

Have the right MaxSonar® for your application?

Check out our MaxSonar® Product Lines

**Indoor Use**

(or protected environments)

**Outdoor Use**

(or rugged environments) IP67

<ul style="list-style-type: none"> <li>• Power-up calibration</li> <li>• Very low cost</li> <li>• Very small size</li> </ul>  <p><b>1 in Resolution</b> LV-MaxSonar-EZ</p>	<ul style="list-style-type: none"> <li>• Real-time auto calibration</li> <li>• Very low cost</li> <li>• Very small size</li> </ul>  <p><b>1 cm Resolution</b> XL-MaxSonar-EZ XL-MaxSonar-AE XL-MaxSonar-EZL XL-MaxSonar-AEL I2CXL-MaxSonar-EZ</p>
 <p><b>1 mm Resolution</b> HRLV-MaxSonar-EZ</p>	

<ul style="list-style-type: none"> <li>• Real-time auto or power-up calibration</li> <li>• Very low cost</li> <li>• Very small size</li> </ul>  <p><b>1 cm Resolution</b> XL-MaxSonar-WR XL-MaxSonar-WRA XL-MaxSonar-WRL XL-MaxSonar-WRAL I2CXL-MaxSonar-WR <b>1 mm Resolution</b> HRXL-MaxSonar-WR HRXL-MaxSonar-WRT</p> <p><b>F-Option</b> Available for all WR models For additional protection when necessary in hazardous chemical environments.</p> 	<ul style="list-style-type: none"> <li>• Real-time auto or power-up calibration</li> <li>• Very low cost</li> <li>• Smallest WR</li> </ul>  <p><b>1 cm Resolution</b> XL-MaxSonar-WRC XL-MaxSonar-WRCA I2CXL-MaxSonar-WRC <b>1 mm Resolution</b> HRXL-MaxSonar-WRC HRXL-MaxSonar-WRCT</p>
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**Accessories**

**MB7954 - Shielded Cable**

The MaxSonar Connection Wire is used to reduce interference caused by electrical noise on the lines. This cable is a great solution to use when running the sensors at a long distance or in an area with a lot of EMI and electrical noise. MaxBotix Inc., has successfully tested our sensors at a distance of 1,000 ft using this wire and it was as stable as if it were next to the power supply.



**MB7950 -XL-MaxSonar-WR Mounting Hardware**

The MB7950 Mounting Hardware is selected for use with our outdoor ultrasonic sensors. The MB7950 Mounting Hardware gives customers easy access to the hardware needed for through hole mounting. The mounting hardware includes a steel lock nut and two O-ring (Buna-N and Neoprene) each optimal for different applications.



**MB7955 / MB7956 / MB7957 / MB7958 / MB7959- MaxTemp**

The HR-MaxTemp is an optional accessory for the HR-MaxSonar. The HR-MaxTemp is a temperature sensor that connects to pin 1 and 7 of the HR-MaxSonar for automatic temperature compensation without self heating or temperature gradient effects.



Product / specifications subject to change without notice. The names MaxBotix®, MaxSonar®, EZ, E20, E21, E22, E23, E24, HR, HRXL, AE0, AE1, AE2, AE3, AE4, WR1, and WRC1 are trademarks of MaxBotix Inc.