# LV-ProxSonar®-EZ™ Series

## High Performance Proximity Sensor

### MB1004, MB1014, MB1024, MB1034, MB1044

*The LV-ProxSonar-EZ is a high performance proximity sensor designed for people and object detection that allows for simultaneous operation of multiple sensors in one environment. With 2.5V to 5.5V power the LV-ProxSonar-EZ provides proximity detection of objects out to a set distance, in an incredibly small package. The LV-ProxSonar-EZ allows users to integrate several sensors into one system and experience little to no effect from the sensor interference than can occur with other ultrasonic sensor solutions. The LV-ProxSonar-EZ features an easy to use logic level (high/low) output, and RS232 format serial output. *Factory calibration and testing is standard.*

### Features

- Proximity Detection
- Simultaneously runs along side other nearby sensors
- ~2.5 second object acquire time
- ~1.5 second object release time
- Object detection includes zero range objects
- 2.5V to 5.5V supply with 2mA typical current draw
- All interfaces are active simultaneously
- Serial, 0 to Vcc, 9600 Baud, 81N
- Digital logic High/Low (True/False) output
- Continuously variable gain for control for side lobe suppression
- Free run operation continually measures and outputs proximity information
- Sensor operates at 42KHz
- Learns nearby environment when commanded to start ranging

### Features Cont.

- Designed for protected indoor environments

### Benefits

- Very low cost proximity sensor
- Simultaneously use up to 20 sensors in the same environment[1]
- Reliable proximity information
- Sensor doubles as a rangefinder (still reports range information over serial)
- Mounting holes provided on the circuit board
- Fast measurement cycle
- Very low power proximity sensor, excellent for multiple sensor or battery based systems
- Outputs allow users to get reliable proximity information at any time freeing up user processors
- User can choose either of the two sensor outputs

### Benefits Cont.

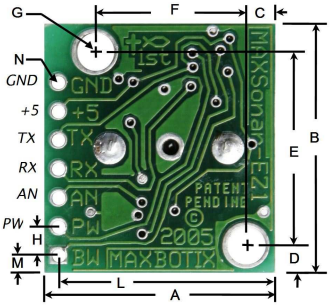
- Can be triggered externally or internally
- Custom object acquire and release times available with a nominal NRE charge
- Quality beam characteristics
- Sensor dead zone virtually gone
- Lowest power proximity sensor

### Applications and Uses

- Proximity zone detection
- People detection
- Booths/Kiosks
- Robot navigation sensor
- Autonomous navigation
- Multi-sensor arrays

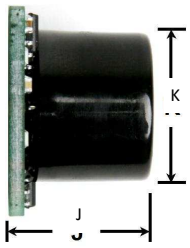
[1] Depends on sensor model and mounting

### LV-ProxSonar-EZ Mechanical Dimensions




| | | |
|---|---|---|
| A | 0.785" | 19.9 mm |
| B | 0.870" | 22.1 mm |
| C | 0.100" | 2.54 mm |
| D | 0.100" | 2.54 mm |
| E | 0.670" | 17.0 mm |
| F | 0.510" | 12.6 mm |
| G | 0.124" dia. | 3.1 mm dia. |

| | | |
|---|---|---|
| H | 0.100" | 2.54 mm |
| J | 0.610" | 15.5 mm |
| K | 0.645" | 16.4 mm |
| L | 0.735" | 18.7 mm |
| M | 0.065" | 1.7 mm |
| N | 0.038" dia. | 1.0 mm dia. |
| weight, 4.3 grams | | |







MaxBotix Inc., products are engineered and assembled in the USA.

## LV-ProxSonar®-EZ™ Circuit

The LV-ProxSonar-EZ sensor functions using active components consisting of an LM324, a diode array, a PIC16F676, together with a variety of passive components as seen in figure 1.

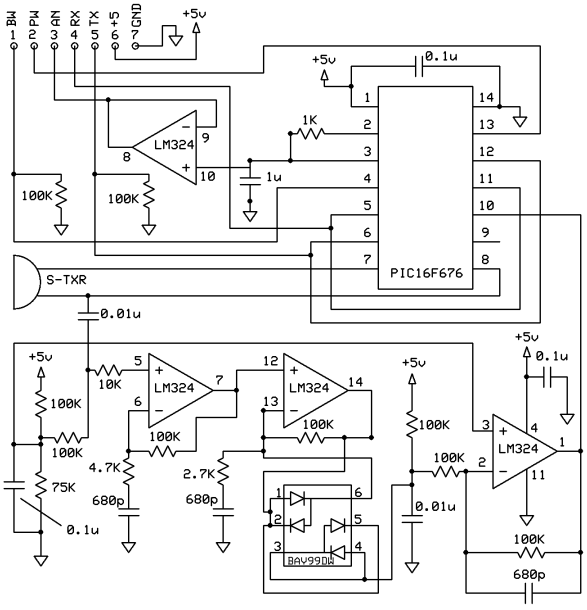



*Figure 1*

## LV-ProxSonar®-EZ™ Pin Out

**Pin 1-BW**- Unused, leave disconnected or connect to circuit common ground

**Pin 2-PW-** Digital Proximity Logic, outputs a High/Low logic voltage level depending on proximity detection. High means an object has been detected in the detection zone. Low means no object is present. There is a ~2.5 second delay on acquiring targets and a ~1.5 second delay for releasing a target once detected. This hysteresis improves sensor reliability

**Pin 3-AN-** Unused, leave disconnected or connect to circuit common ground

**Pin 4-RX-** This pin is internally pulled high. The LV-ProxSonar-EZ will continually measure proximity information and output send to data on the two output pins. Leave the pin disconnected or hold the pin high for proximity information. Hold low to stop all sensor activity and reset acquire timers.

**Pin 5-TX**- The TX output delivers asynchronous serial with an RS232 format, except voltages are 0-Vcc. If a target is detected at 8 inches the output appears as follows: "**R008 P1**<*carriage return*>". The output is an ASCII capital "R", followed by three ASCII character digits representing the range in inches up to a maximum of 255, followed by an ASCII space and the ASCII character "P", follow by one ASCII digit "1 or 0" corresponding to the proximity information, followed by a carriage return. Range information is provided for reference and is not considered accurate when more than one sensor is running in the same environment. Although the voltage of 0-Vcc is outside the RS232 standard, most RS232 devices have sufficient margin to read 0-Vcc serial data. If standard voltage level RS232 is desired, invert, and connect an RS232 converter such as a MAX232.

**Pin 6-+5V**- Vcc – Operates on 2.5V - 5.5V. Recommended current capability of 3mA for 5V, and 2mA for 3V.

**Pin 7-GND**- Return for the DC power supply. GND (& Vcc) must be ripple and noise free for best operation.

## 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 then outputs a range reading.

## LV-ProxSonar®-EZ™ General Power-Up Instruction

Each time after the LV-ProxSonar-EZ is powered up, it will calibrate during its first read cycle. The sensor uses this stored information to detect close objects. It is important that objects not be close to the sensor during this calibration cycle. The best sensitivity is obtained when it is clear for fourteen inches, but good results are common when clear for at least seven inches. If an object is too close during the calibration cycle, the sensor may ignore objects at that distance.

The LV-ProxSonar-EZ does not use the calibration data to temperature compensate for range, but instead to compensate for the sensor ringdown pattern. The sensor will continue to recalibrate to its environment provided the sensor does not detect an object within its detection zone at least once every 30 minutes. If the temperature, humidity, or applied voltage changes rapidly during operation, the sensor may require the user to force recalibration. If this condition occurs the sensor is more likely to have false close readings. To recalibrate the LV-ProxSonar-EZ, cycle power, then command a read cycle.

# LV-ProxSonar®-EZ™

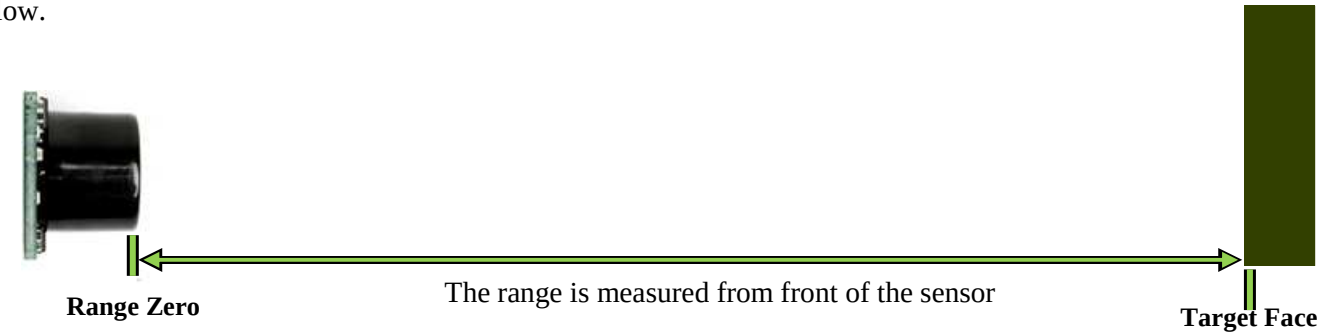
## Sensor Minimum Distance - No Sensor Dead Zone

The proximity information is available from 1mm from the front sensor face to the end of the detection zone.

For the range information provided on the serial output of the sensor. The minimum reported distance is 6-inches (15.2 cm). However, the LV-ProxSonar-EZ will range and report targets to 1mm from the front sensor face. Large targets closer than 6-inches will typically range as 6-inches.

## Range "0" Location

The LV-ProxSonar-EZ reports the range to distant targets starting from the front of the sensor as shown in the diagram below.




Target detection has been characterized in the sensor beam patterns.

## Using Multiple Sensors in a single system

The LV-ProxSonar-EZ is designed to function alongside other ultrasonic sensors operating in the same space, at the same time, on the same frequency. Our industry leading firmware allows users to connect multiple sensors across a single space without worrying about sensor interference (cross-talk). Each sensor is rated to work alongside a certain number of sensors within a closed space. For users working with large open environments, or environments where sensors point in different directions, it is likely that the published recommended number of sensors can be exceeded with little or no effect on user performance.

## Sensor Trigger Distance for LV-ProxSonar®-EZ™

Each of the LV-ProxSonar-EZ models has a set trigger distance. Objects closer than this distance that fall within the sensor detection zone can be detected and reported to the end user. Each LV-ProxSonar-EZ is tolerant of a different number of nearby sensors, this data is provided in the chart below for easy comparison.

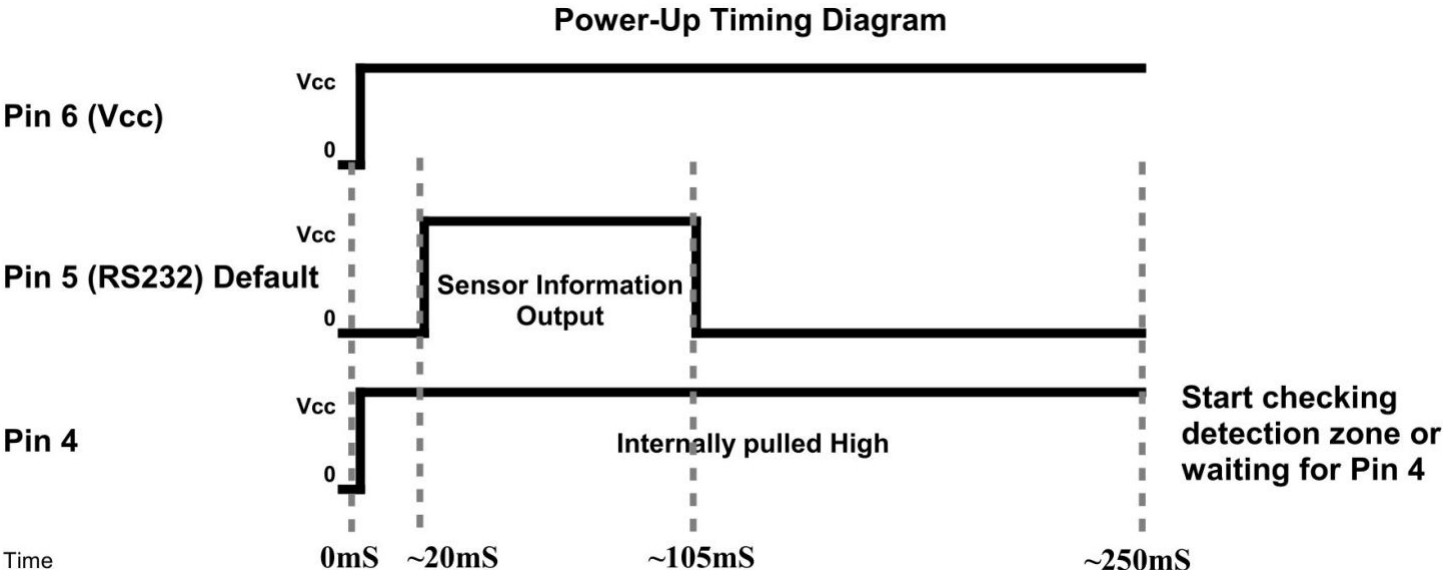
| Part # | Set Distance | # of Sensors that can run in the same space |
|---|---|---|
| MB1004 | ~7 feet (Value of RO83 or lower will cause object detection) | 6 + Sensors Simultaneously |
| MB1014 | ~5 feet (Value of RO59 or lower will cause object detection) | 8+ Sensors Simultaneously |
| MB1024 | ~3 feet (Value of RO35 or lower will cause object detection) | 10+ Sensors Simultaneously |
| MB1034 | ~2 feet (Value of RO23 or lower will cause object detection) | 13+ Sensors Simultaneously |
| MB1043 | ~1 feet (Value of RO11 or lower will cause object detection) | 15+ Sensors Simultaneously |

## LV-ProxSonar®-EZ™ Timing Description

250mS after power-up, the LV-ProxSonar-EZ is ready to accept the RX command. If the RX pin is left open or held high, the sensor will first run a calibration cycle (49mS), and then it will take a range reading (49mS). After the power up delay, the first reading will take an additional ~100mS. Subsequent readings will continue to occur every 50ms to 300ms.

When an object is placed in the sensor detection zone, the sensor will "acquire" the target in ~2.5 seconds and begin sending the appropriate serial output and set the PW pin high.

If the detected object then leaves the sensor detection zone the sensor will "release" the target ~1.5 seconds later. At this time, the PW pin will be set low. Release time can be influenced by other nearby sensors and may appear to be longer in applications with many nearby sensors.




## Selecting a LV-ProxSonar®-EZ™ Detection Zone

Different applications require different sensors. The LV-ProxSonar-EZ product line offers varied detection zones (detection distances) to allow you to select the best sensor to meet your needs. Each sensor is matched to provide the approximate detection zone 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 detection zones. 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 detection zone is a 2D representation of the detection area of the sensor. The detection zone 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 detection zone 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 ProxSonar sensor to another ProxSonar 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 detection zone 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 range.

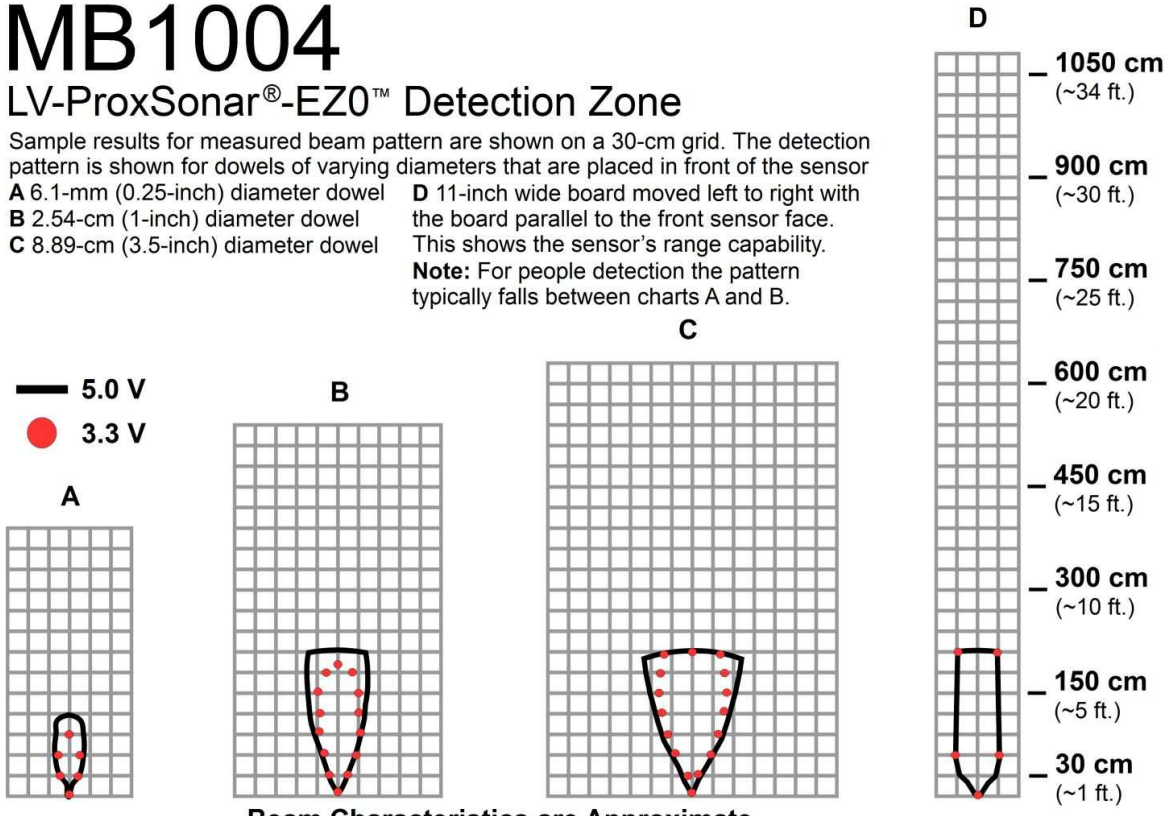
**People Sensing:** For users that desire to detect people, the detection area to the 1-inch diameter dowel, in general, represents the area that the sensor will reliably detect people.

# MB1004

## LV-ProxSonar®-EZ0™ Detection Zone

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.**

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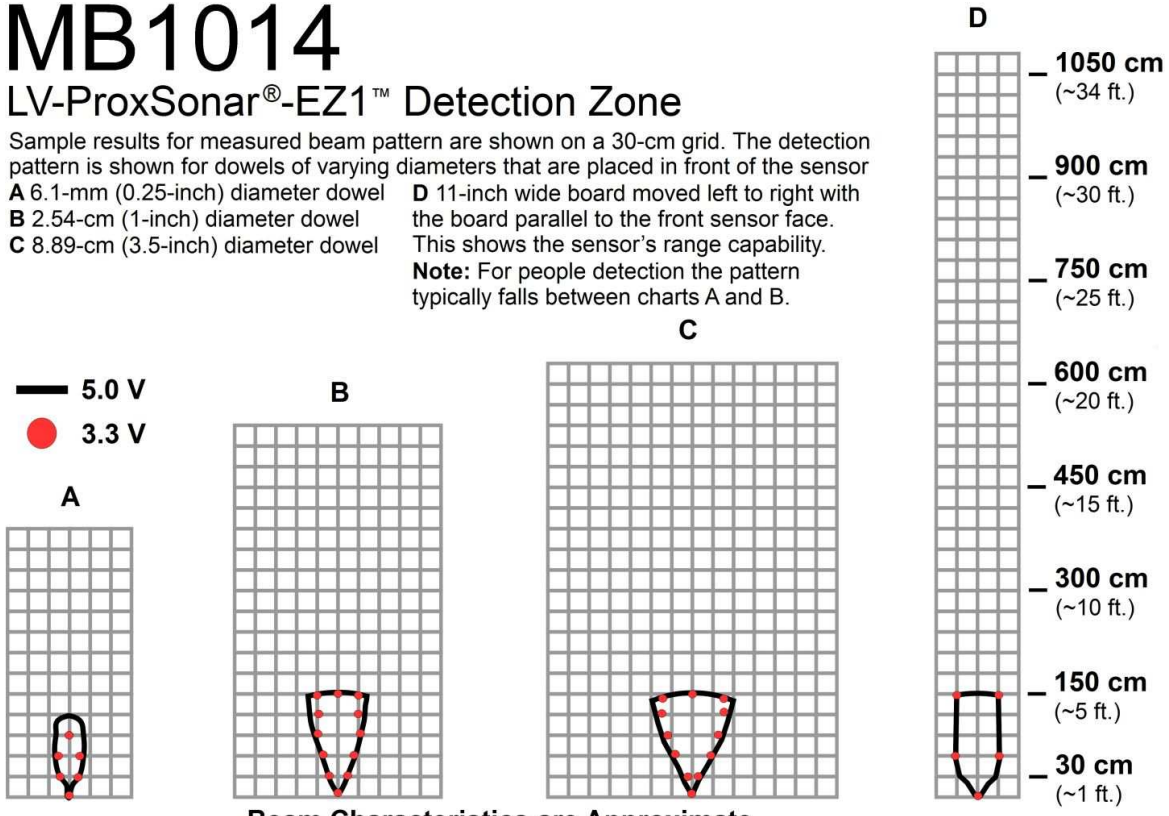
# MB1014

## LV-ProxSonar®-EZ1™ Detection Zone

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.**

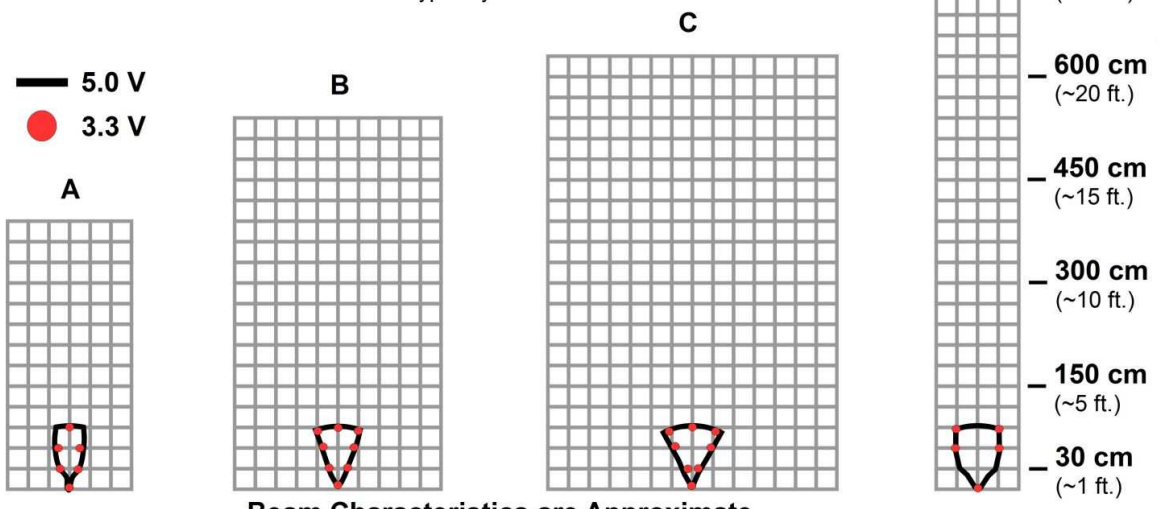
# MB1024

## LV-ProxSonar®-EZ2™ Detection Zone

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.**

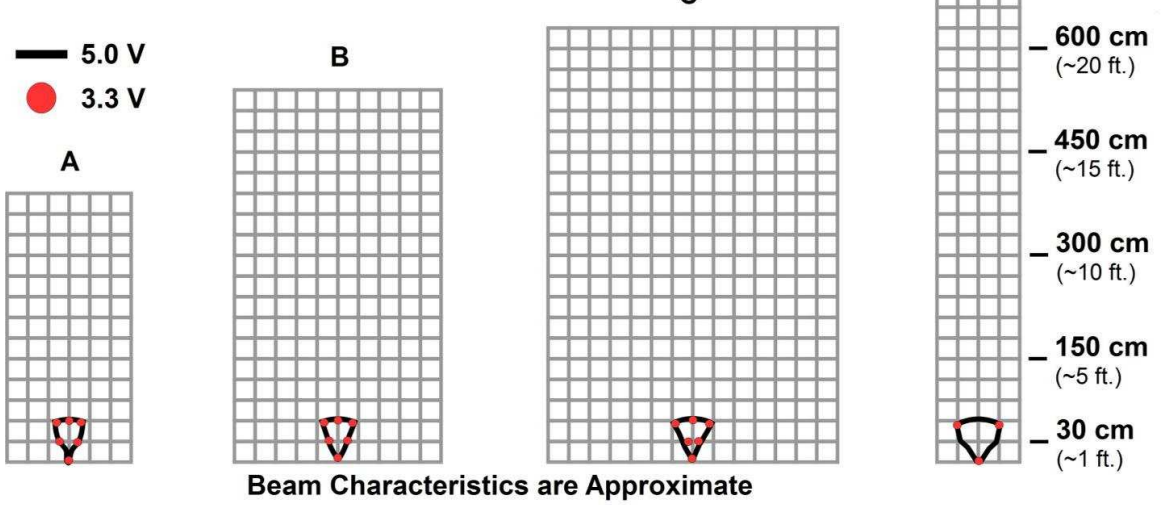
# MB1034

## LV-ProxSonar®-EZ3™ Detection Zone

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.**

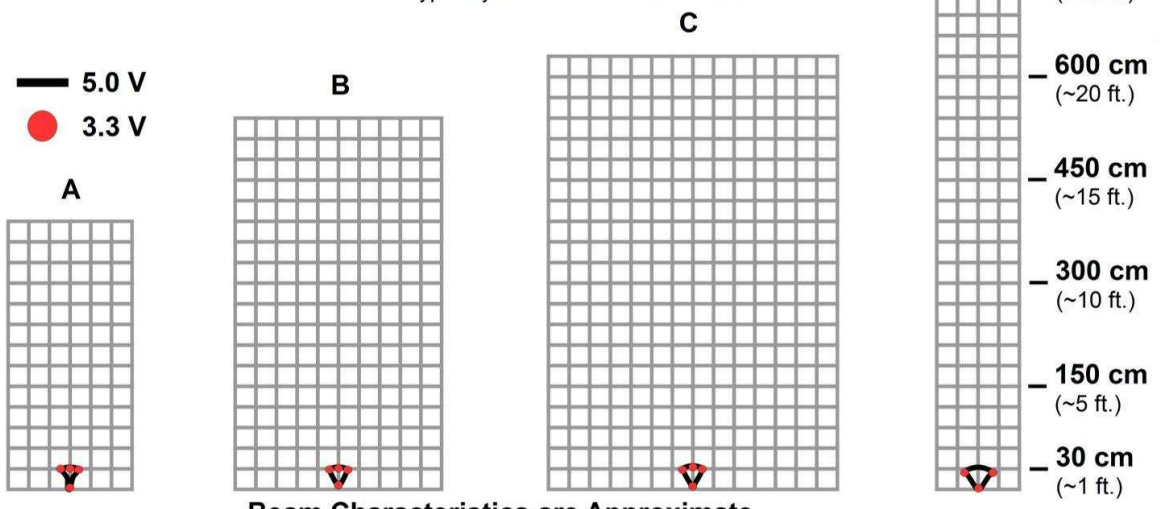
# MB1044

## LV-ProxSonar®-EZ4™ Detection Zone

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.**

## Have the right MaxSonar® for your application?

### Check out our MaxSonar® Product Lines

#### Indoor Use
#### (or protected environments)

- Power-up calibration
- Very low cost
- Very small size

**1 in Resolution**
LV-MaxSonar-EZ
LV-ProxSonar-EZ

**1 mm Resolution**
HRLV-MaxSonar-EZ

- Real-time auto calibration
- Very low cost

**1 cm Resolution**
XL-MaxSonar-EZ
XL-MaxSonar-AE
XL-MaxSonar-EZL
XL-MaxSonar-AEL

#### Outdoor Use
#### (or rugged environments) IP67

- Real-time auto or power-up calibration
- Very low cost

**1 cm Resolution**
XL-MaxSonar-WR
XL-MaxSonar-WRA
XL-MaxSonar-WRL
XL-MaxSonar-WRAL

**1 mm Resolution**
HRXL-MaxSonar-WR
HRXL-MaxSonar-WRL

**F-Option** Available for all WR models For additional protection when necessary in hazardous chemical environments.

Chemical Shield

- Real-time auto or power-up calibration
- Very low cost

**1 cm Resolution**
XL-MaxSonar-WRC
XL-MaxSonar-WRCA

**1 mm Resolution**
HRXL-MaxSonar-WRC

## 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.