USB-ProxSonar-EZ™ Series

High Performance Ultrasonic Proximity Sensor

MB1414, MB1424, MB1434, MB1444[3]

*The USB-ProxSonar-EZ provides proximity detection of objects out to a set distance, in a small and incredibly easy to use package. The USB-ProxSonar-EZ is the lowest cost USB ultrasonic sensor that features a simultaneous multi-sensor design which allows the sensor to operate even in the presence of other ultrasonic sensors. Users are able to integrate many sensors into one system and experience little to no effect from the sensor to sensor interference that can occur with other ultrasonic sensor solutions. The USB-ProxSonar-EZ features a True/False output and an optional range output. With the USB interface, deploying a network of ultrasonic sensors has never been easier. *Factory calibration and testing is standard.*

Features

- USB interface for simple computer connection and installation.
- USB Micro-B connector matches that used on most modern cell phones
- Simple True/False output and optional range output
- ~2.5 second object acquire time[2]
  ~1.5 second object release time[2]
- Filtered range output allows ranging and multi-sensor operation
- Zero range object detection
- Free run operation continually measures and outputs proximity information
- Continuously variable gain for control and side lobe suppression
- Learns nearby environment once connected or powered-up
- Proximity detection from 1 mm to set trigger distance
- Sensor operates at 42KHz
- Range information from 6 inches to 125 inches

Benefits

- USB interface for easy integration
- Very low cost USB proximity sensor
- Simultaneously use up to 20 sensors in the same environment[1]
- Easily deploy network-based IT solutions with integrated ultrasonic sensors
- Reliable proximity information
- Sensor is both a rangefinder and a proximity sensor. Detection zone is from 0 foot to preset range of 1 foot to 5 feet
- Outputs allow users to get reliable proximity information at any time
- Mounting holes provided
- Fast measurement cycle
- Quality beam characteristics

Applications and Uses

- Protected indoor environments
- Lock computers automatically aid in security & HIPAA compliance
- Sensor grids
- Kiosks & booths
- Automated displays & advertising
- Security systems
- Proximity zone detection
- People detection
- Robot ranging sensor
- Autonomous navigation
- Multi-sensor arrays

Notes:
[1] Depends on sensor model and mounting
[2] Custom acquire and release times available with a nominal NRE charge
[3] Please reference page 10 for part number key.

About Ultrasonic Sensors

Our ultrasonic sensors are, non-contact object detection and ranging sensors that detect objects in air, within an area. These sensors are not affected by 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.

Close Range Operation

Applications requiring 100% reading-to-reading reliability should not use MaxSonar sensors at a distance closer than 6 inches. Although most users find MaxSonar sensors to work reliably from 0 to 6 inches for detecting objects in many applications, MaxBotix® Inc. does not guarantee operational reliability for objects closer than the minimum reported distance. Because of ultrasonic physics, these sensors are unable to achieve 100% reliability at close distances.

Warning: Personal Safety Applications

We do not recommend or endorse this product be used as a component in any personal safety applications. This product is not designed, intended or authorized for such use. These sensors and controls do not include the self-checking redundant circuitry needed for such use. Such unauthorized use may create a failure of the MaxBotix® Inc. product which may result in personal injury or death. MaxBotix® Inc. will not be held liable for unauthorized use of this component.

USB-ProxSonar-EZ General Description of Operation

The USB-ProxSonar-EZ sensors are a high performance, ultrasonic proximity sensor that doubles as an ultrasonic range finder. The sensor utilizes a USB Micro-B connector for sensor interfacing. The sensor is small in size with holes on the PCB for easy mounting. The USB-ProxSonar-EZ sends serial data to the users operating system which can then be read from the registered COM port (or equivalent) using a terminal program or read directly from the operating system (OS) by using the appropriate software functions.

The USB-ProxSonar-EZ is powered by the USB connection and begins operating after the USB handshaking has occurred. The sensor will calibrate during the first range reading. The range data and proximity information is sent continuously to the users operating system (OS) and is available to be read at any time.

Connection is handled automatically by device drives that are available for most OS's (Windows XP and later, Linux Kernel 2.6 and later, Mac OS X and later.) The steps taken to perform the configuration varies slightly by the target OS however the general operation and the data sent by the sensor remains the same. Configuration of the USB-ProxSonar-EZ can be seen in the Serial Terminal Configuration section.

USB-ProxSonar-EZ General Power-Up Instruction

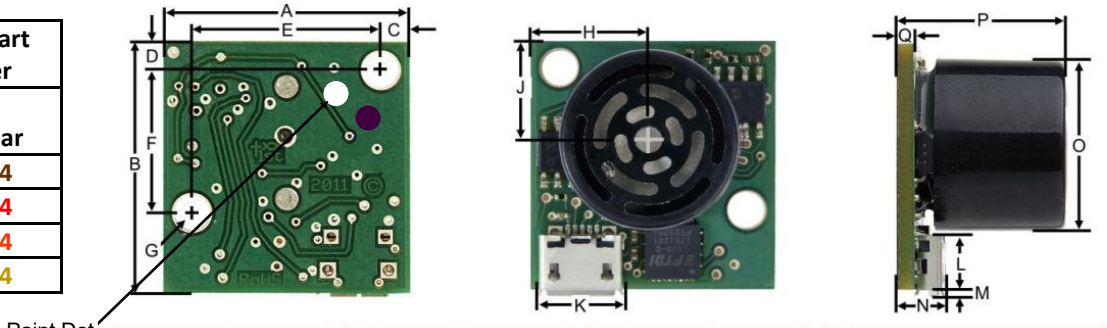
Each time after the USB-ProxSonar-EZ is powered up, it will calibrate during its first read cycle. The sensor uses this stored information to detect close objects. It is important that objects not be close to the sensor during this calibration cycle. The best sensitivity is obtained when it is clear 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 USB-ProxSonar-EZ does not use the calibration data to temperature compensate for range, but instead to compensate for the sensor ring down pattern. If the temperature, humidity, or applied voltage changes during operation, the sensor may require recalibration to reacquire the ring down pattern. Unless recalibrated, if the temperature increases, the sensor is more likely to have false close readings. If the temperature decreases, the sensor is more likely to have reduced up close sensitivity. 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. To recalibrate the USB-ProxSonar-EZ cycle power, either disconnect and reconnect the device or command the USB-port to sleep.

USB-ProxSonar-EZ Mechanical Dimensions

The recommended operating temperature is 0C to 50C. The recommended dry storage temperature is –40C to +65C. Storage in wet or moist environments may result in sensor damage.

Paint Dot	Sensor Part Number
Purple	Notes ProxSonar
Brown	MB1414
Red	MB1424
Orange	MB1434
Yellow	MB1444



A	0.863"	21.92 mm	E	0.670"	17.00 mm	J	0.350"	8.89 mm	N	0.167"	4.24 mm
B	0.888"	22.56 mm	F	0.510"	12.6 mm	K	0.317"	8.05 mm	O	0.645"	16.38 mm
C	0.100"	2.54 mm	G	0.124" dia.	3.1 mm dia.	L	0.197"	5.00 mm	P	0.610"	15.49 mm
D	0.100"	2.54 mm	H	0.425"	10.79 mm	M	0.024"	0.62 mm	Q	0.065"	1.65 mm
					Weight 4.9 grams						

Accessing the USB Serial Output — Quick Setup

A terminal program is the easiest method of reading the sensor output. Software downloads and step by step instructions

are available at http://www.maxbotix.com/terminal.htm

Serial Output Format

The sensor output is provided over the COM port (or equivalent) in an ASCII character format. 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 125 inches. This is followed by an ASCII space and the ASCII character "P", followed by one ASCII digit "1 or 0" corresponding to the "True or False" proximity information, followed by a carriage return. A proximity value of "1" signifies that a target is present in the detection zone. A proximity value of "0" signifies that no target has been detected in the detection zone.

When an object is placed in the detection zone the sensor will "acquire" the target ~2.5 seconds later by sending the appropriate proximity information.

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

The USB-ProxSonar-EZ also double as an ultrasonic range finder. Range information is provided for reference and may experience noise when a large number of sensors (5+ depending on sensor mounting) are running in the same environment. The range reading will report the range to an object to the maximum range of the sensor of 124 inches. When no object is able to be detected by the sensor, the sensor will report R125.

Sensor Trigger Distance for USB-ProxSonar-EZ

Each of the USB-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 USB-ProxSonar-EZ is tolerant of a different number of nearby sensors, this data is provided in the chart below for easy comparison.

Using Multiple Sensors in a Single System

The USB-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

Part #	Set Distance	# of Sensors that can run in the same space
MB1414	~5 feet (Value of RO59 or lower will cause object detection)	8+ Sensors Simultaneously
MB1424	~3 feet (Value of RO35 or lower will cause object detection)	10+ Sensors Simultaneously
MB1434	~2 feet (Value of RO23 or lower will cause object detection)	13+ Sensors Simultaneously
MB1444	~1 feet (Value of RO11 or lower will cause object detection)	15+ Sensors Simultaneously

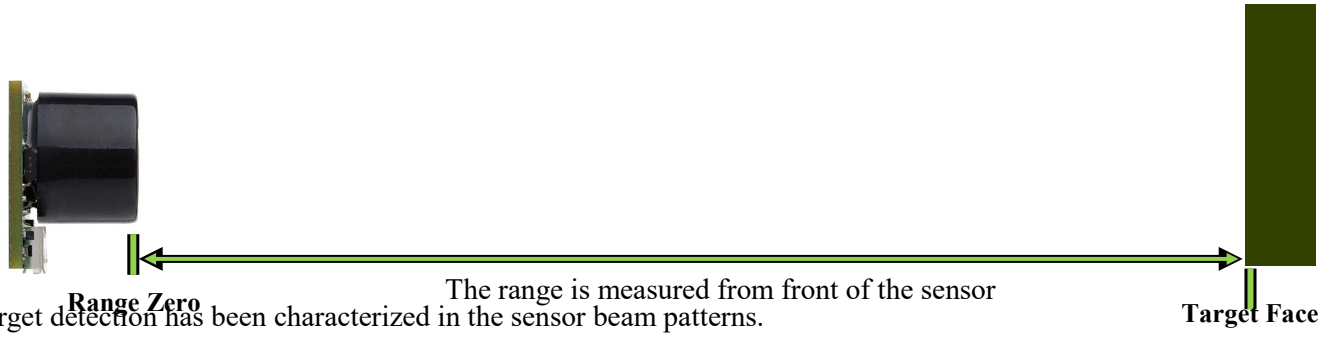
space without worrying about sensor interference (cross-talk). Each sensor is rated to work alongside a certain number of sensors within a closed space. For users working with large open environments, or environments where sensors point in different directions, it is likely that the published recommended number of sensors can be exceeded with little or no effect on user performance.

Sensor Minimum Distance

The proximity information is available from 1mm from the front sensor face to the end of the detection zone.
For the range information provided, the sensor minimum reported distance is 6-inches (15.2 cm). The USB-ProxSonar-EZ will range and report targets to the front sensor face. Large targets closer than 6-inches will typically range as 6-inches.

Range "0" Location

The USB-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.

Serial Terminal Configuration

Windows Configuration

The USB-ProxSonar-EZ inside Windows Operating systems is a plug and play device. When the USB-ProxSonar-EZ ultrasonic proximity sensors is connected to a computer running Windows XP or newer, Windows will automatically install and configure the device drivers. This configuration may take several minutes, but the device configuration will only occur once.

	Value
Baud	57600
Data bits	8
Parity	0 / None
Stop Bit	1
Flow Control	0/None

Computers running Windows XP and older, have HyperTerminal included in the operating system. Computers running Windows Vista and newer require that a software is installed that is able to communicate with a communication port.

To configure the USB-ProxSonar-EZ on computer systems running Windows, use the following directions.

1. Download a terminal program. A simple terminal program is available for download at www.maxbotix.com/terminal.htm
2. Unzip the terminal program to a folder of your choice, if using program that is provided.
3. Connect the USB-ProxSonar-EZ ultrasonic proximity sensor to a computer with a Micro-B USB Cable.
4. Allow Windows time to automatically configure USB-ProxSonar-EZ drivers
5. Run the terminal program of preference. If using the provided program, run the .exe file. The program provided should look for the first available proximity sensor.
6. For users that operate with a different terminal program, set the configuration to the settings provided.

Warning:
Removing the sensor before Windows has configured drivers may result in drivers being corrupted. Please allow time for Windows to fully install and configure drivers for the USB-ProxSonar-EZ

If the provided software does not automatically find the first available USB-ProxSonar-EZ ultrasonic proximity sensor, use the following directions

1. Click the "Settings" option.
2. In the "Serial port settings" window, change the "Port" option to the COM port number assigned to the USB-ProxSonar-EZ ultrasonic proximity sensor.

Serial Terminal Configuration Con't

Windows Configuration Con't

For multiple sensor operation, use the following instruction set.

1. Open a terminal window

2. Click settings, if using the software provided for the USB-ProxSonar-EZ ultrasonic proximity sensor
3. Change the "Port" menu to match the newest "COM#"
4. Click ok.

	Value
Baud	57600
Data bits	8
Parity	0 / None
Stop Bit	1
Flow Control	0/None

Linux Configuration

This was written using Ubuntu 12.10 and MoSerial terminal software.

1. Download and install a terminal program. http://www.maxbotix.com/terminal.htm has a recommended program
2. Configure the USB-ProxSonar-EZ
3. Click "Port Setup"
    a. Set "Device" menu to "/dev/ttyUSB0"
    b. Set Baud, Data Bits, Parity, and Stop Bits to match provided settings.
    f. Turn off all "Handshake" options
4. Click OK
5. Click "Connect"
6. Click the tab that says "Received ASCII"

Apple OS Configuration

To configure the USB-ProxSonar-EZ in Mac OS X operating systems please use the following instruction set.

1. Download a terminal program. http://www.maxbotix.com/terminal.htm has a recommended program
2. Open "Settings"
3. Click "Modem Preferences"
4. Select "usbserial0" for the USB-ProxSonar-EZ sensor.
5. Set Data Rate, Data Bits, Parity, and Stop Bits to match provided settings
6. Remove check boxes from "Flow Control" options
7. Set "Service Name" to a name of preference
8. "Phone Number", "Pre-dial init", and "Password" options can be left blank .

Other Operating Systems

For users that need drivers, drivers may be available for your system at http://www.ftdichip.com/FTDrivers.htm.

Serial Terminal Configuration Con't

USB Latency

Computer USB ports have latency and buffer sizes which can change the time between the range readings reported by the USB-ProxSonar-EZ ultrasonic proximity sensors. This time delay can be caused by the USB hardware on the computer's system board, the chipset managing USB communication ports, the age of the computer hardware, the number of devices using USB communication, and by the computers operating system.

When multiple USB connections are working in parallel, such as a mouse, keyboard, and flash-drive, the bandwidth is shared among the devices. When bandwidth is shared between devices, the buffer and latency is increased due to the extra demand of resources from the computer chipset.

Windows Users

For advanced Windows users, this instruction set will allow the use of a low-latency mode of operation for the USB-ProxSonar-EZ.

1. Open Windows' "Device Manager"
   This can often be accessed from the Windows' Control Panel
2. Expand the "Ports (COM & LPT)" menu
3. Select the COM port that is assigned to the USB-ProxSonar-EZ.
4. Right click on the COM port and go down to "Properties" on the new menu
5. On the Communications Port Properties window select the "Port Settings" Tab
6. Click on the option that says "Advanced"
7. Set the "Recieve (Bytes)" option to 512
8. Set the "Transmit (Bytes)" option to 512
9. Set the "Latency Timer (msec)" option to 2
10. The "Serial Enumerator" option should be checked.
    This setting makes Windows remember the COM port assigned to the Device
    When this is unchecked, Windows will assign it the first available Com Port

Linux Users

For advanced Linux users that wish to operate in low-latency with the USB-ProxSonar-EZ please use the following directions. While operating in low-latency mode, the USB buffer delay will be reduced to 128mS at most.

1. Open xTerm window
2. Type the following command: **$ dmesg | grep FTDI**.
   a line that looks like "/dev/ttyUSB#" will be output
3. Enter the following command. **$ setserial /dev/ttyUSB# -g**.
   The # sign will be the USB port assigned to the USB-ProxSonar-EZ sensor.
   Information will be output that looks like"/dev/ttyUSB#, UART: unk, PORT:0X0000, IRQ:0".
4. Enter the low latency command: **$ setserial /dev/ttyUSB# low_latency**.
   This command will set the USB-ProxSonar-EZ into low-latency mode.

It is recommended that the configuration is confirmed. To do this enter the command **$ setserial /dev/ttyUSB# -g**.
The low-latency flag should be appended as follows:
"/dev/ttyUSB#, UART: unk, PORT: 0X0000, IRQ: 0, Flags: low_latency".

Selecting a USB-ProxSonar-EZ Detection Zone

Different applications require different sensors. The USB-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 detection zone.

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.

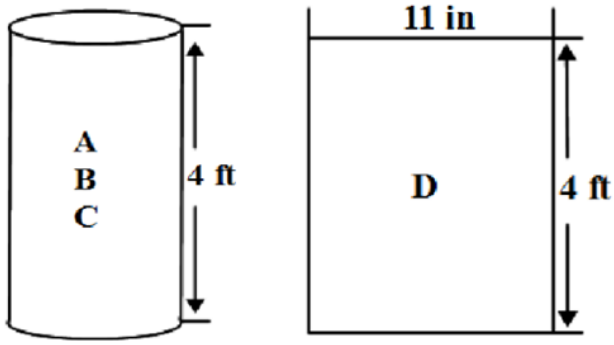
Each detection zone is a 2D representation of the detection area of the sensor. The detection zone is actually shaped like a 3D cone (having the same detection pattern both vertically and horizontally). Detection patterns for dowels are used to show the detection zone of each sensor. Dowels are long 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.

Beam Pattern Target Shapes

A 6.1-mm (0.25-inch) diameter dowel 4ft length
B 2.54-cm (1-inch) diameter dowel 4ft length
C 8.89-cm (3.5-inch) diameter dowel 4ft length
D 11-inch wide board 4ft in length moved left to right with the board parallel to the front sensor face. This shows the sensor's range capability.



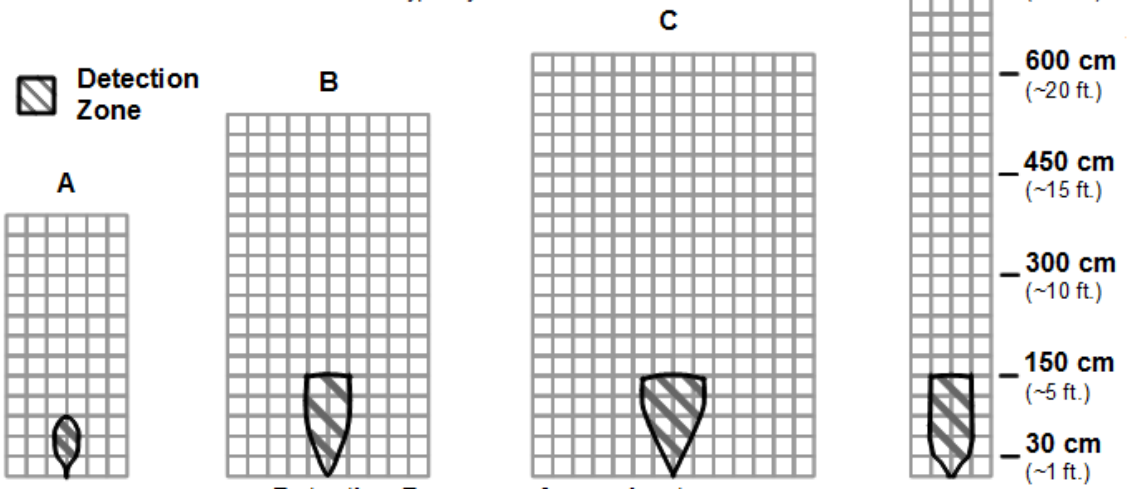
MB1414-000 MB1414-040

USB-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.



Detection Zones are Approximate

Detection Zone drawn to a 1:95 scale for easy comparison to our other products.

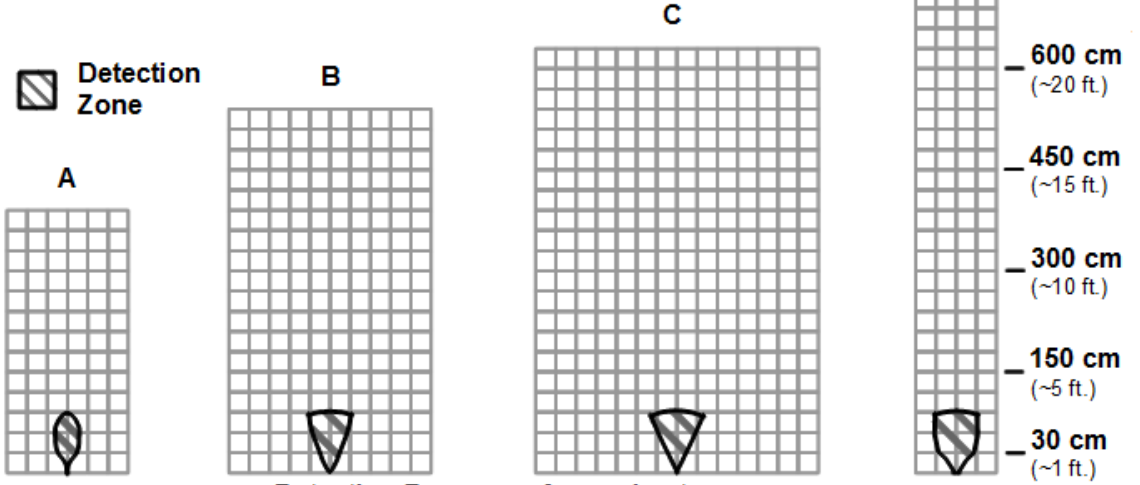
MB1424-000 MB1424-040

USB-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.



Detection Zones are Approximate

Detection Zone drawn to a 1:95 scale for easy comparison to our other products.

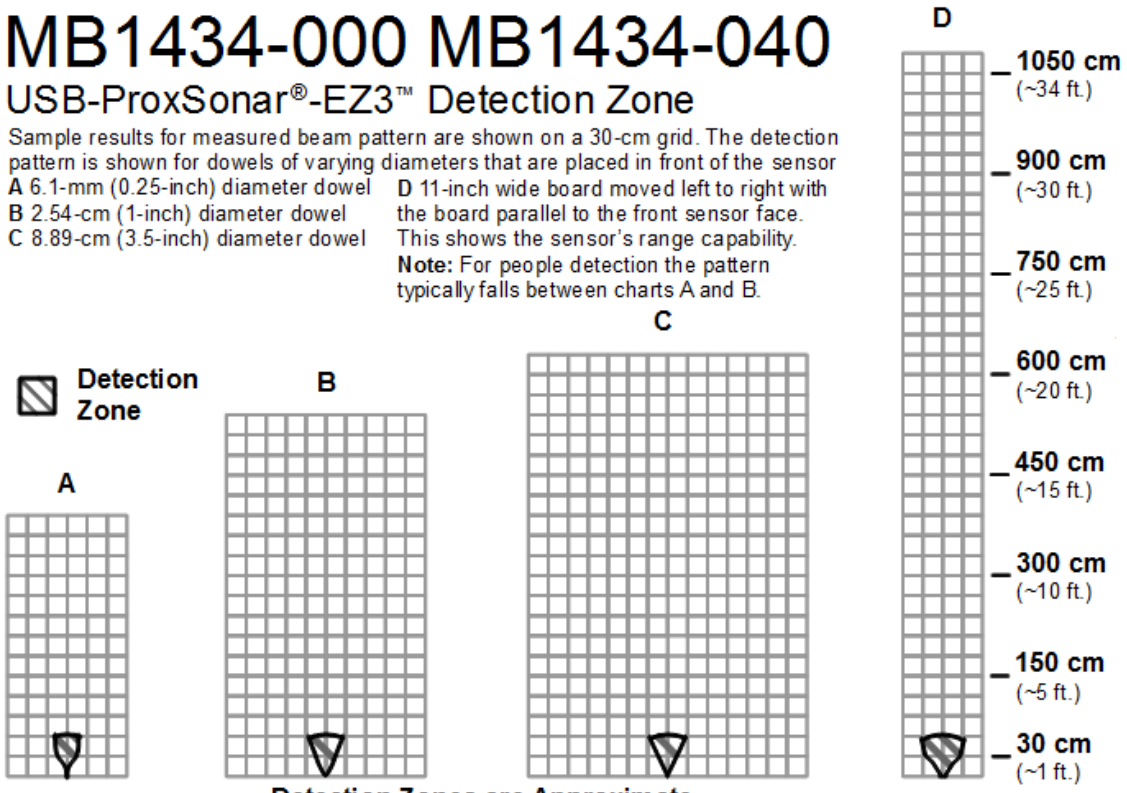
MB1434-000 MB1434-040

USB-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.



Detection Zones are Approximate

Detection Zone drawn to a 1:95 scale for easy comparison to our other products.

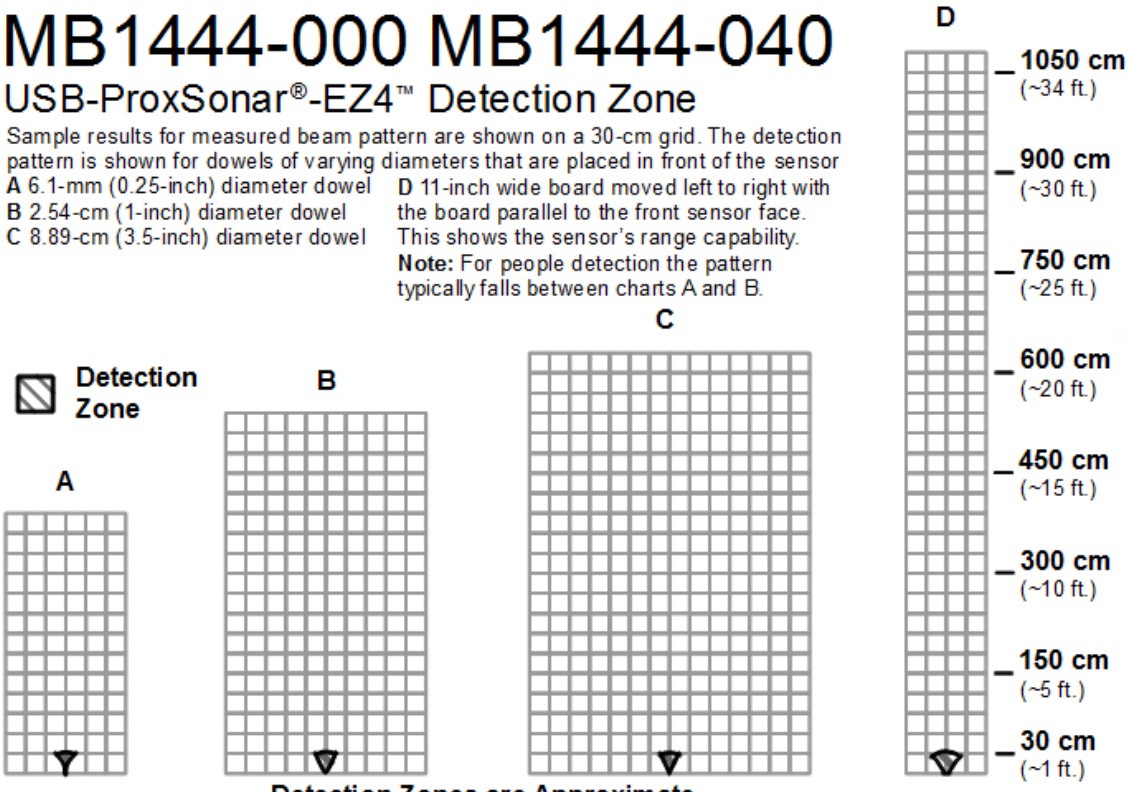
MB1444-000 MB1444-040

USB-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.

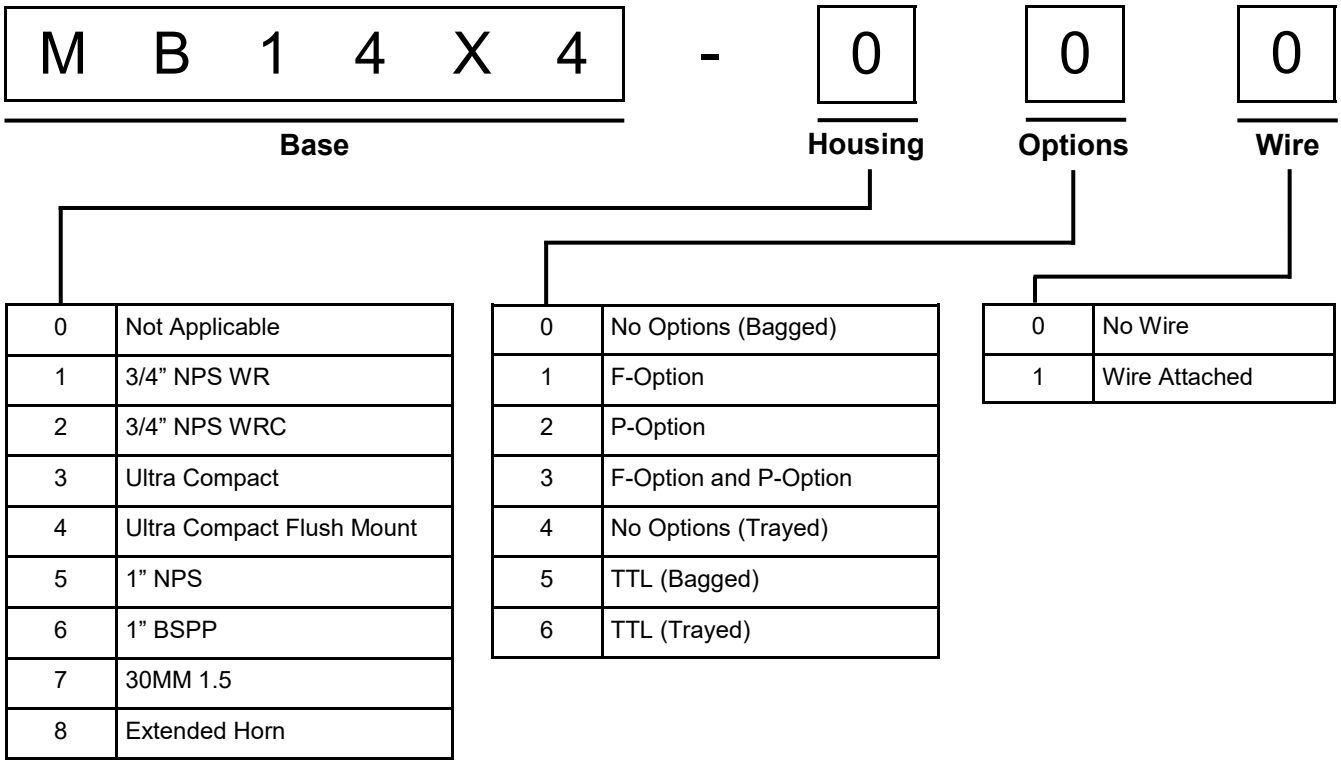


Detection Zones are Approximate

Detection Zone drawn to a 1:95 scale for easy comparison to our other products.

Part Numbers

All part numbers are a combination of a six-character base followed by a dash and a three-digit product code. Please review the following table for more information on the three-digit product code.



0	Not Applicable
1	3/4” NPS WR
2	3/4” NPS WRC
3	Ultra Compact
4	Ultra Compact Flush Mount
5	1” NPS
6	1” BSPP
7	30MM 1.5
8	Extended Horn

0	No Options (Bagged)
1	F-Option
2	P-Option
3	F-Option and P-Option
4	No Options (Trayed)
5	TTL (Bagged)
6	TTL (Trayed)

0	No Wire
1	Wire Attached

The following table displays all of the active and valid part numbers for this product.

Active Part Numbers for MB1414, MB1424, MB1434 and MB1444			
MB1414-000	MB1424-000	MB1434-000	MB1444-000
MB1414-040	MB1424-040	MB1434-040	MB1444-040

After reviewing this datasheet, do you have any more questions?

We offer Technical Support on all of our products even if you purchased them through one of our many vendors worldwide.

You can **fill out a Technical Support form** for assistance on a sensor here --> **Technical Support**

Not sure which sensor you need for your application?

We offer Sensor Selection Assistance, click the link here to fill out a form for support --> **Sensor Selection Help**

Looking for tutorials to help you get started?

Frequently Asked Questions about Our Sensors

We receive many questions about our products and services. This resource offers answers to common inquiries we receive about our product lines and their application.

Fully Calibrated Beam Patterns

All of our sensors are factory calibrated to provide consistent beam patterns, detection zones, to fit into a wide variety of applications. In our product lines, each model number comes with a different beam pattern that reflects the sensitivity and the detection zone of how it sees a target. Additionally, we strive to maintain consistency between our finished products, and you will see little to no deviation between sensors of the same model. This allows you to have confidence in your final application when using multiple sensors.

Understanding Range Readings

The success of an application may hinge upon knowing the exact location of a target. However, a sensor may report one meter even if the target is not exactly one meter away from the sensor. Sensor specifications, such as resolution, precision, and accuracy, help you to understand sensor performance.

How to Use Multiple Ultrasonic Sensors

This guide covers three ways to run your sensors in a Multiple Sensor environment and issues you may face.

Contact us now with any questions at sales@maxbotix.com or call +1-218-454-0766.

Please call during our preferred business hours of 8:00 am – 4:30 pm EST on Monday through Thursday and 8:00 am – 2:00 pm EST on Friday, or you may leave us a voicemail anytime.