

4-20HR-MaxSonar®-WR/WRC™ Series

High Resolution, Precision, IP67 Weather Resistant, Ultrasonic Range Finders

MB7460, MB7469, MB7480, MB7489

The 4-20HR-MaxSonar-WR sensor line is a high performance ultrasonic precision rangefinder that provides high accuracy, high resolution ultrasonic range detection in air. The 4-20HR-MaxSonar-WR sensor line is a cost-effective solution for automation/process control applications where precision range-finding, low-voltage operation, space saving, low cost and IP67 weather resistance is needed. This sensor component allows users of other more costly precision rangefinders to lower the cost of their systems without sacrificing performance. The sensor output works with existing PLC equipment and is also suitable for applications with long cable runs. The 4-20HR-MaxSonar-WR/WRC sensor line features 1.6-mm resolution, superior rejection of outside noise sources, internal speed-of-sound temperature compensation and optional external speed-of-sound temperature compensation. The sensors are factory calibrated to provide stable and reliable range readings. With a maximum range of 5 meters, these ultrasonic sensors detect objects from 5-mm and ranges to objects from 50-cm to maximum range. Objects closer than 50-cm are typically reported as 50-cm (See Close Range Operation).



Precision Ultrasonic Range Sensing

- A fraction of the cost of other precision rangefinders
- Factory-matched accuracy provides a typical accuracy of 1% or better of distance to target¹
- Reading-to-reading stability of 1.6-mm at 1-meter is typical¹
- Compensation for target size variation and operating voltage range
- Temperature compensation is standard
- Additional chemical resistance available²

Low Power Requirements

- Average power draw of 20-40mA
- Other interfaces (non4-20mA) available with lower current draw
- Flexible, low supply voltage requirements simplifies battery powered designs
- Low current draw reduces current drain for battery operation

Easy to Use Component

- Robust and easy to use interface
- Excellent noise rejection
- Small and easy to mount
- Stable, reliable range readings
- Target size compensation provides greater consistency and accuracy
- Auto handles acoustic noise^{1,3}
- Calibrated sensor eliminates most sensor-to-sensor variations
- Handles multiple sensor environments

General Characteristics

- **4-20mA with ~1.6mm resolution**
- Refresh rate of ~8Hz
- Determines range to largest object (MB7469, MB7489)
- Determines range to first detectable object (MB7460, MB7467, MB7480, MB7487)
- Excellent clutter rejection
- Low-cost ultrasonic rangefinder
- Resolution of ~1.6-mm
- Distance from 50-cm to 5-meters
- Excellent MTBF of > 200,000 hrs.
- Superior noise rejection⁴

- Operating temperature range from -40°C to +65°C
- Operating voltage from 10V to 32V
- IP67 rated

Applications & Uses

- Automated process control systems
- Tank level measurement
- Weather station monitoring
- Bin level measurement
- Corn level measurement¹
- Proximity zone detection
- People detection
- Robot ranging
- Long range object detection
- Environments with acoustic and electric noise
- Height monitors
- Auto sizing
- Box dimensions

Notes

¹ Users to evaluate the sensor performance

² F-Option provides added protection from hazardous chemical environments

³ By design

⁴ Part-specific timing information — see page 3

Close Range Operation

Applications requiring 100% reading-to-reading reliability should not use MaxSonar sensors at a distance closer than 50cm. Although most users find MaxSonar sensors to work reliably from 0 to 50cm 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.

General Operation

The 4-20HR-MaxSonar-WR 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 on the time of flight, the sensor outputs a distance value.

4-20 Sensor Connection Pin Out

Pin 6 — Ground return for the DC power supply.

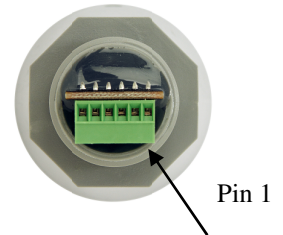
The black wire will be for the cable attach.

Pin 5 — 4-20mA signal output, the analog current output has a resolution of ~1.6mm.

The brown wire will be for the cable attach.

Pin 4 — Vcc input. This sensor has an operational input voltage of 10V to 32V DC. This sensor has a nominal current draw of less than 40mA.

The red wire will be for the cable attach.



Temperature Sensor Connections

Pin 3 — Temperature sensor V+ source. This is the red connection wire on the HR-MaxTemp sensors.

Pin 2 — Temperature sensor input. This is the white connection wire on the HR-MaxTemp sensors.

Pin 1 — Temperature sensor shield.

Output Conversion Equations

Formulas to convert the sensor output are to distance provided below for convenience.

Using I (mA) as the output current and d (mm) as the distance.

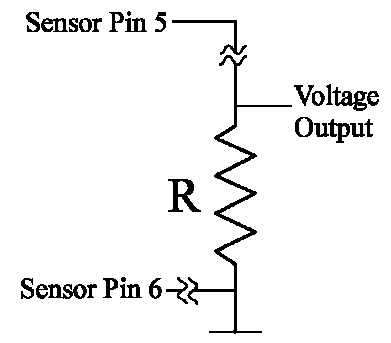
	Distance	Current
MB746X	$d = ((I - 4) * 4500) / 16 + 500$	$I = (((d - 500) * 16) / 4500) + 4$
MB748X	$d = 5000 - (((I - 4) * 4500) / 16)$	$I = (((5000 - d) * 16) / 4500) + 4$

Scaling the 4-20mA to a 5V or 10V Analog Voltage

The 4-20HR-MaxSonar-WR sensor output can be easily scaled at the user end to match the voltage range of an existing PLC or microcontroller system equipped with an analog to digital converter by using the schematic shown to the right.

For 5V data use a resistor value of 250 ohms 0.1% — when using this resistor value the sensor **requires a minimum of 15VDC** for proper operation and runs with a voltage range of 1V to 5V.

For 10V data use a resistor value of 500 ohms 0.1% — when using this resistor value the sensor **requires a minimum of 19VDC** for proper operation and runs with a voltage range of 2V to 10V.



Custom products with analog voltage outputs are also available from MaxBotix Inc.

Formulas to convert the sensor output to distance are provided below for convenience.

Using V (volts) as the output voltage and d (mm) as the distance.

		Distance	Voltage
5V	MB746X	$d = (((V - 1) * 4500) / 4) + 500$	$V = (((d - 500) * 4) / 4500) + 1$
5V	MB748X	$d = 5000 - (((V - 1) * 4500) / 4)$	$V = (((5000 - d) * 4) / 4500) + 1$
10V	MB746X	$d = (((V - 2) * 4500) / 8) + 500$	$V = (((d - 500) * 8) / 4500) + 2$
10V	MB748X	$d = 5000 - (((V - 2) * 4500) / 8)$	$V = (((5000 - d) * 8) / 4500) + 2$

4-20HR-MaxSonar-WR (MB7460 and MB7480)

The MB7460 and MB7480 are the base models of the 4-20-MaxSonar-WR sensor line. These general purpose sensors are recommended unless specific requirements indicate other sensors may be a better fit for the application. All other sensors in this series are based off of this sensor model. The additional features are mentioned in their respective sections below.

4-20HR-MaxSonar-WRM (MB7469 and MB7489)

The 4-20HR-MaxSonar-WRM sensors come with the most-likely filter features. The MB7469 output matches the output of the MB7460. The MB7489 output matches the output of the MB7480.

In general, the 4-20HR-MaxSonar-WRM sensors will select the largest target from its field of view and report its range. Even so, objects up close may provide significantly greater returns over distant objects. Users are encouraged to test the sensor in their application to verify usability.

About Package Types

The 4-20HR-MaxSonar-WR sensors are available in a variety of packages for applications with specific mounting requirements. The full horn package provides peak accuracy and sensitivity in this sensor line. It is recommended that testing is completed to ensure that the selected sensor will operate as desired in your application.

Performance Changes when Selecting a Non-Full Horn Package

Package Types Currently Available
Full Horn – 3/4" NPT straight; back mounted thread (best performance)
Compact – 3/4" NPT straight; back mounted thread
1"NPS – External thread over full sensor body (1"NPS)
1"BSPP – External thread over full sensor body (1"BSPP)
30mm1.5 – External thread over full sensor body (30mm1.5)
All package types have exposed PCB on user end for easy connection. Users desiring a fully enclosed assembly may purchase the "Shielded Cable Option" along with their sensor.



When selecting a 4-20HR-MaxSonar-WR sensor without the full horn the sensor will experience the following performance changes:

- The sensor will have a wider beam shape for the first meter.
- The sensor may be less accurate by an additional +/- 0.5%.
- The sensor may have a dead zone from 0mm–500mm.
- The sensor may have worse performance to small or soft targets.
- The sensor may experience decreased noise immunity when ranging to small, soft, angled, or distant targets.

About Ultrasonic Sensors

The HRXL-MaxSonar-WR 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.