AccuRange 4000™ laser rangefinder with measurement capabilities to 54 feet

The AR4000 family of optical distance measuring sensors have a useful range from zero to 54 feet for most diffuse reflective surfaces. A longer distance, eye-safe version is available for use with reflective tape. These sensors operate by emitting a collimated laser beam that is reflected from the target surface and collected by the sensors. The sensors are suitable for a wide variety of distance measurement applications that demand high accuracy and fast response times.

Model Descriptions

The AR4000-LIR is a Class IIIb infrared laser sensor with an effective range of 54 feet and an accuracy of 0.1 inches. This instrument is ideal for measuring moving objects of different target materials. It is standard with a 8 mW laser and is upgradeable to 20 mW.

The AR4000-LV offers a visible red laser diode. It’s Class IIIa laser has an effective range of 40 feet and an accuracy of 0.3 inches. It is standard with a 5 mW laser.

The AR4000-RET is a Class I, eye-safe infrared laser sensor. It requires the use of reflective tape and is ideal for measuring linear displacement of a target. The AR4000-RET has a calibrated range of 54 feet and with an accuracy of 0.1 inches. It has the ability to measure up to 300 feet in an uncalibrated mode. It is standard with a 130 µW laser.

Features at a glance
- 54 ft. calibrated range
- 0.1 in. accuracy
- 0.0125 in. resolution
- Up to 50 KHz sampling
- Infrared or visible lasers
- Serial or analog output
- Indoor / outdoor use
- Available software library

Mechanical Dimensions (inches)
Principles of Operation
The AR4000 laser rangefinders employ a modulated beam "time-of-flight" principle, which measures the time light takes to travel to the target and back. The time delay is indirectly measured by comparing the signal from the laser with the delayed signal returning from the target. Acuity's modulated beam rangefinders work on a patented range-to-frequency conversion principle, which offers several advantages over conventional phase measurement. Our sensors are typically used in intermediate range applications, for distances from a few inches to several tens of feet on uncooperative targets. With cooperative targets such as with reflective tape, range can be extended to several hundreds of feet.

Calibrated distance measurements from the AR4000 sensor are corrected for return signal strength, background light levels and temperature.

AR4000 Outputs
The AR4000 sensors come with standard serial RS-232 output. Sensor data cables are terminated with a DB-9 connector for direct connection to a PC and other equipment. AR4000 sensors can be ordered with current loop, RS-422, RS-485 or pulse-width (used with the AccuRange High Speed Interface Card) outputs. Low-level outputs include signals for background light levels, temperature and return signal strength.

Serial Output
- **ASCII**
  - Calibrated output: 3-6 bytes; CR, LF terminated
  - Low-level outputs: 9-24 bytes CR, LF terminated
- **Binary**
  - Calibrated output: 3 bytes; FF terminated
  - Low-level outputs: 8 bytes; FFF terminated
- **RS-232 (standard)**
  - 300 - 38.4 K baud
- **RS-422 (optional)**
  - 300 - 38.4 K baud, 4000 ft. max line length

Analog signals (optional)
- 4-20 mA current loop installed internally, configurable zero and set points

Pulse Width Output (standard with HSIF board)
- Uncalibrated range output on power/signal cable
- 18 - 50000 Hz, 0.5V peak to peak square wave signal

Low-level Outputs (standard)
- Supplementary outputs on power/signal cable for target signal strength, background illumination and sensor temperature. Voltage outputs are 0-5 volt analog levels.

AR4000 Standard Cabling
The AR4000 models include two cables: a power / signal cable and a serial data cable terminated with a DB-9 connector. Below is a description of the wires within the power / signal cable:

<table>
<thead>
<tr>
<th>Color</th>
<th>Function</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Power, +5 to +6V(400 mA)</td>
<td>IN</td>
</tr>
<tr>
<td>Black</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>Heater Power, +5 to +6V (4A)</td>
<td>IN</td>
</tr>
<tr>
<td>Brown</td>
<td>Heater Return</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>Temperature (0-5V)</td>
<td>OUT</td>
</tr>
<tr>
<td>Blue</td>
<td>Pulse or Current (0-5V)</td>
<td>OUT</td>
</tr>
<tr>
<td>Green</td>
<td>Ambient Light (0-5V)</td>
<td>OUT</td>
</tr>
<tr>
<td>Purple</td>
<td>Amplitude (0-5V)</td>
<td>OUT</td>
</tr>
</tbody>
</table>

AR4000 Inputs
**AR4000 sensor command set:**
- Laser Power On / Off
- Enable / Disable Serial Data Output
- Set Baud Rate
- Set Serial Output to ASCII / Binary
- Set Analog Zero Current
- Set Span
- Show Version Number
- Read Configuration Data from EEPROM
- Write Configuration Data to EEPROM
- Set Temperature Hold Level
- Take Single Sample (serial only)
- Set Minimum / Maximum Valid Amplitude
- Set Analog Output between Calibrated / Uncalibrated
### AR4000 Common Specifications

**Laser**
- **LIR & RET**: 780 nm, Class IIIb and I respectively
- **LV**: 670 nm, Class IIIa

**Range**
- **LIR**: 54 ft. (16.5 m)
- **LV**: 40 ft. (12.2 m)
- **RET**: 1.5 - 54 ft. (16.5 m) calibrated, up to 300 ft. range in uncalibrated mode

**Accuracy**
- **LIR & RET**: 0.1 in. (2.5 mm) to 85% diffuse reflectance
- **LV**: 0.3 in. (7.6 mm) to 85% diffuse reflectance

**Resolution**
- 0.0125 in. (0.032 mm) at 700 Hz

**Sensor Principle**
- modulated beam, time-of-flight

**Laser spot size**: 0.1 in. (2.5 mm) 0.5 milliradian divergence

**Collection Aperture**: 2.5 in. (63.5 mm) diameter lens

**Laser Power**: 8mW, 5mW, 0.13 mW (LIR, LV, RET respectively)

**Sensor Power**
- **Sensor**: +5-6 V D.C. (400 mA at 5V)
- **Heater (optional)**: +4.5-7 V (4A max) to stabilize sensor temp. in low-temp. environments

**Weight**: 22 oz. (625 grams)

**Operating Temperature**: -17 to 50°C, negligible accuracy drift

**Enclosure**: meets NEMA-4 and IP-67 requirements

**Sample Rates (configurable)**
- **maximums**: 50,000 Hz with optional High Speed Interface,
- **Serial Output**: 700 Hz with standard serial output
- **Analog Output**: 1000 Hz with optional analog output
- **High Speed Interface**: 50,000 Hz
- **minimum**: 0.2 samples / sec or sample on request

**Cable Length**: 6 feet

**Cable Configuration**: 8 conductor, Power and serial Data cables, see prev. page descriptions

**Regulatory**: CE

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**Measurement error vs. Time**

![Measurement error vs. Time graph](image)

**Accuracy vs. Sample Rate**

![Accuracy vs. Sample Rate graph](image)
AR4000 Sensor Options

20 mW Laser Upgrade: Upgrade laser power from 8 mW to 20 mW for the AR4000-LIR. For high sample rates on dark or shiny targets at long distance or use on radiating surfaces. Includes IR laser safety interlocks.

RS 422 Output: Differential serial output for communication up to 4000 feet. 300 - 57600 baud. Replaces standard RS232 output.

Current Loop Output: 4-20 mA current loop output for AR4000, installed internally.

Close Focus Optics: Special optics with the greatest sensitivity within 9 feet and maximum range of 16 feet. Customer specifies min. & max. working distances.

Optical Filter: Optical Filter for brightly lit or glowing targets, installed internally.

Power Supply: Universal AC power supply. 100-240 V, 50 - 60 Hz

AccuRange Line Scanner: One-axis spinning mirror and encoder assembly for scanning points in a line. Scanner couples with AR4000-LIR sensor.

High Speed Interface: Increases sample rate to 50 KHz. Designed to be used with AccuRange line scanner to track two encoder signals. Available in ISA, PC-104 and PCI formats.

Software Library: Software Library license for AR4000 using serial interface or High Speed Interface. Includes tested functions for C, C++, VBA and Microsoft® Excel.

Pan-tilt Unit: Programmable pan and tilt device to automate the pointing and movement of the AR4000 or AccuRange line scanner.

Display: Encased display with bright blue characters, 9 mm high for output from AR4000 in mm or in.

Dimensions: 246.4 x 71.1 x 116.8 mm (L x H x D)

Acuity is the leader in laser sensor development. If our standard products do not exactly meet your needs, please call us with your requirements. We are happy to design a sensor to your range, accuracy and size constraints. For example, our products can be configured to detect multiple surfaces of transparent materials. Our custom configurations provide the greatest flexibility for your specialized applications.