

# Using the Judd Communications Depth Sensor with the HOBO® RX3000 Station

This application note describes how to connect and operate the Judd Communications Depth Sensor with the HOBO RX3000 station. The Judd Depth Sensor is compatible with any RX3000 configuration (cellular, Ethernet, or Wi-Fi) that is equipped with the optional four-channel analog input module. We recommend that you use a 6-watt solar panel to ensure that the battery maintains a charge properly.

Portions of the Judd Technical Manual are used within this application note. The full manual is available at <http://juddcom.com/storage/ds2manual.pdf>. Read and understand the manual before attempting to use this device with the RX3000 station. The Judd Depth Sensor is available in both 0-2.5VDC or 0-5VDC analog output configurations.

## Judd Communications Depth Sensor

### **SPECIFICATIONS**

**Power:** +12 to 18 VDC, 50 mA  
(maximum sample time 2.6 seconds)

**Output:** 0 to 2.5 or 0 to 5 VDC

**Range:** .5 to 10 meters (1.6 to 32.8 feet)

**Beam width:** 22 degrees

**Accuracy:** ± 1 cm or .4 % distance to target

**Resolution:** 3 mm (.12 inches)

**Temp. range:** -40° to + 70°C (-40° to 158°F)

**Size:** 8 x 8 x 13 cm (3 x 3 x 5 inches)

**Weight:** .6 kg (1.3 lbs.)

**Mounting:** 1/2 inch threaded pipe

**Cable length:** 7.6 meters (25 feet)

**Max. cable length:** 304 meters (1000 feet)

**Temperature Sensor Accuracy:** ± .5°C, -40 to +85°C

**Temperature Sensor Resolution:** .5°C



### **INTRODUCTION**

The Judd Communications Depth Sensor is an inexpensive solution for remotely measuring snow depth or water levels. The sensor measures the distance from the sensor to a target. The sensor works by measuring the time required for an ultrasonic pulse to travel to and from a target surface. An integrated temperature probe with solar radiation shield, provides an air temperature measurement for properly compensating the distance measured. An embedded microcontroller calculates a temperature compensated distance and performs error checking.

Both distance and air temperature can be output as an analog signal between 0 to 2.5 Volts or 0 to 5 Volts. The depth sensor is user configurable by means of internal dip switches. Several configurations are possible and allow the depth sensor to work with as many different type of systems as possible.

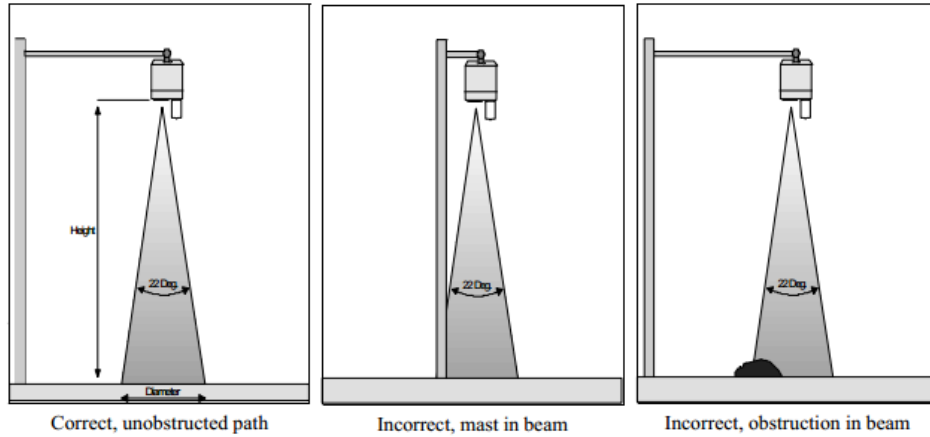
Accurate measurement of snow depth poses many difficult problems. The Judd Communications Depth Sensor has proven very effective in measuring snow depth, which makes it well suited for other various applications.

## INSTALLATION

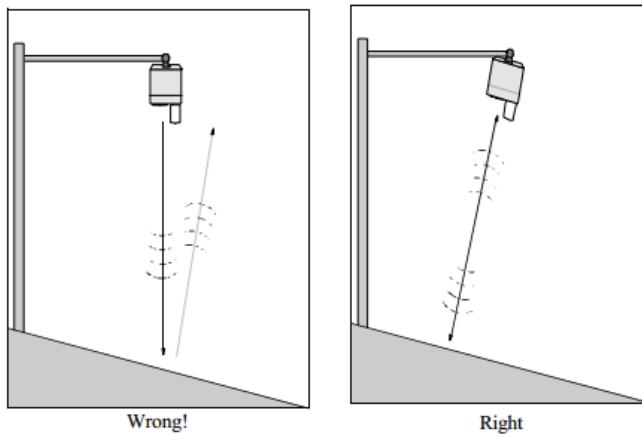
When mounting the sensor pay careful attention to the cone of the ultrasonic beam. The beam width is 22 degrees which means that the diameter of the beam will be 39% of the distance to the target, as shown in Figure 1. This means that after traveling 10 meters the beam diameter will be 3.9 meters. In this example the sensor would need to be mounted at least half the distance of the beam diameter, or 1.95 meters, away from the mast. Be careful to avoid obstructed beam paths.

To determine the minimum distance the sensor must be mounted away from the mast use this formula:  
Crossarm length =  $.194 \times \text{Height}$

### Depth Sensor Beam Width Examples



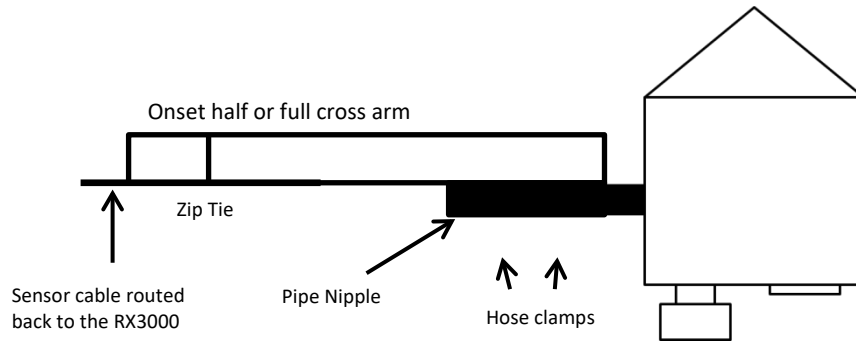
### Perpendicular to Surface



The JC Depth Sensor must be mounted perpendicular to the target surface. Mounting the sensor at an angle will result in erratic and unreliable measurements.

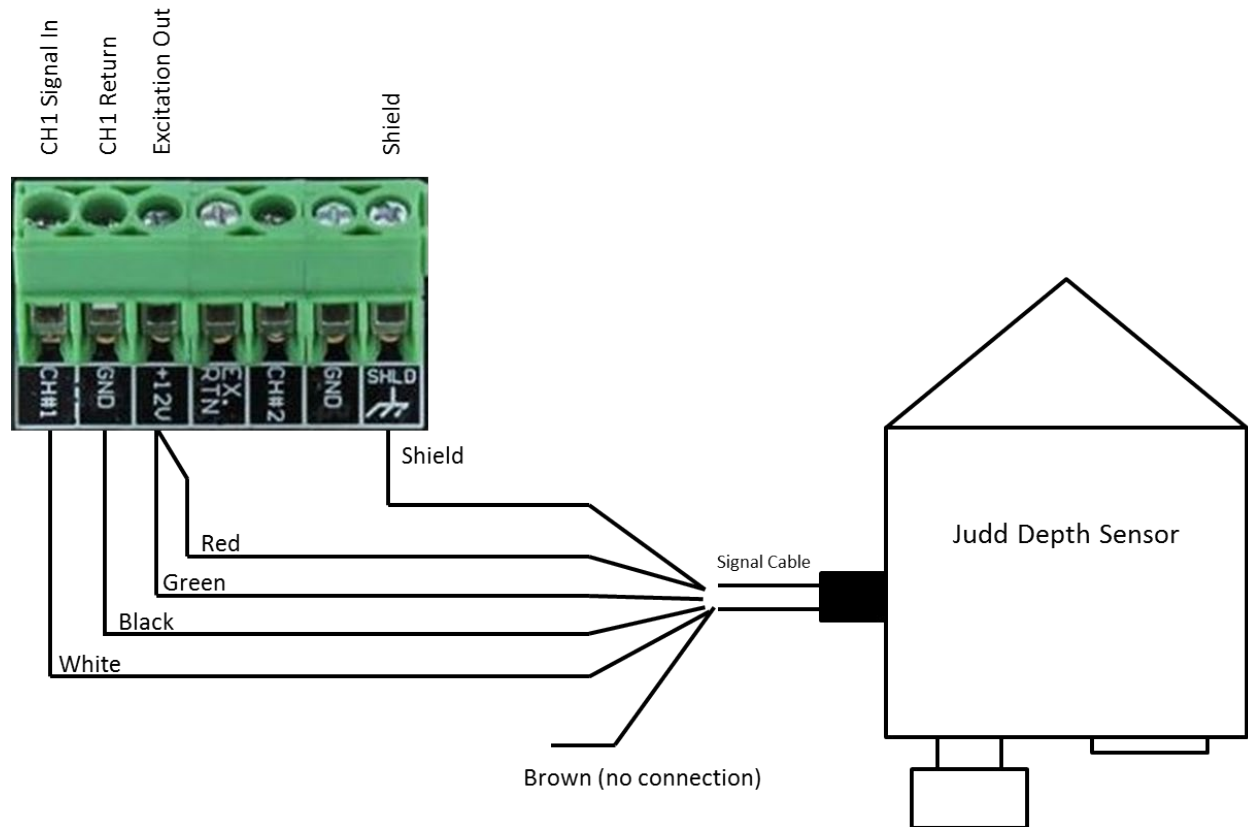
Take care to minimize the distance between the sensor and the snow surface to reduce error caused by temperature stratification through the column of air. The optimal sensor height is the maximum snow depth plus 1.6 feet. For example, if the maximum snow depth expected is 3 feet, then the sensor should be mounted at 3 feet +1.6 feet, or 5 feet (rounding to the closest foot).

The Judd Depth Sensor comes with a 1/2-inch NPT female pipe fitting for mounting and cable egress. Attaching a 4-inch or longer PVC threaded pipe nipple to this pipe fitting allows you to mount the sensor to a horizontal member, such as the Onset half or full cross-arm using two #36 (1 13/16 - 2 3/4 inch) stainless steel hose clamps (not included). Use electrician's putty or silicone sealant to seal the end of the nipple where the cable exits to prevent water/snow ingress.



Be sure that the sensor is mounted plumb and level. For more information on mounting, refer to the Judd Depth Sensor manual at <http://juddcom.com/storage/ds2manual.pdf>.

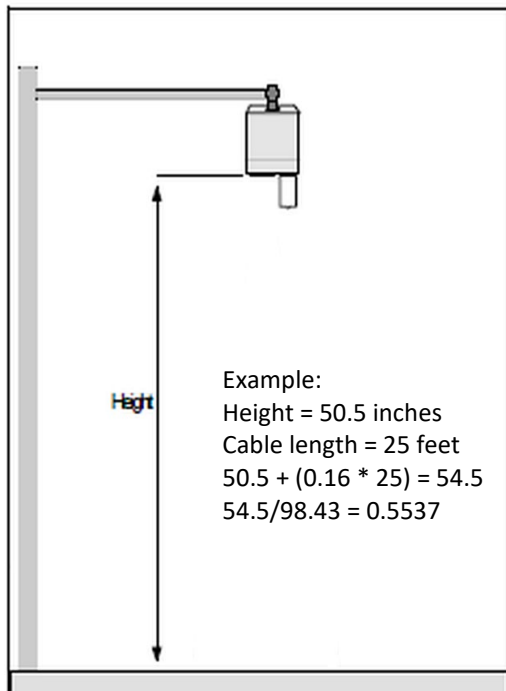
### Wiring to the RX3000 Analog Sensor Module (RXMOD-A1)



## Configuring the RX3000 Station with HOBOLink

1. In HOBOLink, select Device then click the wrench icon on your station's tile.
2. Select Analog Sensors Logging.  
Set the Logging Interval, Sampling Interval (if desired), and select Use Excitation Power. Select Warmup and enter 2 seconds and 400 milliseconds.
3. Scroll down to Sensor Configuration. Select Enable channel. Type a label for the snow (such as Judd Snow Depth). Select the Sensor/Input Type.
4. Next Select Enable Scaling. The Scaled Measurement Type dropdown auto-populates. Leave the selection as is, select a different measurement type, or tap Add to add one.
5. Enter the calculated values in the scaling fields. Use the example in the Scaling Calculation section to calculate values.

## Scaling Calculation



$$\text{Height (inches)} + 0.16(L)^* = \text{Scaled Low}$$

\*L = length of signal cable in feet

$$\frac{\text{Scaled Low}}{98.43} = \text{Real High}$$

## Troubleshooting

When installed correctly and operated within its limitations, the Judd Depth Sensor can provide accurate and reliable distance measurements. The following are the most likely causes of erroneous measurements:

- The sensor is not perpendicular to the target surface.
- The target is small and reflects little sound.
- The target surface is rough and uneven.
- The target surface is a poor reflector of sound, such as low density snow (<5%).
- The transducer is obstructed by ice or debris.
- Strong winds are blowing the echo out from under the sensor.
- The sensor is too close to the target. The minimum distance to the target must be greater than 1.6 feet (0.5 m).

For more information on this sensor, contact Onset at 1-508-759-9500 or [www.onsetcomp.com/contact/support](http://www.onsetcomp.com/contact/support). You can also contact Judd Communications at 1-801-424-2889.