Boltwood Systems Portable Cloud Sensor

Version 011 2007-05-30

1. Introduction

The Portable Cloud Sensor (PCS) is for use when tenting at a star party, for temporary backyard use, or similar situations. It wakes a sleeping observer when the degree of cloudiness changes. It consists of a sensor head, cable, and a control box. The sensor head is placed outside, pointing up at an unobstructed sky. The cable connects the sensor head to the control box inside the tent (or building), near the sleeping observer's head. The control box contains the batteries that power the unit, an alarm beeper, a headphone jack for "silent" alarms, and the controls.

Depending upon a switch setting, the PCS will alarm the user when the cloudiness of the sky goes either above or below a threshold chosen by the user. Usage examples: when set to alarm for cloudiness, it is used to monitor the sky while CCD observations are being made automatically. When set to alarm for clear skies, it is used to wake a sleeping observer so an observing opportunity is not missed.

There also is a photodiode daylight sensor so the three possible alarm signals from high to low priority actually are:

- daylight – you cannot observe
- cloudy – you cannot observe
- clear and dark – you can observe.

The PCS is for short term portable night-time use only. While it uses the same cloud and daylight sensors as our Cloud Sensor II product, it has no other sensors. The sensors must be wiped off after it rains. The PCS does not need a computer nor can it connect to one. It will work down to -20°C (-4°F) and in light dew or frost conditions.

2. Operating Principles

The PCS detects the presence of clouds in an indirect manner. What it really does is measure the sky temperature by sensing the infrared radiation from the sky in the 8 to 14 micron wavelength range. A clear sky is at least 20°C (36°F) colder than the ambient temperature. A fully overcast sky with low clouds usually will be close to the same temperature as the ambient temperature. The PCS uses a thermopile to make this measurement and then it compares this reading to the ambient temperature.

The thermopile is fully sensitive over an 80° angular diameter and has some sensitivity out to 120°. The thermopile will not work through water, glass or many plastics. The thermopile is heated slightly to prevent dew or frost from forming on it except under severe conditions.

3. Using The PCS

You will need to supply 4 alkaline AA batteries and some way to fasten the sensor head to an outside support such that the sensors are looking up at the sky. Consider tape or Velcro ties or cable ties. The pictures show an example. The end without the cable jack needs to face the sky nearly vertically. If you want a "silent" alarm, you will also need a headphone set or an earphone. The alarm will be very loud so get one that has a volume control and test the setting. If your headphone does not have a volume control, it is possible to buy a separate volume control for your headphones.

Open the battery door on the back of the control box and insert the batteries. Please do not just shove the batteries in. Instead, flex the battery clips and ease each battery into place. Follow the molded-in battery orientations. Then close the door. Plug the cable into the control box and the sensor head. Strain relieve the cable near the sensor head in case someone trips over it. The cable is symmetrical and can be used either way around.

Turn on the On/Off switch and the red LED above it will light. If it does not, that means that your batteries have less than 10 hours of life left or are missing. Replace them now. Normal life is about 100 hours. The battery warning circuit will work only if you use alkaline batteries. If, when alarming, this LED flickers it means that the battery voltage is getting low. If your On/Off switch is on, your batteries will run down slowly even if the cable is unplugged.

On a clear night, put the threshold knob at mid-range and point the sensor head at the clear sky. Set the "Alarm For" switch to "Clear & Dark". You should now get an alarm. If not, turn the threshold knob counter-clockwise a bit and you should get an alarm. If it is too loud, put tape partially or fully over the sound hole at the end of the box.

Now cover the sensor head with your hand to simulate clouds. The clear alarm should stop in ~5 seconds and then if you set the "Alarm For" switch to "Cloudy or Light", an alarm should sound. If not, turn the threshold knob clockwise a bit. Once you are familiar with the unit, determine the threshold settings that you like.

Please note that to get a clear sky alarm, the sensor head must be in the dark. This is to avoid waking you up if it is already light outside. While the unit responds quickly to changes in the knob position, it takes ~5 seconds to respond to a change in the cloudiness or sky brightness condition. This was done to avoid waking you up with false alarms due to flashlights (even red ones) and car headlights.

If there is anyone else within hearing range, please turn the unit off when you are not in attendance. If you wake up your spouse or the whole campground, there might be consequences. When you return and turn the unit on, confirm that the red LED goes on.

There are several beeping patterns each repeating every 1/2 second. In the chart below "dit" is 0.05 seconds and "dah" is 0.15 seconds.

Clear	dit dah
Cloudy	dah dah
Daylight	dah dit dit

There are other patterns that indicate failures which require service.

When facing the sky, the sensor head is rainproof. But it will not automatically resume operations after rain: you must wipe the water off first with a cloth. There are some unusual meteorological situations that may cause rain yet look like cold (and therefore clear) sky to the PCS, so a check of the weather forecast is advised before going to sleep with the PCS on guard.

4. Cables

You may need to replace the cable if it is damaged, or in order to get a different length. It is a standard modular telephone 6/4 cable available at stores that sell telephone equipment. The "6" means that there can be up to 6 pins. The "4" means that there must be 4 pins and 4 wires. They will be the center 4 pins. Make sure that the replacement has connectors that have their release tabs on the same side of the cable. The "standard" telephone cable we use is this way and it therefore reverses the wires from end to end. Using the wrong type of cable for a short period will not cause damage but the PCS will not work.

If you use an extension cable or you are not sure that your new cable is "reversing", please check it out with an ohmmeter or continuity tester. If you put the two connectors side by side oriented the same way then the leftmost pin on one will be connected to the rightmost pin on the other, etc.

Buy a white cable to make it less likely that someone will trip over it in the dark. When tenting, arrange the cable so as to prevent rain from running down the cable and into the control box.

Modular cables come in various gauges (26 to 32 AWG) and qualities. This table is conservative:

Cable wire gauge AWG	Maximum length in meters	Maximum length in feet
26	20	65
28	12	40
30	8	25
32	5	16

If you use cables longer than these limits, performance may be compromised but damage will not occur.

5. Care of The Unit

The control box is NOT water-proof. The sensor head is rain proof if it is facing upward or nearly so. The sensors need to be kept clean and undamaged. Treat the thermopile window like a fine lens. Protect the sensors when transporting the sensor head. The PCS is not designed to be used for a permanent installation, or deep winter or wet weather use.

6. Warranty and Disclaimer

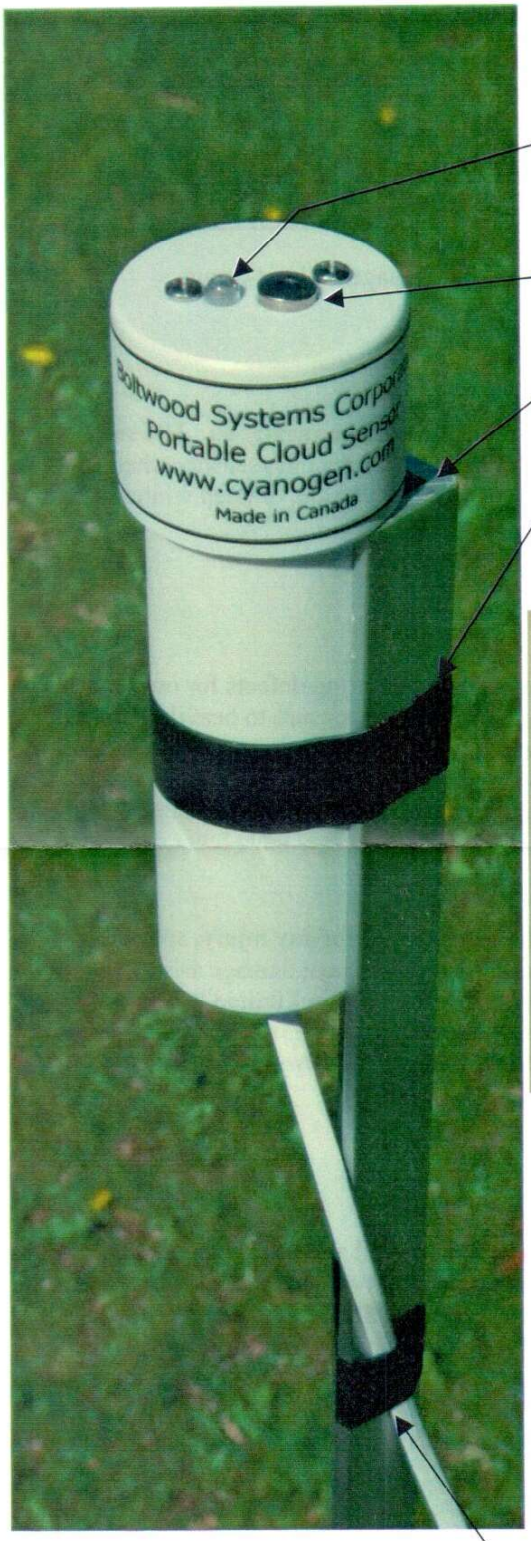
Boltwood Systems Corporation warranties the Portable Cloud Sensor against manufacturing defects for one year from the date of purchase. This warranty does not cover damage due to improper handling, exposure to heavily polluted, dirty, or corrosive atmospheres, intentional damage or tampering, lightning, or extreme weather conditions. If you have a problem, please contact us via the web site below before you ship the unit to us. This warranty is exclusive and in lieu of all other warranties, whether express or implied, including the implied warranties of merchantability, fitness for a particular use, and non-infringement. This warranty gives you specific rights. You may have other rights that vary from jurisdiction to jurisdiction.

In no event shall Boltwood Systems Corporation or Diffraction Limited be liable to you for any injury, special, consequential, indirect, or similar damages, including any lost profits, lost data, or equipment damage arising out of the use or inability to use this product even if Boltwood Systems Corporation and/or Diffraction Limited has been advised of the possibility of such damages. Some jurisdictions do not allow the limitation or exclusion of liability for incidental or consequential damages so the above limitation may not apply to you. In no case shall Boltwood Systems Corporation's and Diffraction Limited's liability exceed the purchase price for the product.

7. Contacting Us

Before reporting any fault please be sure that you have fresh batteries correctly installed and have tried another cable. If the problem is the lack of a clear sky alarm, please be sure that the sensor head is out of doors, is in the dark, is pointed at a clear sky, the threshold is set to Cloudier, and you have waited more than 5 seconds. For assistance with the Portable Cloud Sensor, please contact us through our exclusive distributor, Diffraction Limited. Go to http://www.cyanogen.com/support/tech_main.htm.

For further information on the Portable Cloud Sensor or a copy of this manual, please go to http://www.cyanogen.com.



daylight sensor (photodiode)

cloud sensor (thermopile)

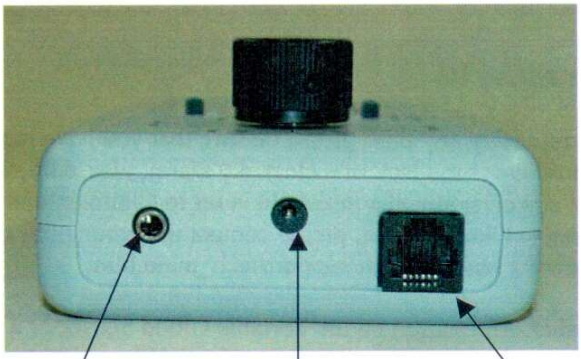
a suggested mounting support:
aluminum angle 2 cm X 2 cm X 120 cm,
3 mm thick, or ¾" X ¾" X 4', 1/8" thick
(not included)

vinyl electrician's tape twice around

tape to provide a strain relief

One Example of a
Sensor Head Setup

Control Box



headphone jack sound exit hole cable jack