

A DS1620 Digital Thermometer was included in the case to monitor the temperature of the electronics, as the shelter is not well ventilated.

The unit is powered by a 6v 10000 mAh LiMH battery with 3 solar panels used to recharge the battery. Diodes are placed between the output of the solar panels and the battery to prevent discharge through the panels during low light conditions.

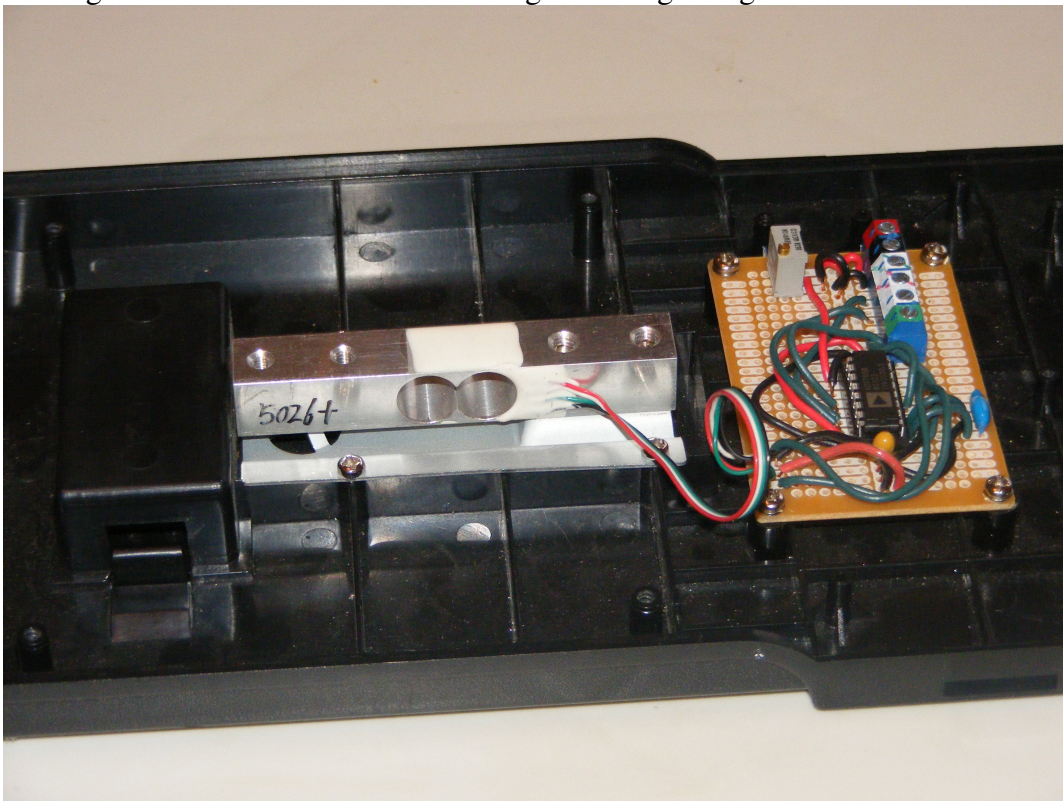
3.1 Temperature Sensor

The temperature sensor is a Sensirion SHT11 Sensor Module (Parallax part #28018). This is a calibrated temperature and humidity sensor on a mounting base that will allow it to be remotely placed to minimize errors due to heat generated by the controller board and other electronics in the external controller unit.

The sensor is housed in an Onset Computer Corporation Solar Radiation Shield (Part # RS3) attached to the side of the shelter assembly.

3.2 Rain / Snow Sensor

The rain/snow sensor is a weight based rain measuring device. This sensor weighs the accumulated precipitation and calculates the rainfall equivalent. It will handle both rain and snow with an accuracy to provide readings to the nearest 0.01". The sensor is the strain gage from a Kologn Industrial Co. KL-9102 kitchen scale with the output fed to an Analog Devices AD7705 16 bit Delta Sigma analog to digital converter.

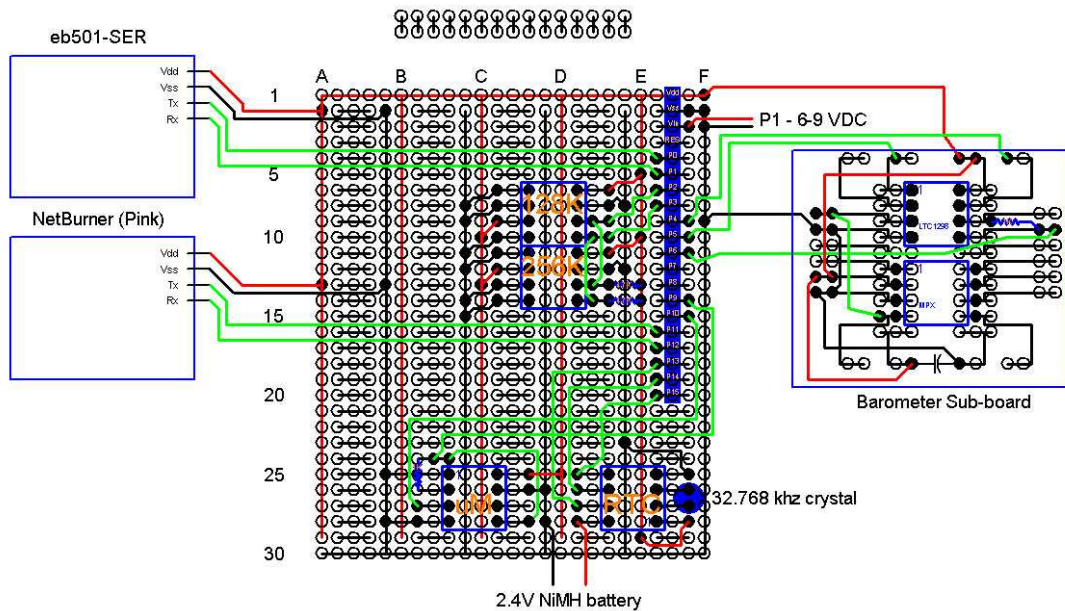


3.3 Snow Depth Sensor

An LV-MaxSonar®-EZ1™ ultrasonic range finder aimed at a snowboard will provide the current distance to the surface above the snowboard.

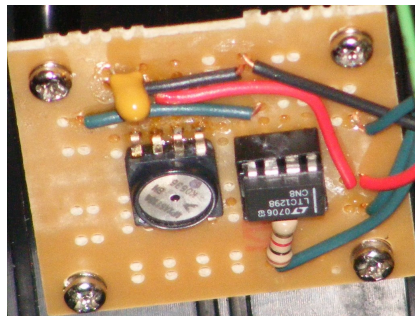
4.0 Internal Control Unit & Internet Connection

The Internal Control Unit is responsible for requesting, receiving and logging data from the External Control Unit. The unit formats the data and publishes it to the Internet Connection. The logical control will be accomplished with a Parallax Basic Stamp 2 microcontroller OEM Board (Item Number: 27291). A Micromega V2 floating point processor is used to perform data reduction from the raw instrument reading into a usable value. The Bluetooth Data Connection is an A7 Engineering EmbeddedBlue eb501-SER and SMA antenna. The internet connection is made with a Parallax PINK (Parallax Internet Netburner Kit – Item Code: 30013). This unit combines some data storage capability, Ethernet connectivity, and both a web server and ftp server in a single module. Also included in the Internal Control Unit are a DS1302 real time clock and a 24LC256 EEPROM for data storage.



Internal Controller Circuit Layout

The barometer was included in the Internal Control Unit and consists of a Freescale Semiconductor MPXA6115A absolute pressure sensor and an LTC1298 analog to digital converter.



5.0 System Operation

The system uses a master slave model of operation. The internal control unit is the master with the external unit the slave. The internal control unit requests a specific data element from the external unit and waits for the external unit to process the request and send back the raw instrument data. The internal unit then processes the raw instrument data into a usable format for publishing.

5.1 Communications Protocol

The internal unit will begin each data exchange with the characters “DR”. The PBASIC command SERIN allows the receiving station to wait for a specific series of characters to be received before proceeding. The external unit will be set to wait for “DR” before accepting data. Following the “DR” command, the internal unit will send a 1 character data type request and wait for the data type code to be received, followed by the raw data. To allow for loss of power on the external unit, a 5 second timeout to an error processing routine will be included. The two character data types are:

S – Output of Solar Panel 1

U – Output of Solar Panel 2

N – Output of Solar Panel 3

B – Output of power supply bus

T – External temperature

E – Temperature in electronics compartment

H – Relative Humidity

R – Rain/Snow sensor reading

W – Snow Depth Sensor reading

X – Reset Snow Sensor

Y – Reset Rain Gage ADC

Z – Perform a zero calibration on the Rain Gage

The external unit will read the requested sensor and return the 8 bit request code and the raw reading as a 16 bit variable.

5.2 Data Processing

The internal control program requests data from each of the sensors; stores the raw value in a variable on the timekeeping chip; and updates the appropriate value on the Netburner web page. The internal unit will monitor the hour value on the timekeeping chip. When the hour value changes, the controller updates the next available slot for the history on the Netburner web page and burns the raw data to the EEPROM data storage chip.

5.3 Auxiliary Programs

In addition to the main processing program, the following auxiliary programs are used with the internal controller:

- Time Set – this program sets the time in the timekeeping chip.
- Data Read – this program reads the contents of the EEPROM for storage on a PC.
- Data Clear – this program clears the data from the EEPROM by resetting the variable used to track the next available location on the EEPROM.