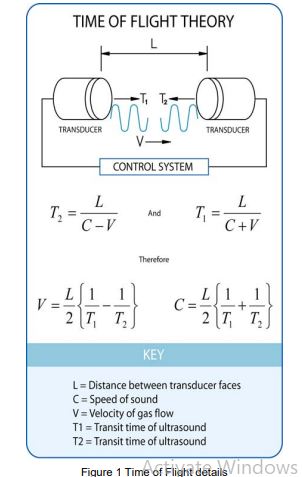
**Wind Speed and Wind Direction**

**PRINCIPLE OF WINDSONIC**

The WindSonic measures the times taken for an ultrasonic pulse of sound to travel from the North transducer to the South transducer, and compares it with the time for a pulse to travel from S to N transducer. Likewise times are compared between West and East, and E and W transducer.

If, for example, a North wind is blowing, then the time taken for the pulse to travel from N to S will be faster than from S to N, whereas the W to E, and E to W times will be the same. The wind speed and direction can then be calculated from the differences in the times of flight on each axis. This calculation is independent of factors such as temperature



**Global Radiation Sensor**

**Principle of Pyranometer**

Pyranometers operate based on the principle of thermopiles or photodiodes. When solar radiation strikes the sensor surface, it generates heat or produces an electric current proportional to the radiation intensity. This signal is then amplified and converted into irradiance units using calibration factors.

## How works

1. **Sensor Design**: The heart of a pyranometer is a sensor that's typically made of thermopiles or photodiodes. These sensors are designed to convert solar radiation into an electrical signal proportional to the solar irradiance.
2. **Absorption of Solar Radiation**: The surface of the pyranometer is designed to absorb incoming solar radiation. This surface is often treated to minimize reflection and maximize absorption.
3. **Thermopiles or Photodiodes**: In thermopile-based pyranometers, the absorbed radiation heats up a set of thermocouples, which generate a voltage proportional to the temperature difference. In photodiode-based pyranometers, photons from the incoming solar radiation create electron-hole pairs in semiconductor materials, generating a current or voltage.
4. **Calibration**: Pyranometers need to be carefully calibrated to ensure accuracy. This involves comparing the electrical output of the sensor to known standards under various conditions.
5. **Data Processing**: The electrical signal generated by the sensor is processed by associated electronics. This may involve amplification, filtering, and conversion to digital form for further processing or display.
6. **Output**: The output of the pyranometer typically represents the solar irradiance measured in watts per square meter (W/m²) or equivalent units.

## Calibration of Pyranometers

Calibration is a critical process to ensure the accuracy and reliability of pyranometer measurements. It involves comparing the instrument's output to known reference standards under controlled conditions.

AT/RH Sensor(41382VC)

### ****(a) Temperature Measurement Principle****

* The **temperature sensor** (RTD or thermistor) works on the **resistance-temperature relationship**.
* As air temperature changes, the **resistance of the sensing element changes**.
* This resistance change is converted to a voltage or current signal, which corresponds to temperature.

**Formula:**

Rt​=R0​(1+α(T−T0​))

Where:

* Rt​ = Resistance at temperature T
* R0​ = Resistance at reference temperature T0​ (usually 0°C)
* α = Temperature coefficient of resistance
* T = Temperature in °C

### ****(b) Relative Humidity (RH) Measurement Principle****

* The **RH sensor** works on the **capacitive principle**.
* It consists of a **polymer dielectric** material whose **capacitance changes** as it absorbs or releases water vapor.
* The change in capacitance is proportional to the **relative humidity** of the air.

**Formula:**

RH=PH2​O/​P sat H2​O​​×100

Where:

RH = Relative Humidity (%)

PH2​O​ = Actual partial pressure of water vapour

P sat H2​O = Saturation vapor pressure at the same temperature

Atmospheric Pressure Sensor(61204V-72)

The **RM Young 61204V-72 Atmospheric Pressure Sensor** works on the **piezoresistive (strain-gauge) principle** — it measures changes in **air pressure** by detecting how pressure deforms a **silicon diaphragm** inside the sensor.  
When the air pressure changes, this diaphragm bends slightly, and the sensor converts that tiny mechanical deformation into an electrical signal (voltage) proportional to the atmospheric pressure.

**1. Basic Principle — Piezoresistive Effect**

The **piezoresistive effect** means that:

When a material (like doped silicon) is subjected to mechanical stress (pressure), its **electrical resistance changes** in proportion to that stress.

In this sensor:

* A **thin silicon diaphragm** acts as the pressure-sensitive element.
* On this diaphragm, **piezoresistive strain gauges** are diffused or deposited in a Wheatstone bridge arrangement.
* As the diaphragm flexes due to air pressure differences, the **strain in the gauges changes their resistance**.
* This unbalances the bridge and produces a **measurable voltage output**, which corresponds to the pressure applied.

**3. Working Formula**

The relationship between the pressure applied and the sensor output can be expressed as:

Vout​=S×(P−Pref​)

**Where:**

* Vout ​ = Output voltage (Volts)
* S = Sensitivity of the sensor (V/Pa or V/mbar)
* P = Measured atmospheric pressure
* Pref​ = Reference pressure (vacuum or sealed chamber)

**Rain Gauge Sensor(KDS-071)**

The Rain Gauge Sensor (KDS-071) works on the **tipping bucket principle**.

When rain falls into a **funnel-shaped collector**, it directs the water into a **small tipping bucket** inside the sensor. Each time the bucket fills up to a certain amount (usually 0.2 mm of rain), it **tips over** and empties itself. This tipping motion **closes a magnetic reed switch**, creating an **electrical pulse**.

By **counting the number of pulses**, the system calculates the **total rainfall** over a period of time.

**FORMULA:**

Rainfall (mm)=N×R

**Where:**

N = Number of tips (pulses)

R = Rainfall per tip (e.g., 0.2 mm/tip for KDS-071)