

Instrument Glossary

TEMPERATURE & HUMIDITY MEASUREMENTS

Distance-to-Spot ratio (D:S)

The distance-to-spot ratio (D:S) is the ratio of the distance to the object and the diameter of the temperature measurement area. For instance if the D:S ratio is 8:1, measurement of an object 8 inches away will average the temperature over a 1 inch diameter area. For better accuracy the spot needs to be kept on the object being measured.

Emissivity

Emissivity is measured by the amount of energy radiated when the surface is directly observed. The emissivity of a black body is unity at all wavelengths whereas painted surfaces are typically 0.95.

Sling Psychrometer

A sling psychrometer consists of two thermometers mounted together within a handle. One thermometer is ordinary. The other has a cloth wick over its bulb and is called a wet-bulb thermometer. It is used in determining the relative humidity.

Fahrenheit or F

Celsius or C

$$^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32$$

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 0.555$$

$$\text{Kelvin} = ^{\circ}\text{C} + 273.15$$

$$\text{Rankin} = ^{\circ}\text{F} + 459.67$$

Dry-bulb

Dry-bulb temperature is the temperature registered by the dry-bulb thermometer of a psychrometer. It is identical to the temperature of the air.

Wet-bulb

Wet-bulb temperature is the temperature that the air would have if cooled to saturation by the evaporation of water.

Humidity

The degree of water vapor or wetness in the air.

Relative Humidity (RH)

The amount of water vapor in a sample of air compared to the maximum amount of water vapor the air can hold at any specific temperature. It ranges from 1 to 100% RH.

Thermistor

A semiconductor material whose resistivity changes with temperature.

Thermocouples

A widely used type of temperature sensor that can also be used as a means to convert thermal potential difference into electric potential difference. They are sets of two dissimilar metals used to measure temperature. Some of the most commonly used types of thermocouples are:

J (Fe/constantan) **K** (chromel/alumel)

T (Cu/constantan) **E** (chromel/constantan)

R (Pt/Pt - 30% RH) **S** (Pt/Pt - 10% RH)

N (NiCrSi-NiSi).

Heat index

The temperature the body feels when heat and humidity are combined. The body dissipates heat by varying the rate and depth of blood circulation, by losing water through the skin and sweat glands, and, as a last resort, by panting, when blood is heated above 98.6°F (37° C). Sweating cools the body through evaporation. However, high relative humidity retards evaporation, robbing the body of its ability to cool itself. When heat gain exceeds the level the body can remove, body temperature begins to rise, and heat related illnesses and disorders may develop.

Wind chill

The term used to describe the rate of heat loss on the body resulting from the combined effect of low temperature and wind. As winds increase, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature.

Data Logger

An instrument that records or logs data, much of which may be real-time and later downloaded to a computer for studies.

Moisture content

The amount of moisture in material being tested. Some moisture meters directly read % material moisture and others provide a relative scale.

WATER QUALITY

pH

A measure of acidity and alkalinity of a solution on a scale in which a value of 7 represents neutrality and lower numbers indicate increasing acidity and higher numbers increasing alkalinity. Each unit of change represents a tenfold change in acidity or alkalinity and is the negative logarithm of the effective hydrogen-ion concentration or hydrogen-ion activity in gram equivalents per liter of the solution. It ranges from 0 to 14.

Oxygen Reduction Potential (ORP)

This is basically a measurement to oxidize contaminants. It is the only practical method we have to electronically monitor sanitizer effectiveness.

Reduction/Oxidation Reaction (Redox)

This describes all chemical reactions in which atoms have their oxidation number (oxidation state) changed.

Oxidation

This describes the loss of electrons by a molecule, atom or ion.

Reduction

This describes the gain of electrons by a molecule, atom or ion.

Total Dissolved Solids (TDS)

This is a measurement for the combined content of all inorganic and organic substances present within a liquid. Total Dissolved Solids (TDS) of the water tells you the quality of water. It may be used to check if your reverse osmosis water system is working properly. It may also be used to decide if the membrane or cartridges should be changed or not.

Dissolved Oxygen (DO)

This is the relative amount of oxygen that is dissolved in a given sample.

Electrical Conductivity (EC)

This is the measurement of the electrical conductivity of water. Clean water has a low EC. When you add nutrients and pH adjusters, the EC will increase.

Conductivity (μS)

This is a measurement of the number of ions in a liquid. It is commonly used to measure the quality of a solution.

Automatic temperature compensation (ATC)

Automatic correction for the influence of temperature on a given measurement.

SOUND MEASUREMENTS

A-frequency-weighting is mandated for the protection of workers against noise-induced deafness affecting their health and welfare. The levels, are not single event, or "peak" levels, but represent averages of acoustic energy over periods of time such as 8 hours or 24 hours, and over long periods of time such as years. This allows old data to be compared with new measurements.

C-frequency-weighting is primarily used in the measurement of the peak value of a noise.

GAS MEASUREMENTS

Carbon Monoxide (CO)

An odorless and very toxic gas. CO is formed as a product of the incomplete combustion of carbon or a carbon compound.

Carbon Dioxide (CO₂)

This gas is naturally present in the atmosphere at levels of approximately 0.035%. Short-term exposure to CO₂ at levels below 2% (20,000 parts per million or ppm) has not been reported to cause harmful effects. Higher concentrations can affect respiratory function and cause excitation followed by depression of the central nervous system. High concentrations of CO₂ can displace oxygen in the air, resulting in lower oxygen concentrations for breathing. Therefore, effects of oxygen deficiency may be combined with effects of CO₂ toxicity. It is often monitored with IAQ equipment.

Indoor Air Quality (IAQ)

This is used to determine the health of the workplace or building by measuring gasses such as carbon dioxide.

Lower explosive limit (LEL)

This is the lowest amount of gas that will cause an explosion. Detectors that sense lower levels of gas will warn you more quickly of the presence of a combustible gas than detectors that sense higher levels.

Parts per million (ppm)

This is the ratio of how much of the tested solid, liquid or gas is present within a million of the sampled solid, liquid (solution) or gas (air) molecules.

LIGHT MEASUREMENTS

Lux

A photometric unit of illuminance or illumination equal to one lumen per square meter.

Foot-candle (fc)

A unit of illuminance or illumination equal to one lumen per square foot.

$$fc = 10.76 \times lux$$

$$lux = fc / 10.76$$

Ultraviolet light (UV)

This is the part of the electromagnetic spectrum which is adjacent to and greater in energy than visible light. The ultraviolet spectrum extends from 180 to 400 nanometers (nm) and is divided into three categories: shortwave (UV-C), medium-wave (UV-B), and longwave (UV-A).

UV-A Ultraviolet radiation in the wavelength band of 320 - 390nm with a peak in energy at about 365 nm; a component of the spectrum of solar radiation that can tan human skin or cause redness in sensitive skin.

UV-B Ultraviolet radiation in the wavelength band of 290 - 320nm with a peak in energy at about 312 nm; a component of the spectrum of solar radiation that can cause sunburn and skin cancer. This band is only partially blocked by the atmospheric ozone layer.

UV-C Ultraviolet radiation in the wavelength band of 200 - 290nm with a peak in energy at about 254 nm; a very harmful component of the spectrum of solar radiation that can cause chromosome mutations, death of single-cell organisms, and damage to the cornea of the eye.

This band is almost completely blocked by the atmospheric ozone layer.

EMF/BTU MEASUREMENTS

Electro-Magnetic Interference (EMI)

Radiation which may affect the performance of electronic equipment.

Electromagnetic field (EMF)

This is the field comprised of the electric field and the magnetic field (magnetic induction). The field can be viewed as the combination of an electric field and a magnetic field. All electric and magnetic fields are electromagnetic fields and can't be divided.

British thermal unit (BTU or Btu)

This is a unit of energy commonly used in the power, steam generation, and heating and air conditioning industries.

Manometer

These are instruments (such as a pressure gauge) for measuring the pressure of gases and vapors.

Barometric pressure

The pressure in the atmosphere at any given location typically measured in inHg.

AIRFLOW MEASUREMENTS

Anemometer

This is an instrument for measuring and indicating the force or speed of the air movement.

Area of a rectangular duct $L \times W$

Area of a circular duct $Pi R^2$ $Pi = 3.14$

CFM (ft³/min) =

$$\text{Air Velocity (ft/min)} \times \text{Area (ft}^2\text{)}$$

CMM (m³/min) =

$$\text{Air Velocity (m/min)} \times \text{Area (m}^2\text{)}$$

Square feet /144 = square inches

ELECTRICAL MEASUREMENTS

Measurement categories (Over-voltage categories).

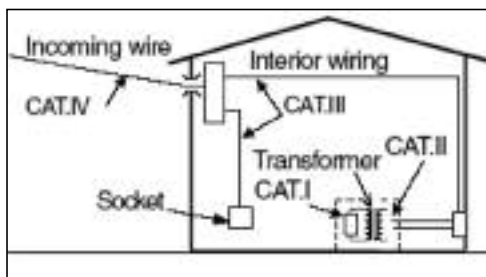
To ensure safe operation of measuring instruments, IEC61010 establishes safety standards for various electrical environments, categorized as CAT I to CAT IV, and called measurement categories. Higher-numbered categories correspond to electrical environments with greater momentary energy, so a measuring instrument designed for CAT III environments can endure greater momentary energy than one assigned for CAT II.

CAT I: Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.

CAT II: Primary electrical circuits of equipment connected to an AC electrical outlet by a power cord.

CAT III: Primary electrical circuits of the equipment connected directly to the distribution panel, and feeders from the distribution panel to outlets.

CAT IV: The circuit from the service drop to the service entrance, and to the power meter and primary over-current protection device (distribution panel).



Power (W) = voltage (V) X current (A)

(RMS reading) x (1.414) =

Peak to Peak reading

True Root Mean Square (TRMS)

A TRMS meter is used to measure non sinusoidal waveforms (harmonics).

Volt (E) is the unit of electric pressure or electromotive force. It is the potential that will produce a current of 1 ampere through a resistance of 1 ohm. The volt (symbol: V) is the SI derived unit of electric potential difference or electromotive force.

Ampere (I) is the unit of electrical current (coulombs per second). The ampere, in practice often shortened to amp, (symbol: A) is a unit of electric current, or amount of electric charge per second.

Ohm (R) is the unit of electrical resistance (volts/ampere). The ohm (symbol: Ω) is the SI unit of electrical impedance or, in the direct current case, electrical resistance,

Watts (W) and **Kilowatts (KW)** are units of electric power.

Kilovolt-ampere (KVA) is a measurement of apparent electric power.

Kilowatt hour (Kwhr) is a unit of electrical energy or work performed.

Joule (J) is a metric unit of energy: watt per second. 1 Kwhr = 2,655,224 ft-lb = 1.341 hp-hr = 3412 Btu = 3,600,000 joules.

Ohm law relationships (direct current)

$$E = IR + W/I = \sqrt{WR}$$

$$W = I^2R = E^2/R = EI$$

$$I = E/R = W/E = \sqrt{W/R}$$

$$R = E/I = W/I^2 = E^2/W$$

Capacitance

The ability an electronic component has to store energy as an electrical charge.

Insulation Resistance

The property of a material to resist the flow of electrical current and expressed in Megohms as the ratio of an applied electrical potential divided by the flow of electrical current.

INDUSTRIAL

NIST Certification - Traceability

Calibration in accordance with and against standards traceable to NIST (National Institute of Standards and Technology, USA). Traceability to NIST is a means of ensuring that reference standards remain valid and their calibration remains current.

Peak Hold

Output of the maximum measurement indicated by an instrument during the time duration for which this display mode has been active.

Refractometer

An instrument for measuring refractive indices in a fluid or solution.

Stroboscope

An instrument for determining the speed of cyclic motion that causes the motion to appear slowed or stopped.

Tachometer

A device for indicating speed of rotation.

Fiber optic inspection scope

This type of scope has the ability to see around a bend and see or capture images of hard-to-reach places.