

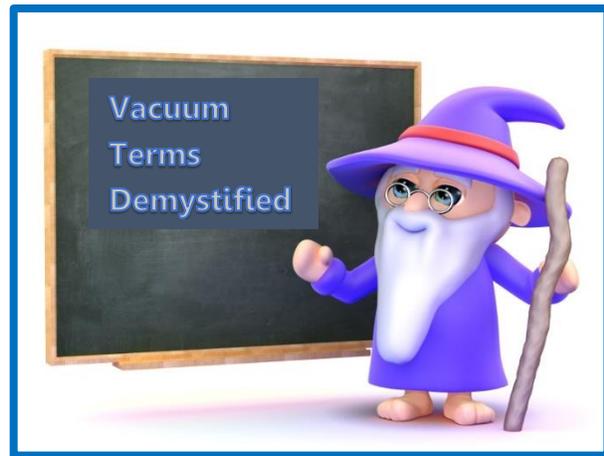


DESIGNING INNOVATIVE VACUUM  
GAUGES AND CONTROLLERS FOR  
OVER 30 YEARS

## VACUUM TERMINOLOGY DEMYSTIFIED

**INTRODUCTION:** Vacuum terminology has evolved over time. In order to describe what you are looking for, it is helpful to have a guide that describes what different terms mean so people from different industries can communicate with one another. We'll start from the beginning and focus on vacuum measurement and control.

The term *vacuum gauge* has a meaning when talking with people in the scientific and industrial vacuum communities, and another meaning in the MRO market (Maintenance, Repair and Operations, such as HVAC). In MRO, people are typically referring to fairly inexpensive all in one vacuum instruments, commonly based on thermistor technology. However in the Scientific and Industrial communities, a vacuum gauge refers to the passive sensing element such as a thermocouple or Bayard Alpert tube. To make that passive element useful, that passive vacuum gauge would be matched with a "vacuum gauge controller".



## GENERAL VACUUM TERMS—THOSE THAT ARE CONSISTENT ACROSS INDUSTRIES

Some terms apply universally across industries, while other terms mean different things depending on the industry. Examples of general vacuum terms that apply universally are absolute, differential and gauge pressure readings. An example of terms that belong to a particular industry are "Vacuum Controller" for the scientific and industrial communities.

## TERM

## MEANING

<b>Manometer</b>	Pressure measuring instrument, originally via a liquid column like water or mercury. This term has evolved to mean instruments that measure in the same range as these original liquid filled instruments did.
<b>Sensor</b>	Simple device that gives an electronic response in response to change in the surrounding environment with minimal or no electronics. Examples include Thermocouple sensors and RTD temperature sensors
<b>Transducer</b>	Sensor with some electronics - like the typical 0.5-4.5 volt or 4-20ma output.
<b>Absolute</b>	Describes pressure measurement in reference to absolute vacuum (deep space), where typical atmospheric readings would be 1013 mbar, 760 Torr or 14.7 PSIA
<b>Gauge</b>	Describes pressure measurement with respect to atmospheric pressure. "0" is atmospheric pressure, negative numbers indicate vacuum and positive numbers indicate pressure.
<b>Gauge Pressure</b>	Pressure measured with atmospheric pressure as a base.
<b>Differential</b>	Describes the pressure difference between two points in a system. For example, the pressure difference across a typical diesel filter is 5 inches of mercury.

## SCIENTIFIC & INDUSTRIAL

The scientific and industrial communities were among the first to adapt vacuum technology, and have very specific terms to describe their instruments, and the pieces that make up those instruments. Many applications require knowing the difference between different types of sensors, and experiments or processes that may affect them.

## TERM

## MEANING

<b>Vacuum controller</b>	Display and electronics to interpret vacuum gauge readings
<b>Vacuum gauge</b>	Passive sensor, what the industry commonly refers to as the sensing component of the vacuum instrument
<b>Tube</b>	Slang for a Thermocouple vacuum gauge tube
<b>Active gauge</b>	Sensor and electronics in a single enclosure



**Vacuum Control**

Regulation or manipulation of vacuum system, often achieved by manual valves, relays (controls), VPC or PLCs

**Upstream**

Bleed type vacuum pressure control

**Throttle**

Throttle Valves are used to control conductance or reduce the vacuum pump suction, often to achieve a particular vacuum level

**Downstream**

Vacuum pressure control through limiting pump flow

**Bleed**

Introduction of air or a specific gas into a vacuum system in order to achieve a particular vacuum level, also called upstream vacuum control

**Direct Pressure Measurement**

Measuring the pressure in a way that isn't dependent on a variable of the sensor. The isolated 775i sensor is an example of direct pressure measurement

**Indirect Pressure Measurement**

Measuring pressure based on a property of the gas. Thermal gauges are indirect pressure devices and thus exhibit gas dependence.

**Thermal Gauges**

Indirect pressure measurement instruments such as Thermocouple, Pirani and Convectron ®

**MRO MARKET (MAINTENANCE, REPAIR AND OPERATIONS)**

The technician that needs a vacuum gauge to measure the base pressure of an evacuated refrigeration system typically is more concerned with reaching a particular vacuum level, and then looking at the leak rate. They are using vacuum as a tool.

**TERM**

**MEANING**

**Vacuum Gauge**

Display and sensor, most often integrated into one package, typically battery operated

**Micron Gauge**

Display and vacuum sensor that measures in micron units, most often integrated into one package, typically battery operated

**Micron**

A unit used to measure the level of vacuum. One micron equals 1/25,400 of one inch mercury. The lower the number the deeper the vacuum, as measured with a micron gauge. A good practice for technicians is to pull a vacuum to 500 microns or less.

**Deep Vacuum Method of Evacuation**

Method used to ensure the system is thoroughly dry and free of non-condensibles and leaks. Requires a two-stage vacuum pump and a quality micron gauge to accurately measure evac down 500 microns.



## TERMS IN ACTION—A LOOK INTO SOME APPLICATIONS

### METALIZING

We recently had a customer who was looking for the ability to control vacuum for a metalizing application. They considered using a traditional *manometer*, but realized that the kind of accuracy and control they wanted was more easily achieved by a *vacuum controller*. They wanted to regulate their vacuum while having a steady stream of Argon injected in their chamber, and wanted to use vacuum controls to actuate a series of valves in response to target vacuum pressures. Because they were dealing with several exotic gasses in multiple proportions, they required a *direct pressure measurement* approach to insure accurate readings. What they decided on was an isolated sensor for low pressure, and a capacitance manometer for medium vacuum. A simple combination of throttle valves was employed to achieve a fast convergence on the target pressure combined and precise control utilizing *downstream vacuum control*.

### LYOPHILIZATION

One of our customers was looking to monitor and control their Freeze Dryer. They were looking for an *active gauge* to monitor their base pressure of the vacuum pump for in-situ testing, and also the ability to retrofit their older freeze dryer with the ability to regulate the vacuum pressure using *upstream vacuum control*. Because the Lyophilization presented a contamination challenge, they went with thermocouple vacuum gauge tubes and a *vacuum controller* that also was able to administer the *upstream vacuum control*. Being able to replace tubes when contaminated worked well in their preventative maintenance program. Because the air being measured was mostly nitrogen and water vapor, the expense of direct measurement technology was not required.

If you would like a fresh pair of eyes to review a process that you have or are considering, [contact us here](#). **We would love to help!** We will respond with our thoughts within 24 hours.

