

Vacuum Pressure Measurements



The term vacuum is often misunderstood when discussing pressure measurements and selecting a pressure transducer. By definition, vacuum is a space that is partially exhausted (to the highest degree possible) by artificial means (as an air pump), which is also referred to as a high or hard vacuum. Figure 1 illustrates that relationship of absolute and gauge pressure with 0 PSIA equal to high vacuum.

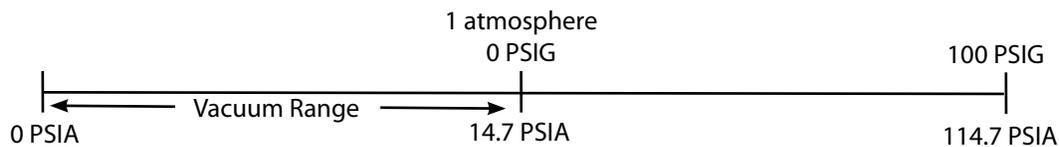


FIGURE 1

Remember, gauge pressure is pressure measured relative to ambient atmospheric pressure (approximately 14.7 PSIA). It is referred to as pounds per square inch (gauge) or PSIG. The electrical output of a gauge pressure transducer is 0 VDC at 0 PSIG (14.7 PSIA) and full scale (FS) output (typically 5 VDC) at FS pressure in PSIG.

Absolute pressure is measured relative to high vacuum (0 PSIA). It is referred to as pounds per square inch (absolute) or PSIA. The electrical output of an absolute pressure transducer is 0 VDC at 0 PSIA and FS output, typically 5 VDC, at FS pressure (in PSIA).

Vacuum can refer to any pressure between 0 PSIA and 14.7 PSIA and should be further defined. For applications concerned with measuring vacuum pressure over this full range, two different approaches are often taken. Figure 2 illustrates the relationship of absolute and vacuum pressures.

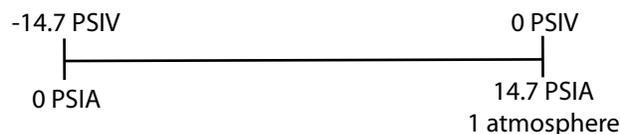


FIGURE 2

Vacuum pressure is measured relative to ambient atmospheric pressure. It is referred to as pounds per square inch (vacuum) or PSIV. The electrical output of a vacuum pressure transducer is 0 VDC at 0 PSIV (14.7 PSIA) and full scale output (typically 5 VDC) at full scale vacuum, 14.7 (0 PSIA).

The vacuum pressure transducer gives an increased positive voltage output proportional to decreasing pressure (increasing vacuum). The absolute pressure transducer gives an increased positive voltage output proportional to increasing pressure (decreasing vacuum).

Example:

Vacuum Transducer
 Range: 0 to 14.7 PSIV
 Output: 0 to 5 VDC

Absolute Transducer
 Range: 0 to 14.7 PSIA
 Output: 0 to 5 VDC

Vacuum also is often referred to as negative pressure (or soft vacuum). This occurs when the application requires monitoring both decreases in pressure below atmospheric pressure and increases in pressure above atmospheric bidirectional differential pressure.

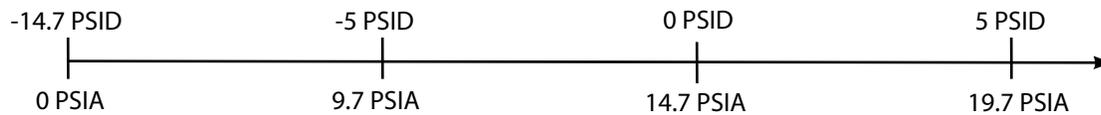


FIGURE 3

Differential pressure is pressure measured relative to a reference pressure. It is referred to as pounds per square inch (differential) or PSID. If the reference pressure is one atmosphere the differential pressure range is equal to gauge pressure range. The electrical output of a bidirectional differential pressure transducer (DPT) is typically 0 VDC at one atmosphere with increased positive voltage output proportional to increased positive pressure and increased negative voltage output proportional to increased negative pressure.

Example:

Bidirectional DPT
 Range: 0 to ±5 PSID
 Output: 0 to ±2.4 VDC

Bidirectional DPTS are used for soft or low vacuum measurements (typically >5 PSIA) while low absolute pressure transducers are used for hard or high vacuum measurements (typically <5 PSIA). Figure 4 illustrates soft and hard vacuums.

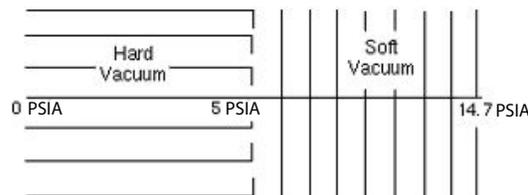


FIGURE 4