

Oxygen Alarms

Biosystems confined space gas detectors feature two alarms for oxygen. A low alarm for oxygen deficiency and a high alarm for oxygen enrichment.

Oxygen deficiency is the leading cause of worker fatality during confined space entry. Fresh air contains 20.9% oxygen. Any environment in which the concentration of oxygen is less than 19.5% has been determined by OSHA to be oxygen deficient. Biosystems default alarm setting for oxygen deficiency is 19.5%.

Too much oxygen in an environment can result in an increased flammability hazard. The OSHA standard for "Permit Required Confined Space Entry" (29 CFR 1910.146) requires that oxygen concentrations not exceed 23.5%.

Combustible Gas Alarms

As an environment becomes contaminated with combustible gases or vapors, concentrations can eventually reach ignitable or explosive levels. The minimum amount of a combustible gas or vapor in air, which will explosively burn if a source of ignition is present is known as the Lower Explosive Limit (LEL). The combustible gas readings for Biosystems confined space gas detectors are given in percent LEL, with a range of 0 to 100% LEL. The combustible gas sensor responds to all combustible gases and vapors. The instrument's response to a particular combustible gas is relative to the type of combustible gas used during instrument calibration. For complete details on selecting the right combustible calibration gas, please refer to Biosystems application note AN20010808.

In the confined space entry standard OSHA has determined that a combustible hazard exists whenever the concentration of combustible gas or vapor exceeds 10% LEL. The default alarm setting for Biosystems confined space monitors is 10% LEL.

Toxic Gas Alarms

Biosystems confined space gas detectors have three separate alarm points for toxic gases: Ceiling, STEL, and TWA.

The Ceiling is the highest concentration of a toxic gas to which an unprotected worker should ever be exposed, even for a very short time. Unprotected workers should never enter an environment even momentarily where concentrations of toxic substances exceed the ceiling level.

The Time Weighted Average (TWA) is the maximum average concentration to which an unprotected worker may be exposed based on an eight hour working day.

The Short Term Exposure Limit (STEL) is the maximum average concentration to which an unprotected worker may be exposed in any fifteen minute interval during the day.

OSHA has assigned exposure limits in terms of Ceiling, STEL and TWA for many toxic gases. Some toxic gases may only have one type of limit where others may have two or all three types.

The table below shows the highest levels at which these alarms should be set for CO, H₂S and SO₂. Please be aware that OSHA permissible exposure limits may be subject to change. Recent court decisions have affected the enforcement of permissible exposure limits published or modified since the initial enactment of OSHA in 1971.

OSHA (1989) Permissible Exposure Limits:

Gas	Ceiling	TWA	STEL
CO	200 ppm	35 ppm	N/A
H ₂ S	N/A	10 ppm	15 ppm
SO ₂	N/A	2 ppm	5 ppm

Choosing Toxic Alarm Set Points

Biosystems uses a more conservative approach for toxic gas alarm settings than OSHA requires.. The Ceiling alarm is set to the OSHA-assigned TWA value (when this is given). Besides an increased level of safety, this approach has another benefit. This setting makes it unlikely that either the STEL or TWA alarms will ever be activated, so training of employees who uses gas detectors in confined spaces may be simplified to address only Ceiling alarms.

Biosystems default alarm settings:

Gas	Ceiling	TWA	STEL
CO	35 ppm	35 ppm	100 ppm
H ₂ S	10 ppm	10 ppm	15 ppm
SO ₂	2 ppm	2 ppm	5 ppm
O ₂	Low: 19.5% High: 23.5% [†]		
LEL	10% LEL		

[†] Some Biosystems gas detectors default to 22% for the oxygen high alarm.

The OSHA confined space standard requires that all confined spaces be tested prior to, and periodically during entry. Based on the measurements taken, the atmospheric condition is considered unsafe when it is oxygen deficient or enriched, when there is a combustible hazard or when the level of toxic contaminants exceeds any of the OSHA-assigned limits.

If a pre-entry test determines that the atmospheric condition is unsafe, then the space may not be entered. Likewise, workers are required to immediately leave the space if the atmosphere becomes unsafe after entry.

Additional considerations should be given to other factors, which may require the reprogramming of alarms to even lower levels. These factors may include the potential for erroneously low readings, particularly associated with the calibration scale used for the combustible gas sensor. The factors may also include potential delays in evacuating the space when a hazardous condition develops.