

## Calibrations Left Dock Feature

### Estimating Remaining Calibrations in a Gas Bottle

This guide outlines the methodology used to estimate the number of remaining calibrations in a gas bottle. It is designed for technicians and engineers who need accurate gas usage monitoring for calibration processes. The system ensures efficient gas usage and prevents unexpected shortages.

## 1. Calculation of Remaining Calibrations

### 1.1 Determining the Remaining Gas Volume

The system calculates the remaining gas based on the following parameters:

- **Initial Bottle Pressure** – The pressure of a full gas bottle (e.g., 1000 psi).
- **Bottle Capacity** – The volume of the bottle when uncompressed (e.g., 116 liters).  
Note that smaller, compressed values (e.g., 1.6L) are not applicable.
- **Current Bottle Pressure** – The real-time pressure reading of the gas bottle.
- **Calibration Time per Gas Type** – The duration required for calibration with different gases.

Using these inputs, the system computes the remaining gas volume.

### 1.2 Gas Consumption per Calibration

Different gases require different calibration durations, impacting gas consumption rates. The following table details the calibration times per gas type:

Gas Type	Current Duration (sec)	Future Update (sec)
Fresh Air	60	60
SO <sub>2</sub>	120	120
H <sub>2</sub>	120	TBD
CH <sub>4</sub> S	120	TBD
NH <sub>3</sub>	250	180
HCN	150	TBD
ETO	90	255
Other Gases	90	90

The system then calculates the gas consumed per calibration using the following formula:

$$\text{Liters Per Calibration} = \frac{\text{Liters Per Minute}}{\left( \frac{\text{Calibration Duration (sec)}}{60} \right)}$$

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## 1.3 Computing Remaining Calibrations

To determine the number of calibrations left, the system applies the following calculation:

$$\text{Calibrations Left} = \frac{\text{Liters Left}}{\frac{\text{Liters Per Minute}}{(\text{Calibration Duration (sec)}/60)}}$$

## 2. Displaying Number of Calibrations Left

The system presents the remaining calibrations in a user-friendly manner:

- The count is **rounded down** (e.g., 16.8 and 16.2 both display as 16).
- If between 6 and 10 calibrations remain, the system displays: **“Cals left <10”**
- If 5 or fewer remain, it displays: **“Cals left <5”**
- Otherwise, it shows the approximate number, such as **“Cals left ≈16”**

## 3. Data Collection and Sensor Adjustments

To ensure accuracy, the system:

- Monitors pressure for four seconds and records the lowest reading.
- Adjusts for common sensor errors by subtracting **38 psi** (e.g., some sensors incorrectly register **38 psi** for an empty bottle).
- Plans future updates to enhance pressure reading accuracy.

## 4. System Update Triggers

The system refreshes the gas bottle's pressure reading under the following conditions:

- Manual bottle information update.
- Connection or removal of a pressure sensor (applicable for software version **1.14 and later**).
- Modification of dock sensor settings.
- Automatic refresh every **five minutes**.
- **Note:** Automatic updates after calibrations or bump tests are under development.

## 5. Why Continuous Updates are avoided

Constant pressure updates can drain battery life and cause unstable display readings. To optimize performance, the system updates data only when necessary.