

$^{13}\text{CO}_2/^{12}\text{CO}_2$ Stable Isotope Tracing



Built In. Not Bolt On.

PhenoMaster's new integrated $^{13}\text{CO}_2/^{12}\text{CO}_2$ gas sensor enables real-time, automated stable isotope tracing directly within the indirect calorimetry system – eliminating manual sampling and ex vivo mass spectrometry for continuous, high-precision in vivo metabolic analysis in awake, freely moving animals.

The Integration Difference

Other systems treat $^{13}\text{CO}_2$ measurement as an add-on – a separate standalone analyzer, an external vacuum pump, and custom tubing connected to your existing metabolic system. Each device needs its own calibration, its own maintenance, and manual data alignment in post-processing.

TSE Systems CaloMax HS Fully Integrated Platform

- ✓ Single integrated gas sensor module
- ✓ O_2 , CO_2 and $^{13}\text{CO}_2$ – one board, one clock
- ✓ No external pump required
- ✓ No hardware modification needed
- ✓ Automated calibration and diagnostics
- ✓ Unified data stream – no manual alignment
- ✓ Ready from day one, no extra setup

Other systems Standalone Add-On Approach

- ✗ Separate standalone $^{13}\text{CO}_2$ analyzer
- ✗ Multiple sensors from different suppliers
- ✗ External vacuum pump required
- ✗ Additional sample line needed
- ✗ Separate calibration per device
- ✗ Manual data alignment in post-processing
- ✗ Hours of setup before first measurement

Research Applications

- Nutrient metabolism and substrate switching (glucose \leftrightarrow lipid oxidation)
- Diet-induced obesity and diabetes
- Cancer metabolism and tumor energetics
- Mitochondrial function and oxidative stress
- Microbiome–host metabolic interaction studies
- Drug efficacy and nutraceutical interventions
- Aging and longevity research

CaloMax HS Zero Compromise



Integrated Module

All gas sensors on one board. Faster response. Perfect sync.



Real-Time Detection

Continuous $^{13}\text{CO}_2$ tracing in awake, freely moving animals.



Turnkey Platform

No extra devices. No manual steps. Your focus stays on the science.

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Redefining In Vivo Metabolic Research with Integrated Gas Sensors

Key Advantages

- Fully automated long-term $^{13}\text{CO}_2$ tracing integrated into indirect calorimetry
- Measures isotopic enrichment in exhaled CO_2 in real time
- $^{13}\text{CO}_2$ sensor is integrated on the same multi-sensor board as O_2 and CO_2 sensors — ensuring faster response and perfect synchronization
- Compatible with glucose, fatty acids, amino acids, and custom tracers
- High sensitivity (1 ppm resolution) and fast response (< 2.5s)
- Cost-effective, user-friendly alternative to isotope mass spectrometry
- Available factory-installed or as retrofit upgrade to existing PhenoMaster setups

$^{13}\text{CO}_2/^{12}\text{CO}_2$ Sensor

Range: 0–200 ppm

Resolution: 1 ppm

T90: <2.5 sec for sample gas flow = 60 l/h

Linearity deviation: $\leq 1\%$ of span

Repeatability: $\leq 0.5\%$ of span

Zero-point drift: $\leq 1\%$ of span per week

Sensitivity drift: $\leq 1\%$ of measured value per week

PhenoMaster Integration Options

Factory Installed

New CaloMax HS systems ship with the $^{13}\text{CO}_2$ sensor pre-configured and factory calibrated

Flexible Configuration

Compatible with O_2/CO_2 and H_2CH_4 . Scalable from 4 to 24 cages

Retrofit Upgrade

Existing PhenoMaster users can add the sensor via field installation without replacing the system

**From nutrient tracing to translational metabolism.
One system, endless insight.**

www.tse-systems.com



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