

# Binary Gas Analyzer

BGA244 — Gas ratio measurement to 0.1 % accuracy



## BGA244 Binary Gas Analyzer

- **Measures ratio of two gases**
- **Analyzes purity of a single gas**
- **<0.1 % accuracy (typ.)**
- **Touch screen display**
- **Data acquisition software (BGAMon)**
- **4 Hz measurement rate**
- **USB, RS-232 and RS-422 (opt.)**

• **BGA244 ... \$3950 (U.S. list)**

The BGA244 Binary Gas Analyzer quickly, continuously, and non-invasively determines the ratio of gases in a binary mixture, or checks the purity of a single gas.

It's ideal for semiconductor processing, research, and industrial applications where precise measurements of gas mixtures are necessary.

The BGA244 operates without lasers, filaments, chemical sensors, optical sources, separation columns, reference gases, or reagents, and runs virtually maintenance-free.

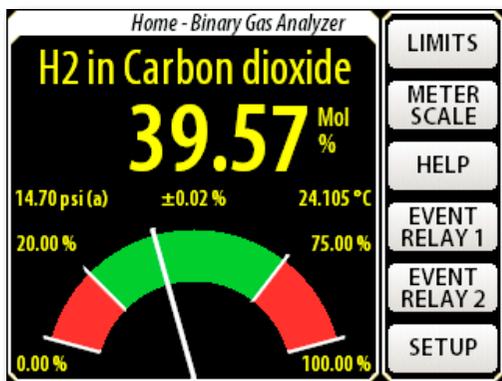
### Principle of Operation

The speed of sound in a gas depends on the temperature, specific heat, and the molar mass of the gas. By precisely measuring the speed of sound and temperature in a gas mixture, and knowing the thermodynamic properties and molar masses of the gases, the BGA244 determines the composition of gas mixtures with an accuracy of about 0.1 %.

### Operating Modes

The BGA244 has three basic measurement modes: Binary Gas Analyzer, Gas Purity Analyzer, and Physical Measurements Analyzer.

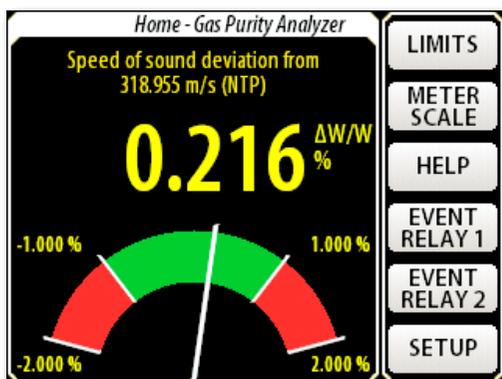
In Binary Gas Analyzer mode, two gases for analysis can be chosen by name, formula, or CAS number on the touchscreen



Binary Gas Analyzer mode

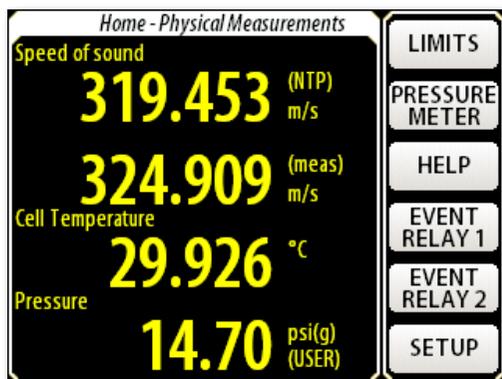
display. When operating in Gas Purity Analyzer mode, the user simply selects the single gas of interest.

In Physical Measurements mode, the BGA244 reports the speed of sound, temperature, and gas pressure. This extends the BGA244's utility beyond gas analysis, for example, to enable the measurement of thermodynamic properties of gas mixtures.



Gas Purity Analyzer mode

In each mode, the BGA244 displays large numeric readouts of the parameters being measured. In the Binary Gas Analyzer



Physical Measurements Analyzer mode

and Gas Purity Analyzer modes, a needle graph shows the user-defined operating range in green, and higher and lower limits in red.

**Comprehensive Database**

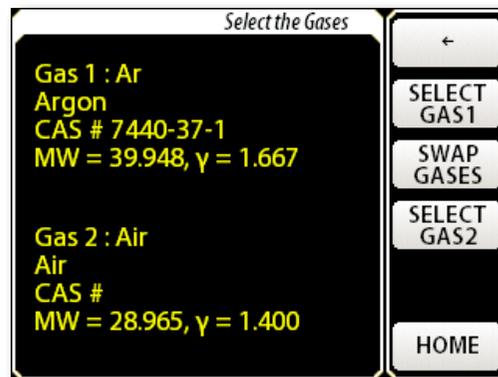
Thermodynamic and molar mass data for more than 250 gases have been tabulated in the BGA244, enabling the instrument to measure tens of thousands of mixtures. Gases can be added to the data tables, as can pseudo-gases (user-defined gas mixtures which are treated as one gas species).

**Remarkable Accuracy**

The accuracy of the gas composition result depends on the difference in the speed of sound between the gas species. Shown below are the typical composition errors for several gases mixed with air.

Gas (in air)	Error
Hydrogen	± 0.04%
Helium	± 0.03%
Methane	± 0.09%
Water	± 0.11%
Neon	± 0.08%
Nitrogen *	± 1.03%
Ethane	± 0.09%
Oxygen	± 0.31%
Argon	± 0.13%
Carbon dioxide	± 0.05%
Propane	± 0.03%
1,1-Difluoroethane	± 0.02%
Tetrafluoromethane	± 0.01%
Sulfur hexafluoride	± 0.01%

\* Dry air is 78 % N<sub>2</sub>, 21 % O<sub>2</sub>, and 1 % Ar. Since the speed of sound in N<sub>2</sub> (349 m/s) is very close to that of air (343 m/s), the largest composition error in the table occurs when nitrogen is mixed into air.



Gas selection menu

# BGA244 Binary Gas Analyzer

## Gas Connections

The BGA244 can be installed in-line with the user's gas flow. All metal seals are used to assure gas purity. The instrument operates over conventional gas manifold pressures and covers a mass range from H<sub>2</sub> to SF<sub>6</sub>.

A wide variety of gas connections are available. For the highest purity, the instrument may be ordered with welded-in-place VCR fittings. To accommodate other fittings, the instrument may be ordered with replaceable VCR, VCO, NPT, tube compression, or flexible hose fittings.

## Operating Pressure

The accuracy of the BGA244 is improved when the pressure is known. The user can enter the operating pressure, or a pressure transducer can be connected to one of the instrument's analog inputs if option 1 is installed.

The BGA244 operates over a pressure range that extends from a few psia up to 150 psia.

## Heaters, Relays, I/Os & Power

Option 1 brings additional capability to the BGA244. There are several multipurpose analog I/Os, two user-defined event relays for process control or alarms, an RS-422 port for robust serial communications, and cavity heaters for temperature regulation and condensation prevention. This option also adds an input for 24 VDC power.

## Limits and Events

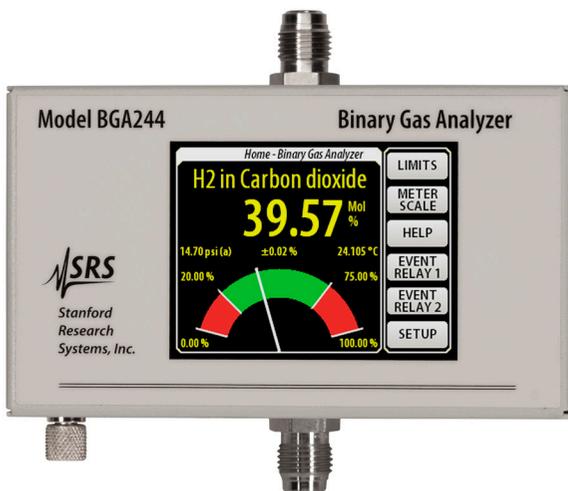
Limits can be set in all modes of operation. High and low limits can be defined for gas composition, gas purity, speed of sound, temperature, and pressure. Limits can generate "events", setting or clearing relays when equipped with option 1.

## Power

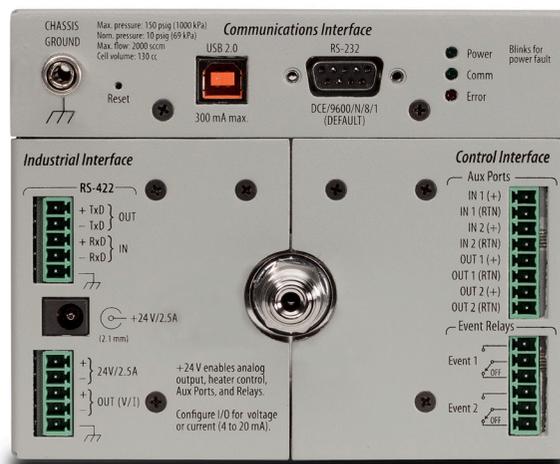
The instrument can operate from the power provided by a standard USB port or from a USB wall charger. An external 24 VDC supply can be used for power if option 1 is installed.

## Communication

With the standard RS-232 and USB computer interfaces, all instrument functions can be set and queried remotely. The instrument can operate independently or via a host computer. A Windows monitor program, BGAMon, records and displays time records of gas composition, temperature, and pressure. The program also displays acoustic spectra, resonance line fitting, and can be used to update gas property tables.



BGA244 front panel



BGA244 rear panel

## Operation

Operating temperature	-20 °C to +70 °C
Temperature resolution	0.001 °C
Temperature accuracy	±0.1 °C
Measurement rate	4 samples per second
Exponential averaging	Off, or 2 to 100 periods

## Cavity

Volume	130 cc
Operating flow rate	0 to 5000 sccm
Cavity proof pressure	2,500 psi

## Option 1 — Heaters, Relays, I/Os and Power In

### Analog I/O

Ports	3 output ports, 2 input ports
I/O port ranges	0 to 5 V, 0 to 10 V, and 4 to 20 mA
4-20 mA loop power	0 to ±19.0 VDC
4-20 mA compliance	0 to ±16.8 VDC

### Cavity Heaters

Set temperature	0 °C to 70 °C
Power limit	Off, or 0.5 W to 60 W

### Communication

RS-422	2400 to 115,200 baud
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### Power

+24 VDC	0.1 A to 2.5 A depending on heater power
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## Serial Communication

USB	WHQL high speed USB 2.0
RS-232	2400 to 115,200 baud

## General

USB power	+5 V, 350 mA (when not using +24 V)
Wetted materials	Electropolished 304 stainless steel, gold flashed OFHC copper gaskets, nickel plated/Immersion gold copper traces on 0.001" Kapton film, nickel plated NdFeB magnets, glass, Constantan (Cu55/Ni45) wire, and vented 316 stainless steel screws. The BGA244 may be ordered with welded or replaceable gas fittings. The welded-in-place gas fittings are TIG welded at the inside surface of the gas cylinder. The replaceable gas fittings connect to the cylinder via a 1/8" female NPT port and use Loctite 565 thread sealant.
Gas fittings	
Dimensions	5.5" × 4.5" × 3.25" (WHL)
Weight	7 lbs.
Warranty	One year parts and labor on defects in materials & workmanship

### Important Safety Note

*The BGA244 should not be used to measure explosive, flammable or corrosive gases and should not be used in explosive or flammable atmospheres. The instrument should be ordered with the optional environmental enclosure if used outdoors or subject to corrosive environments, salt spray, or wash down.*

## Ordering Information

BGA244	Binary gas analyzer	\$3950
Opt. 01	Heaters, relays, I/Os and Power In	\$750