Multi-Component Gas Analyzer
VA-3000 Series
Rack-Mounted Sample Gas Conditioning Systems
VS-3000 Series

One analyzer for measurement of up to 3 gas components

3 in 1
Provides true VERSATILITY

From environmental monitoring to developing new energy sources and chemicals for the new era, gas analysis systems are faced with needs and challenges that have changed dramatically over time. Responding to these new needs, HORIBA has developed the VA-3000, the versatile gas analyzer that’s ready for the future. A single analyzer is now capable of measuring a wider selection of gas components utilizing many different types of sensor technology. Non-dispersive infrared (NDIR) modules are available to measure gases such as CO, CO₂, NO, NOₓ, SO₂, CH₄, N₂O and others. A chemiluminescent sensor module may be included to measure NO or NOₓ with a standard converter. And four different types of sensor modules are available to measure O₂ – galvanic, zirconium oxide or magnetopneumatic. Designed to be compact and lightweight, the VA-3000 may have up to three sensor modules installed in a single analyzer case. This unique feature means the VA-3000 can be used today for a broad range of applications including research and development or environmental pollution monitoring, where efficiency and space-saving are crucial.

Use to measure the concentration of many different gases

A single VA/VS-3000 analyzer is capable of simultaneously measuring multiple gas components such as CO, CO₂, O₂, NOₓ, SO₂, CH₄, NO and other gases. With the VS-3000 sampling system, the VA/VS-3000 will meet the needs of a diverse range of applications.

Many combinations of sensor modules are possible

Development of smaller sensor modules now makes it possible to install up to three sensor modules in a single unit. You can install three NDIR modules in a single case or substitute a chemiluminescent or oxygen module for any of the NDIR modules.

Wide selection of ranges and flexibility for many applications

The VA-3000 also features dynamic ranges up to 20x the base (first) range. And the dynamic range can be further expanded by installing multiple sensor modules for the same component gas in a single analyzer case. Now a single unit can perform measurements over a wide range from ppm to 100 percent concentrations. With our diversified lineup of modules, you can always choose the optimum range for your application.

High precision assured

The VA-3000 achieves repeatability of ±0.5% of F.S.R. (Full Scale Range), linearity of ±1.0% F.S.R., and drift of less than ±2.0% per week without requiring recalibration with a gas standard saving you money. For optimum precision, use the auto daily calibration feature, to virtually eliminate drift. Or specify the optional gas filled calibration cell that is used to routinely check and adjust the calibration of the NDIR modules without the need for external gas cylinders. With these features, high precision measurement is maintained throughout the entire measurement range.

Standard RS-232C interface makes data collection easy and remote operation possible

Analog outputs are also available for direct connection to control systems.

HORIBA provides reliable gas analysis systems

As an expert on gas analysis systems, with a wealth of experience, HORIBA can provide consulting services and/or appropriate hardware for pretreatment of even the most difficult sample gases.
Some of the common gases measured

- CO
- CO₂
- SO₂
- CH₄
- N₂O

**New NDIR Sensor Module utilizing proprietary IR detector**

**NDIR**

**Able to measure many different gases accurately**

As sample gas flows through the measurement cell, a beam of infrared energy (at a wavelength appropriate for the gas being measured) travels through the sample gas and strikes the infrared (IR) detector. The gas being measured absorbs infrared energy and reduces the energy reaching the IR detector. As a result the pressure of the gas in the first chamber of the detector is reduced causing gas to flow from this chamber to the other. This gas flow passes over the precision temperature sensor between the chambers and reduces the resistance value of the sensor element. Since the resistance value was previously calibrated relative to a specific gas concentration, the resistance value now measured can be displayed as a gas concentration reading for the sample gas.

HORIBA’s MEMS technology allows HORIBA to manufacture IR temperature sensors that are very small yet very sensitive, highly reliable, and vibration-resistant. Since IR temperature sensors are very small, HORIBA can manufacture small, compact and lightweight sensor modules that have the same sensitivity and performance as the previous larger gas analyzer optical benches. This feature allows three analysis modules to fit into a single 19-inch rack case.

Note 1: Select the lowest range and maximum range ratio within the above concentration ranges according to the following conditions.

- [NDIR] 4 ranges with a maximum range ratio of 10x (or 20x as an option, although this may be limited by the cell length). [CLA] 8 ranges with a maximum range ratio of 100x if the maximum range exceeds 2000 ppm, the minimum range should be 50 ppm or more.
- [MPA] 4 ranges with a maximum range ratio of 10x (Galvanic) 4 ranges with a maximum range ratio of 5x [Zirconia] 4 ranges with a maximum range ratio of 5x.

Note 2: Contact us if you require any ranges below the concentration ranges noted above.

Note 3: Contact us if you require measurement of special gases such as NH₃.

**Wide measurement ranges are provided for each module.**

<table>
<thead>
<tr>
<th>Measurement method</th>
<th>Component</th>
<th>Standard Minimum range</th>
<th>Standard Maximum range</th>
<th>Zero and span drift</th>
<th>Repeatability</th>
<th>Example of ranges (See Notes below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDIR</td>
<td>CO</td>
<td>0-200 ppm</td>
<td>0-100 vol%</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>1-0-100/200/500/1000 ppm (CO, N₂O)</td>
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<tr>
<td></td>
<td>CO₂</td>
<td>0-100 ppm</td>
<td>0-100 vol%</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>2-0-200/500/1000/2000 ppm (CO, CH₄, SO₂)</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>0-100 ppm</td>
<td>0-5000 ppm</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>3-0-1000/2000/5000 ppm/1 vol% (CO, CO₂, CH₄, SO₂)</td>
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<tr>
<td></td>
<td>CH₄</td>
<td>0-200 ppm</td>
<td>0-100 vol%</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>4-0-5/10/20/25 vol% (CO, CO₂, CH₄)</td>
</tr>
<tr>
<td></td>
<td>SO₂</td>
<td>0-200 ppm</td>
<td>0-10 vol%</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>5-0-10/20/50/100 vol% (CO, CO₂, CH₄)</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>0-500 ppm</td>
<td>0-1 vol%</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>6-0-10/20/50/100 vol% (CO, CO₂, CH₄)</td>
</tr>
<tr>
<td>CLA</td>
<td>NOx</td>
<td>0-20 ppm</td>
<td>0-5000 ppm</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>1-0-20/50/100/200/500/1000/2000 ppm</td>
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<tr>
<td></td>
<td>O₂</td>
<td>0-5 vol%</td>
<td>0-100 vol%</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>2-0-5/10/25 vol%</td>
</tr>
<tr>
<td>MPA</td>
<td>O₂</td>
<td>0-5 vol%</td>
<td>0-25 vol%</td>
<td>±1.0% full scale per day</td>
<td>±0.5% of full scale</td>
<td>3-0-5/10/25 vol%</td>
</tr>
<tr>
<td>Galvanic</td>
<td>O₂</td>
<td>0-5 vol%</td>
<td>0-25 vol%</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>4-0-5/10/25 vol%</td>
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<tr>
<td>Zirconia</td>
<td>O₂</td>
<td>0-5 vol%</td>
<td>0-25 vol%</td>
<td>±2.0% full scale per week</td>
<td>±0.5% of full scale</td>
<td>5-0-5/10/25 vol%</td>
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</table>

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Note 3: Contact us if you require measurement of special gases such as NH₃.
Many combinations of different sensor modules provides greater flexibility

The NOx analysis module uses the sensitive chemiluminescence method (CLA) which permits NOx measurements in a range as low as 0 – 10 ppm. The chemiluminescence analyzer has virtually zero interference. HORIBA design technology and experience have virtually eliminated CO2 quenching and water vapor interference; operates at atmospheric pressure.

NOx

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O2

Choose from four analysis methods for the oxygen analyzer module. Select the sensor module based on your specific requirements and sample gas conditions.

Performance
- Stability by design
- Low-concentration gas is measured
- Warm-up and startup performance is important

Sample gas condition
- Flammable gas is also present
- High-concentration acidic gas is also present
- Alkaline gas is also present
- Water in a liquid state may be contained in the gas
- Sample flow rate should be minimized

Installation environment
- Carrier gas is not available
- VS-3000 sample conditioning system is not used
- Back pressure exists
- Installation environment is vibrating

Cost and other points
- Operating costs should be minimized
- Maintenance should be minimized

Chemiluminescence

Virtually zero interference from CO2 and water vapor; very stable

Magnetopneumatic

Highly accurate and stable measurement unaffected by coexisting gases or external vibration

Zirconia

Stable measurement unaffected by environmental conditions

Galvanic

Stable measurement with a compact and lightweight sensor

Easy operation from the front panel

A large liquid crystal panel and numeric keypad make it easier than ever to operate the VA-3000. Designed as an interactive system, basic operations are performed on the front panel. With the clear and sharp display, an operator can set parameters and check data on the display using easy push button operations.

- Up to the three components can be measured simultaneously with a single analyzer.
- Measure a wide range of the same gas using two sensor modules.
- Setting measurement parameters is simple with a push of a button on the front panel.
The free combination of modules and sampling units can satisfy diverse measurement needs.

<table>
<thead>
<tr>
<th>Model</th>
<th>Analysis unit</th>
<th>CO</th>
<th>CO₂</th>
<th>SO₂</th>
<th>Cl₂</th>
<th>NO₂</th>
<th>O₂</th>
<th>Sampling Unit</th>
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<tbody>
<tr>
<td>3001</td>
<td>NDIR</td>
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Note: Modules to measure other gases are available.

### VS-300X Standard Sampling Units

Four different sampling units are available in 19-inch rack mount cases to meet the requirements of the different combinations of modules. The basic sampling unit (VS-3003) provides the pumps, filters, thermo-electric cooler, flow-meters and other components required to clean, dry and regulate the flow of sample gas to the analyzer modules. Any of the four sampling units may be used with the NDIR modules; however, the CLA and MPA modules require additional components for proper operation. The sampling units for use with the CLA module include an NO₂ converter and a pump, flow-meter and conditioning components to provide clean air to the ozone generator in the CLA module.

The sampling units for use with the MPA module include a pump, filter and buffer tank required to maintain a vacuum on the MPA detector chamber. Refer to the chart above to select the proper VS-300X unit to use with the VA-3000 instrument you have configured and refer to the schematics on page 8 for the flow diagrams for each sampling unit. If a user assembles their own sample system, the requirements for these instruments must be considered. HORIBA also provides kits containing the additional components required to support the CLA and MPA modules.
Many Output and Communication Options are available. To Facilitate Data Collections and Remote Operation.

● Analog Outputs:

Two Analog outputs for each component measured by the VA-3000 are available through a DB15 connector on the rear panel of the instrument. Each output may be set to either 4 to 20mA or 0 to 1Vdc non-isolated. If an O2 measurement module is included in the instrument, separate outputs may be configured by the user for the raw and O2 corrected values.

● Discrete I/O options:

The optional VA-PIO-01 board provides 16 channels of digital inputs and 16 channels of digital outputs. The inputs require an external dry contact closure from the users control system (some commands require momentary closures) and the outputs are form C dry contacts rated 24V DC, 0.5A. The following functions are provided by the optional VA-PIO-01 circuit board via three DB25 connectors on the rear panel:

Analyzer Alarm:
Activated when diagnostic values monitored in each analyzer module are abnormal including module temperature, chopper motor failure and low sample flow-rate. The alarm activates when the temperature is outside the range of -10 to 70°C. When NDIR modules are installed, the alarm is active if the movement of the chopper motor becomes abnormal or stops. If the flow sensor option is installed, the alarm is active if the gas flow in sample or calibration mode is too low. All alarms are identified on the LCD display. See the operator manual for a complete list of alarm conditions for each analyzer module.

Calibration Alarm:
Active when a zero calibration exceeds +/-50% of the maximum full scale range or when a span value is less than 0.60 or greater than 1.30 times the initial span adjustment. Initial adjustments are the values recorded during the analyzer set-up by service personnel. Other conditions may also activate this alarm. Refer to the service manual for details.

In Calibration:
Active when the instrument is placed in the calibration mode either manually from the front panel or remotely via one of the instrument communication modes.

Range Identification:
A combination of two or three contact outputs allows identification of up to four ranges and a third contact will identify up to eight ranges using BCD logic. There is one set of contacts for each analyzer module. Single range configuration is standard for all analyzer modules; additional ranges are optional.

Concentration Alarm:
The instrument software allows the user to set an alarm for the concentration measured on each channel. These may be set at a Low level or a High level.

Remote Range Change:
Allows the user to remotely select any of the configured ranges on the analyzer modules. Depending on the number of ranges, this function requires two or three contact inputs per analyzer module.

Output Hold:
Allows the user to request the instrument to hold the analog outputs at the current value when the instrument is put into calibration mode.

Zero Calibration Request:
Allows the user to remotely put the instrument into zero calibration mode. All modules zero simultaneously.

Span Calibration Request:
Allows the user to remotely put the instrument into span calibration mode individually by module.

● Serial communication function

Serial communication is available through two RS-232 serial ports with DB9 connectors on the rear panel. The first RS-232 port is configured to communicate using HORIBA’s generic communication protocol. The commands for the HORIBA generic protocol are available for customer use on request. This port is used by HORIBA service personnel to set-up and service the instrument. It also connects to the optional HORIBA data collection software package. The second serial port can be easily converted to RS-485 and is available for data collection by customer-supplied software. This port communicates via the optional Modbus protocol.

● Optional HORIBA data collection software facilitates remote data management from your computer

The optional HORIBA data collection software allows you to transfer the data to your computer using the HORIBA protocol. The software is similar to an electronic strip chart recorder. The data is displayed in graphical form and saved as a CSV format file and accessed via standard spreadsheet software such as Microsoft® Excel®.
Wide Variety of Standard Features and Functions as well as Optional Features. Allow the VA-3000 to be Configured to Meet the Requirements of Any Application.

●Standard functions configured prior to shipment include:

**Output:**
Select 0-1VDC or 4-20 mA for each of two channels per module

**Communication Ports:**
One of two RS-232 may be changed to RS-485

**Automatic Calibration:**
Activate this function to allow the instrument to reset the zero and span calibrations when the instrument is manually or remotely put in the calibrate mode.

**Select Automatic Range Change:**
Allows the user to set a point where the analyzer will automatically change from the measurement range it is currently on to the next highest or lowest range available in the analyzer module depending on whether the measured concentration is increasing or decreasing.

**Select Negative Display:**
Negative measurement value means you will never see any value on the screen less than 0.000.

**Select O2 Correction:**
If an O2 module is installed in the instrument case with other modules such as CO and NOx and if this function is activated, the measured values for CO and NOx will be corrected for dilution based on the measured O2 concentration in accordance with US EPA procedures. The instrument will have analog and digital (if communication options are installed) outputs for both the raw CO and NOx values as measured and the corrected values.

**Select the Concentration HOLD Function:**
If this function is activated, when the instrument is put into the zero or span calibration mode, the concentration values indicated at the analog outputs and any digital outputs (if additional communications options are installed) will be held at the concentration value last measured before the instrument mode was changed.

**Set Alarms for the Gas Concentration:**
There are two alarm points that can be set for each analyzer module. These can be set to alarm at a Low (zero) and a High value, or at a High and a Higher value. The alarm will show on the instrument front panel screen and will transmit information via the RS-232 port and if the optional PIO board is installed, contact closures are also available.

**Select Memory of Calibration and Alarm History:**
The processor in the instrument stores the zero and span calibration coefficients for each module installed in the case for 15 days. This information can be displayed on the front panel to indicate if there is a significant trend in calibration shift that would indicate that there might be a problem with the analyzer module. The processor also stores the last 30 analyzer alarms that occurred for each module installed in the case. This information can be displayed on the front panel.

**Alarms recorded include:**
Zero/ Span Calibration alarm, Cell Temperature and Chopper alarm for NDIR, Detector Temperature alarm for CLD module.

●Other Optional Features:

**Atmospheric Pressure Correction:**
The pressure compensation function corrects the output signal from the NDIR and MPA O2 modules for changes in sensitivity caused by changes in the atmospheric pressure since the instrument was last calibrated with a cylinder calibration gas. Galvanic, PMA and Zirconia O2 modules and the CLD module do not have pressure compensation. This option is useful if you desire the best possible accuracy over a period of time when you will not calibrate the instrument with cylinder gas.

**Flow Rate Display:**
A miniature mass flow meter is installed to monitor the flow rate of gas through the instrument. The flow rate is displayed on the front panel and if the flow rate deviates from a preset value an alarm will be displayed on the front panel and, if the VA-PIO-01 board or other communication options are installed, will be transmitted external to the instrument.

**Stainless Steel Tubing with Swaglok Fittings**
Stainless Steel Tubing and Swaglok Fittings can be provided as an option when the instrument is initially delivered. This option cannot be easily added at a later date. This option is not available for the CLD or O2 analyzer modules at this time.

**Separate Gas Inlet Fittings per Module:**
In the standard instrument, gas flows to the three modules sequentially in series. As an option HORIBA can make separate gas inlet connections for each module with a common exhaust; however, the software is designed so that all three modules will be in the zero calibration mode simultaneously and this cannot be changed. The span calibration may be done separately.

**Gas Connections on the Front Panel:**
The gas connections can be moved from the rear of the case to the front panel but if this is done then only two analyzer modules will fit into the standard VA-3000 case.
Provides true VERSATILITY

From environmental monitoring to developing new energy sources and chemicals for the future, gas analysis systems are faced with needs and challenges for measurement of up to 5 gas components. The VA-3000 series of gas analysis systems offers true VERSATILITY with many combinations of sensor modules, a wide selection of sensor modules for many applications, and efficient space-saving. The VA-3000 series can be a single system, a sampling system, or a combination of both. The system can be used in any environmental conditions and is capable of measuring up to 5 gas components, with 99.5 ppm sensitivity, and drift of less than 0.5% of full scale range (F.S.R.). The VA-3000 achieves repeatability of 1.0% of F.S.R.

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Please read the operation manual before using this product to assure safe and proper handling of the product.

- The specifications, appearance or other aspects of products in this catalog are subject to change without notice.
- Please contact us with enquiries concerning further details on the products in this catalog.
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