

PGC1000 HRVOC application

HRVOC stands for “Highly Reactive Volatile Organic Compound”. Compounds such as ethylene, propylene, butadiene, and butenes have been found to contribute to elevated ozone levels.



Introduction

In order to achieve federally mandated ozone requirements in the Houston-Galveston area, the Texas Commission on Environmental Quality requires the monitoring of HRVOC emissions from vent gas streams, flares, and cooling towers. Specifically, for flares, it is mandated to: continuously measure flow rate, measure speciated HRVOC concentrations every 15 min., and calculate net heating value and exit velocity every 15 min. The PGC1000 is uniquely suited to be the most cost-effective solution for monitoring HRVOC's in flare gas.

The PGC1000 HRVOC delivers on site flare gas analysis and heating value computation using parallel chromatography. A single computer controller seamlessly processes all analysis and computation data for various outputs. It also handles the stream switching and the timing for the sample. Incorporating a state-of-the-art, built-in, 32-bit digital controller, three electronic carrier pressure regulators, oven-mounted sensors and advanced low-noise digital electronics, the PGC1000 performs with unparalleled repeatability and sensitivity. Not only does the PGC1000 provide custody transfer/metrology-quality chromatography for heating value and composition measurement, it also has the ability to interface with a differential pressure transmitter to accomplish all the necessary flow calculations for this application. The PGC1000 provides the user with a GC that is lower in cost, easier to install and commission, and less costly to operate.

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Standard features

Modular design includes:

- Three analysis trains
- Modular software – application-based, plug-in software modules
- Manifold modules
- Analysis sections contain stream selection solenoids, temperature and pressure regulation, 32-bit digital detector electronics, replaceable column/valve modules, and a low power, 32-bit digital controller, that uses Windows CE® (internal to GC unit)
- Microsoft® Windows® 2000 or XP based MMI software (PCCU_ NGC)
- Lithium battery-backed RAM
- Two remote serial digital communications ports; one local port (USB client)
- One USB host and one Ethernet port
- Comprehensive diagnostics and wizards available to users
- Three-level security for user access control (read only, operate and read/write)
- Audit-quality historical data, date and time stamped
- Auto-start cycle automatically after power failure:
 - Stabilizes oven temperature
 - Confirms modules' functions
 - Checks for operational alarms
 - Returns to pipeline streams
- Operational alarms available with each analysis cycle
- Detectors - constant temperature and glass encapsulated thermister beads for rugged service and long life. Will not burn out on loss of carrier
- Ten port valves have no moving metal parts in each analysis unit
- Low utility usage - low-power, low-carrier, no instrument air required
- On demand or scheduled automatic calibration and diagnostics
- Continuous monitoring for alarms

Standard options

- Sample conditioning modules
- On-board digital 1/4" VGA display with multiple screen access
- Integral gas flow tube calculations (e.g., orifice or turbine meter calculations)
- SD memory cards for raw chromatogram storage
- Feed-through heater for colder operations or high dew point gas sampling

Description

A flare gas sample is extracted from a flowing pipeline, transported to the analyzer, processed for particle removal and phase integrity, and injected onto the three sets of chromatographic columns where component separation and peak detection occurs. The PGC1000 HRVOC analyzes each sample utilizing established chromatographic techniques. The resulting information consists of mole percent values for the following:

Train BBC	Train BBJ	Train BBH
Air	Propane	Hydrogen or Helium
Methane	Propylene	Oxygen
Carbon Dioxide	Isobutane	Helium
Ethylene	Butane	Nitrogen
Ethane	Butene-1	Nitrogen
Acetylene	Isobutylene	Carbon Monoxide
C3+	trans-Butene-2	
	cis-Butene-2	
	1,3-Butadiene	
	C5+	

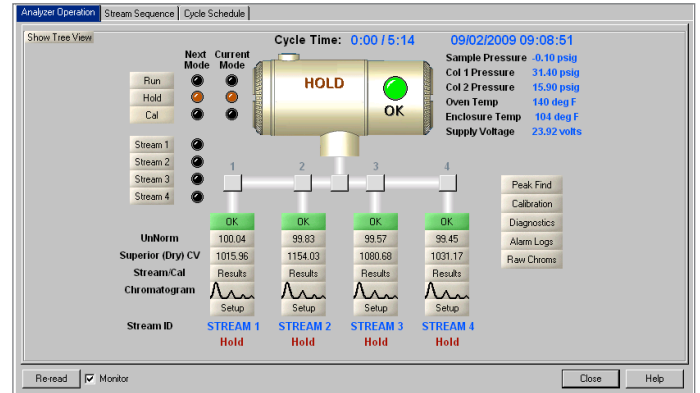
Using process chromatographic techniques, the analyzed components are carried through the columns and the detectors where integration takes place. Composition results and calculated values are then stored in memory and communicated to other devices, as needed. All of these values, as well as composition, are available on various Modbus communication protocols.

Operator interfaces

Functional set up and operation of the PGC1000 is accomplished by using a graphical user interface software package called PCCU 32 (supplied with each unit) operating on a laptop PC in a Microsoft® Windows® environment. PCCU 32 provides a powerful tool for operations, diagnostics, and downstream data handling. The PC can be directly connected to the PGC1000 via an RS-232, USB, or Ethernet connection or indirectly by remote telemetry (phone modem, radio, cell phone, satellite, etc.). The user is prompted through pushbuttons, drop-down boxes, wizards, and dialog boxes for setup, operations, data collection and monitoring. In addition, the unit has an optional, ¼" VGA interactive display screen allowing the user access to basic analysis data and to perform basic operations.

Maintenance

The PGC1000 was designed from the ground up to be maintained by personnel with little or no prior knowledge of gas chromatography.



Both the hardware and software are designed to provide low maintenance through easily replaceable electro-mechanical modules such as:

- Termination panel
- Analytical module that contains: easily removable chromatograph subassembly, manifold, stream selector solenoid valves, GC valve assembly, multiple electronic carrier pressure regulator valves, chromatograph pilot valve, and the analytical processor
- Feed-through (with optional heater)
- Sample conditioning module (SCM) (optional)
- Digital controller, (32-bit processor)
- ¼" VGA display (optional)

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Other maintenance support features:

- Intuitive local operator interface (PCCU 32) running Microsoft® Windows® environment
- Diagnostic software and wizards (future) for maintenance
- Diagnostic file output system for email support (future)
- Digitized detector output (chromatogram) to PCCU 32
- Remote or local operation of PCCU 32
- Quick start guide, startup manual, and startup video (future)

Historical data

The PGC1000 is designed to retain historical data. This data can be used for custody transfer needs, verify transmitter operation over time, and provide a limited data backup for communication link reliability.

The user is allowed to configure the period of the data retained by the PGC1000 via the Operator Interface. The default memory configuration provides the most recent 480 analysis cycles containing:

- Normalized components
- Un-normalized components
- Ideal Btu/CV
- Real Btu (wet and dry) / CV (superior and inferior)
- Relative density (specific gravity)
- Density
- Alarms

Stream averages for the 840 last hours (default), 35 last days, and the most recent last month analyses. Operational parameters for the last 480 cycles (default) (Diagnostics Report).

Data retained by the PGC1000 can be collected via a remote communication link or by the laptop PC local operator interface

- Selected peak times
- Selected peak areas
- Ideal Btu/CV
- Carrier regulator pressure
- Oven temperature
- Ambient temperature
- Sample pressure
- Detector noise values
- Detector balance values
- Audit logs (default)
- Last 480 alarms
- Last 480 events

Available accessories


- 120/240 V AC to 12 V DC power supply
- 120/240 V AC to 24 V DC power supply
- Pole or pipeline mounting kits
- Cold weather enclosure (also available in pipe mount configuration)
- Modular sample conditioning systems
- Probes
 - Temperature compensating fixed
 - Temperature compensating retractable
 - Liquid rejection
 - Electrically heated, retractable
- Regulators (carrier and calibration blend)
- Startup calibration/validation gas sample ($\pm 2\%$ blend)
- Carrier gas: 99.995% pure helium (chromatographic grade)
- SD memory card, various up to 1Gig
- Export crating
- Tool kit
- Welker and A+ Corp. liquid shut-offs
- Various maintenance kits
- Customer factory acceptance test (FAT)

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Specifications

- Calculations per: GPA 2172-96 (Z by AGA-8 or single virial summation) and 2145-03 (rev. 1), ISO 6976-95
- Four stream capability. Manual calibration required with four sample streams
- Single auto calibration stream and three sample streams or a max of two auto calibration streams and two sample streams
- Designed for monitoring HRVOC's in flare gas. Individual component concentrations are listed in the table to the right

Dimensions	22.58" wide (57.35 cm) × 17.1" deep (43.43 cm) × 22.50" high (57.15 cm)
Weight	Approximately 50 lb. (22 Kg) Shipping Weight: 94 lb. (45 Kg)
Weatherproof construction	CSA Type 4X, IECEx IP56, ATEX Type 4X (IP66 equivalent); aluminum alloy with white polyester powder coating
Power consumption	Nominal operation @ 0°F (-18°C) = 28 Watts Startup @ less than 16.4 Amps (246 Watts @ 15 V DC) without optional heater Optional heater requires an additional 6 Amps on startup
Carrier	Gas helium (consumption rate <40 cc/minute during analysis cycle)
Analysis time	Approximately 7-8 minutes; cycles may be scheduled by user
Repeatability	See table @ right for individual component repeatability
Temperature range	0°F to 130°F (-18°C to 55°C)
Temperature range (storage)	-22°F to +140°F (-30°C to 60°C)
with cold weather enclosure	-40°F to +130°F (-40°C to 55°C)
Moisture	95% relative humidity non-condensing
Supply voltage	10.5 to 16 V DC or 21 to 28 V DC as an option
Certifications	NEC & CEC Class I, Div. 1, Groups B, C and D, T6: CFR 47, Part 15: CE ATEX  II 2G : Ex d, IIB+H2 T6; Class I, Zone 1 EMC - EMI/RFI: EN 55022, EN 61000-6-1, EN 61000-4-2, 4-3, 4-4, 4-6, 4-8: CISPR 22-2004 IECEX Ex d IIB + H2 T6; Class I, Zone 1
Communications supported	Two serial digital ports, software selectable for RS-232, RS-485, or RS-422. One MMI (USB slave). One USB host, one Ethernet port
Protocols supported	Totalflow Remote / Local MMI Totalflow / TCP Modbus / TCP Server Modbus / TCP Client Modbus ASCII or RTU (Modicon, WordSwap, or Danalyzer 2251) Marquis Protocol (future)

Dimensions	Symbol	Range bottom	Range top	Repeat (FS)	MDL
Methane	C1	0.05%	100%	1%	0.01%
Carbon Dioxide	CO2	0.1%	100%	1%	0.02%
Ethylene	C2=	0.1%	100%	1%	0.02%
Ethane	C2	0.1%	100%	1%	0.02%
Acetylene	C2*	0.2%	100%	1%	0.02%
Pentane Plus	C5+	0.02%	50%	2%	0.03%
Propane	C3	0.1%	100%	2%	0.002%
Propylene	C3=	0.1%	100%	1%	0.001%
Isobutane	IC4	0.1%	100%	1%	0.001%
Normal Butane	NC4	0.1%	100%	1%	0.001%
Butene-1 & Isobutylene	B-1 & IC4=	0.1%	50%	1%	0.001%
Trans-Butene-2	tB-2	0.1%	50%	1%	0.001%
Cis-Butene-2	cB-2	0.1%	100%	1%	0.002%
1,3-Butadiene	1,3-BD	0.2%	100%	2%	0.001%
Hydrogen	H2	0.5%	20%	1%	0.2%
Oxygen	O2	0.2%	20%	1%	0.01%
Nitrogen	N2	0.1%	100%	1%	0.01%
Carbon Monoxide	CO	0.2%	100%	2%	0.02%

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