

Procal 7000 Bio Gas Monitoring System

- ✓ Bio Gas Multi-Gas Analyser
- ✓ Low cost of through-life ownership
- ✓ Proven technology

Instrument Overview

Procal 7000 is a system designed to continuously monitor process gas from:

Land Fill

Bio Gas

Natural Gas

The Monitoring System is designed to be located in a hazardous area with the display and control unit mounted in a safe area.

The system is of a module design and its configuration will depend on the application and therefore the gases to be monitored.

Monitoring Pages Include:-

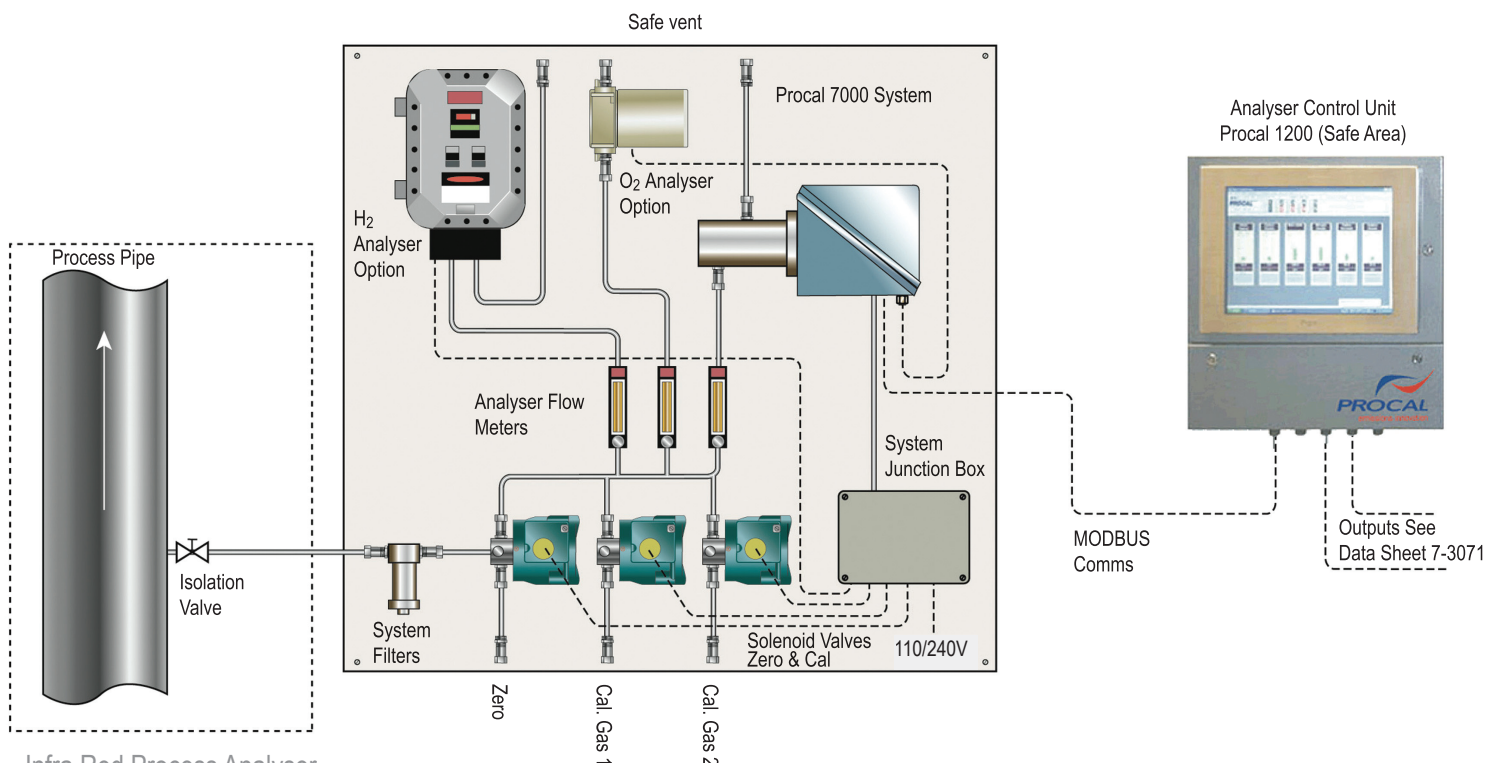
Procal 7100 CH₄, C₂+, CO₂

Procal 7200 CH₄, C₂+, CO₂, O₂

Procal 7700 CH₄, C₂+, CO₂, O₂, H₂

The Monitoring System can report individual concentrations in percent (%)

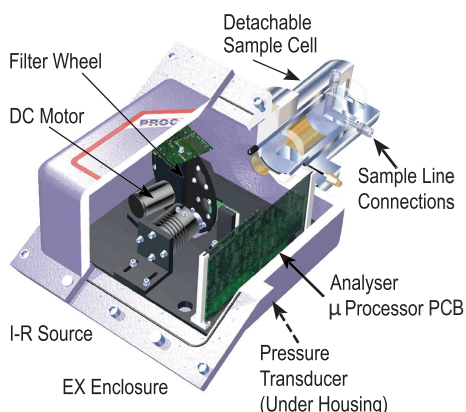
Procal 7000 Field located system comprises of a Multi component Infra-Red (IR) analyser mounted on a panel with optional modules depending on the application. The optional modules include Oxygen Sensor and Hydrogen Sensor which are mounted on the system panel. The fields mounted panel is connected via MODBUS to a system display unit mounted in a safe area or purged enclosure.



Infra Red Process Analyser.

The Infra Red Process Analyser is capable of monitoring up to five (6) gases simultaneously, using multiple wavelengths and a folded beam technique it is an ideal solution for Bio Gas applications.

Principles of Operation



The Procal 7000 analyser operates on the proven, single beam, dual-wavelength IR light principle. Mid IR Pulses, at two specific wavelengths per monitored gas, are transmitted through the sample cell. The 'measure' pulse is partially absorbed by the gases being measured while the 'reference' pulse remains unaffected. Up to eight wavelengths are available, sometimes sharing reference wavelengths, allowing up to six gas-phase component concentrations to be monitored simultaneously. Uniquely, the operation, zero and calibration are "fully challenged" in that all operating modes use the same optical path and system components. The folded beam sample cell incorporates both sample temperature and pressure measurements allowing the reported concentration to be corrected for any effect of temperature or pressure. The robust demountable sample cell incorporates, cell windows manufactured from Calcium Fluoride (CaF₂), retro reflector and sample pipe connections.

IR Analyser Specification

Spectral Range:	Specific application dependent wavelengths (up to 8) are selected between 2-8 μm
Infra-red source:	Enclosed nichrome filament.
Infra-red detector:	Solid state pyroelectric element.
Sample path length:	2mm – 100mm
Sample temperature:	Up to 100°C (212°F)
Cross-sensitivity:	Minimal due to the wavelength selection and advanced algorithms in the processor this software
Accuracy:	Typically $\pm 2\%$ of full scale concentration but dependent on application.
Response time:	Application dependent but typically 45 seconds to T90.
Enclosure:	Aluminium alloy casting with high protection finish, protected to IP65 (NEMA 4X)
Operating Environment:	Operating temperature range 0°C to 45°C (-50°F to 113°F). Optional Analyser Cooler/Heater for greater temperature range.
Materials-contact with gas:	316 Stainless Steel, Calcium Fluoride (CaF ₂)
Services required:	Power for analyser 115V/230V 100W
Instrument air for the analyser void purge, auto zero and sample cell protection, controlled by the analyser, 2 barg; flow rate 0.5 litre/min constant and 1 litre/min intermittent during Auto-zero (typically 2 minutes every 24 hours).	

Oxygen Analyser Module

System Description

The Oxygen instrument is loop powered from the IR analyser, and provides a 4-20 mA dc output that is connected to the IR analyser. Optional Explosion Proof Version rated Class 1, Groups C, & D, Div 1. Is available.

The Oxygen Transmitter features a patented, extended life oxygen sensor with EES (Enhanced Electrolyte System). This sensor provides exceptional performance, accuracy, and stability. The output from the sensor is temperature corrected to provide optimum performance over a wide range of operating conditions. Some oxygen analyzers require the user to make manual adjustments (scale factor) to the instrument in order to compensate for certain changes in gas composition. Errors as large as 300% of the reading may exist if the factor isn't changed, making the instrument a questionable choice for process applications. The Percent Oxygen Transmitters do not require any such adjustment and as such, are ideally suited for process monitoring and control applications.

Oxygen Analyser Specifications

Measurement Ranges (percent oxygen):	0-25%
Accuracy:	$\pm 1\%$ of full scale
Linearity:	$\pm 1\%$ of full scale
Response Time:	90% of full scale in less than 20 seconds typical
Sensor Type:	Electrochemical Sensor
Temperature Compensation:	Standard
Operating Temperature Range:	5° to 38°C (40° - 100°F)
Sample Gas Pressure Limits:	0.1 to 1.0 psig (1.04 kg/cm ² to 1.10 kg/cm ²)
Sample Flow Rate:	1.0 to 2.0 SCFH (0.5 to 1.0 liters/min.)
Electrical Input/Output:	4-20 mA (Connected to IR Analyser)
Warranty:	2 years electronics/1 year sensor
Enclosure:	Polycarbonate-rated NEMA 4 (IP66)

Hydrogen (H₂) Analyser module

The H₂ module incorporates a thermal conductivity analyser which works on the principle that the basic property of each gas species relates to their ability to conduct heat. Good conductors of heat, such as H₂ and He, have a high thermal conductivity whereas poor conductors of heat, such as CO₂ and Ar, have low values. This ability to conduct heat forms the basis of detection. The H₂ analyzes gas compositions by continuously comparing the sample gas with a reference gas (sealed or flowing) of known thermal conductivity. This comparison is performed in a 2-chamber detector cell block. Reference gas occupies one chamber and sample gas the other. A pair of temperature-sensitive heated filaments is mounted in each chamber. These filaments are part of a Wheatstone Bridge circuit. Should the sample gas composition change, its thermal conductivity will also change, conducting different amounts of heat

away from the sample gas filaments. Since the resistance of the filaments is a function of their temperature, the resistance changes when the sample gas changes.

Any such change results in an imbalance in the Wheatstone Bridge, resulting in an electrical signal proportional to the change. Since the temperature of the filaments is tightly temperature controlled, the H2 analyser provides an accurate measure of any change in the sample gas composition.

Hydrogen Analyser Specifications

Hydrogen Analyser Specifications

Ranges:	Three ranges plus a cal range, field selectable within limits (application dependent) and auto ranging
Display:	Backlit 2 line alphanumeric LCD; 5 digit LED display
Accuracy:	±1% of full scale for most binary mixtures at constant temperature; ±5% of full scale over operating temperature range once temperature equilibrium has been reached
Response time:	90% in less than 10 seconds with a flow rate of 100 sccm
System operating temperature:	32 to 122° F (0 to 50° C)
Sensor type:	Standard TC cell (4-filament detector)
Signal output:	Two 4-20 mADC isolated (concentration and range ID) (Connected to I-R Analyser)
Cell material:	Nickel plated brass block with nickel alloy filaments and stainless steel piping and end plates
Reference gas:	Sensor selection dependent. Semicon-based = sealed. Filament-based = flowing or sealed (app. dependent)
Wetted parts:	Stainless steel, nickel, and gold (gold filament option); NACE compliant parts available as option
Sample gas flow rate:	Recommended 0.1 to 0.4 SCFH
Zero / Span drift:	±1 % of FS
Pressure:	5-50 psig

Procal 7000 System

A typical system comprises the field located Monitoring Station (Panel mounted analysers) and a Analyser Control Unit which can support up to Six monitoring Stations. The sample that is supplied to the Monitoring Station is driven by the process pressure, in applications where there is insufficient process pressure a optional pump is available.

In addition to the analysers the Monitoring Station panel also contains:-

- Sample line filter (5µm), to ensure a clean sample is supplied to the analysers
- Solenoid Valves (3), to enable automatic zero and, if required automatic calibration verification and correction
- Flowmeter, to enable the system flow rate to be adjusted and set
- Junction Box, accommodate system wiring
- External Pipe Connections, 1/4 NPT

The Analyser Control Unit is normally located in a safe area, the unit calculates, displays, data logs and transmits all the monitored concentrations. Unlike competitive systems Procal's advanced algorithms enable inter analyser cross sensitivity corrections, for example if the H2 measurement is affected by CO2 a real time correction is applied to the H2 displayed concentration. The Analyser Control Unit displays gas concentrations in percent and calculates and displays BTU & Wobbe Index.

The Procal 7000 analyser requires very little maintenance and achieves a class-beating up-time of over 98% in demanding applications.

The system can be supplied as an Optional - The Field Mounted Monitoring Station can be supplied with all relevant components to conform to ATEX, IEC, UL, CSA certification option to conform to ATEX, IEC, UL, CSA certification



Kittiwake Procal Ltd Tel: +44 (0) 1733 232495
 5 Maxwell Road Fax: +44 (0) 1733 235255
 Peterborough
 PE2 7HU sales@procal.com
 United Kingdom www.procal.com