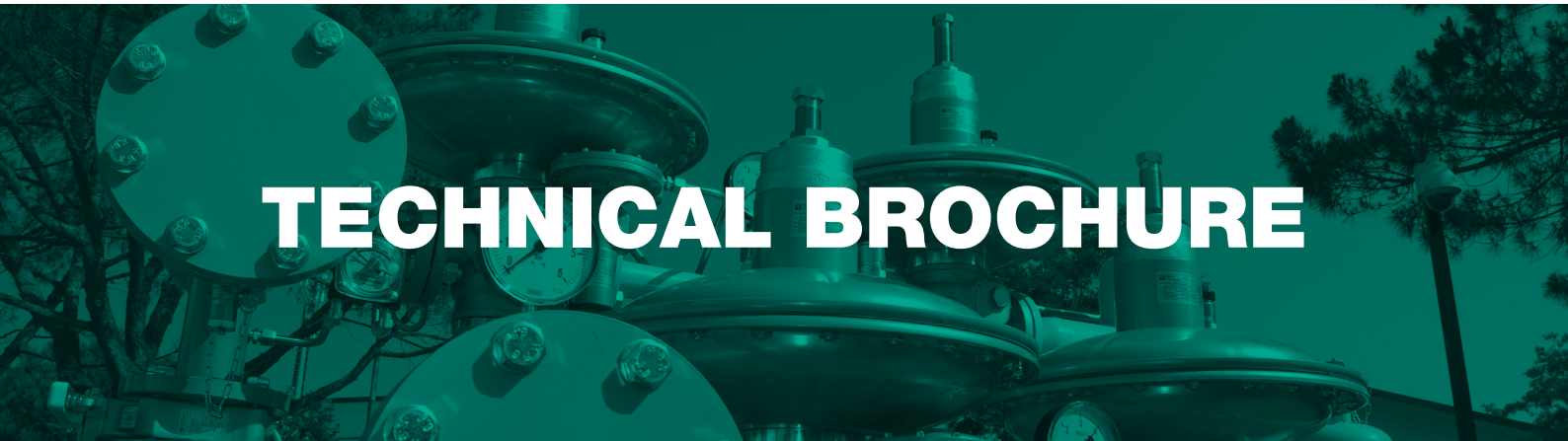
Pietro Fiorentini

GEDRA

Gas quality analyzer



Pietro Fiorentini S.p.A.
Via E.Fermi, 8/10 | 36057 Arcugnano, Italy | +39 0444 968 511
sales@fiorentini.com

gedra_technicalbrochure_ENG_revA

www.fiorentini.com

Who we are

We are a global organization that specializes in designing and manufacturing technologically advanced solutions for natural gas treatment, transmission and distribution systems.

We are the ideal partner for operators in the Oil & Gas sector, with a business solutions that span the whole natural gas chain.

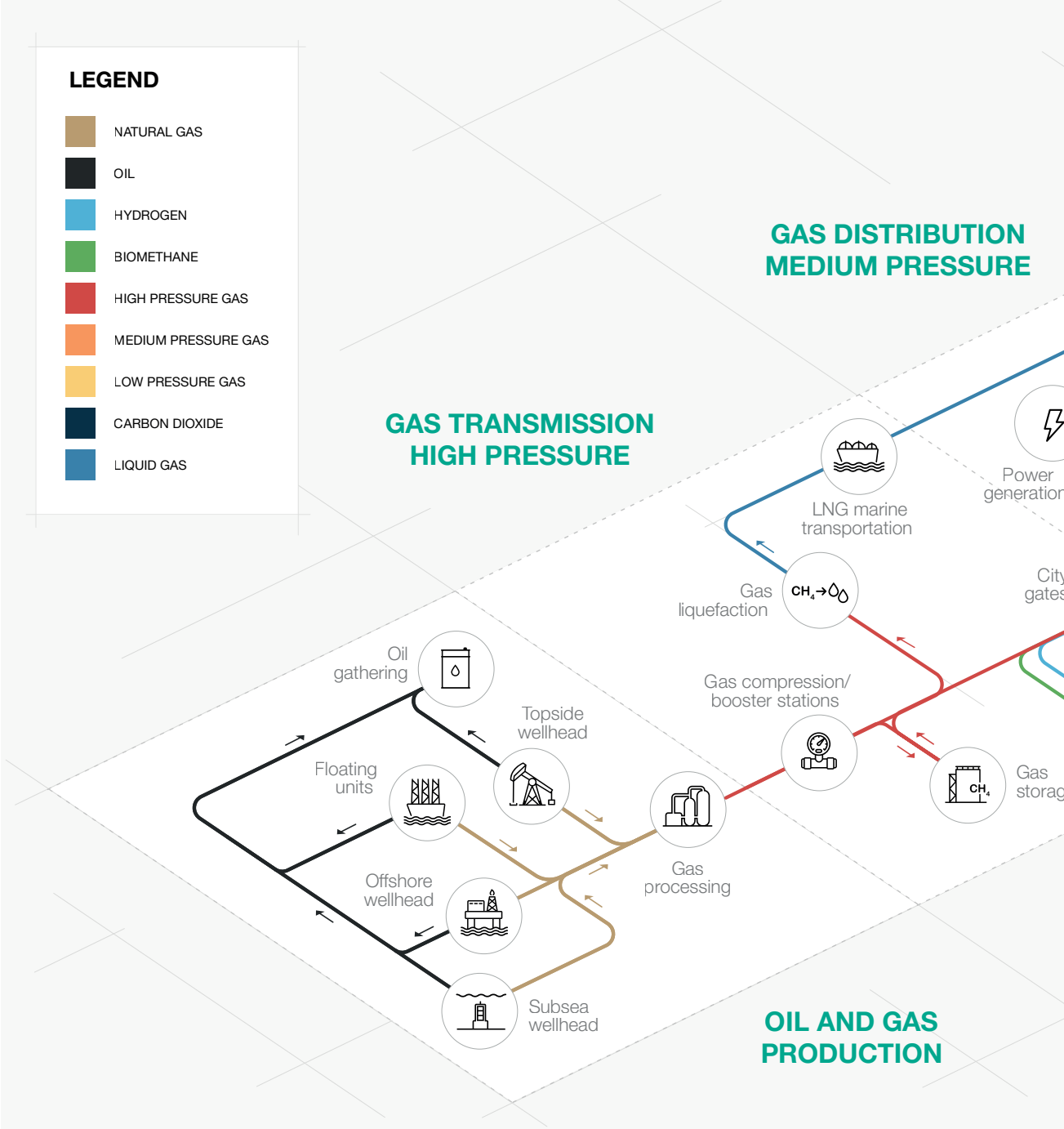
We are constantly evolving to meet our customers' highest expectations in terms of quality and reliability.

Our aim is to be a step ahead of the competition, with customized technologies and an after-sale service program undertaken with the highest level of professionalism.

Pietro Fiorentini advantages

- Localised technical support
- Experience since 1940
- Operating in over 100 countries

Area of Application



Green icon indicates the application where this product is suitable for

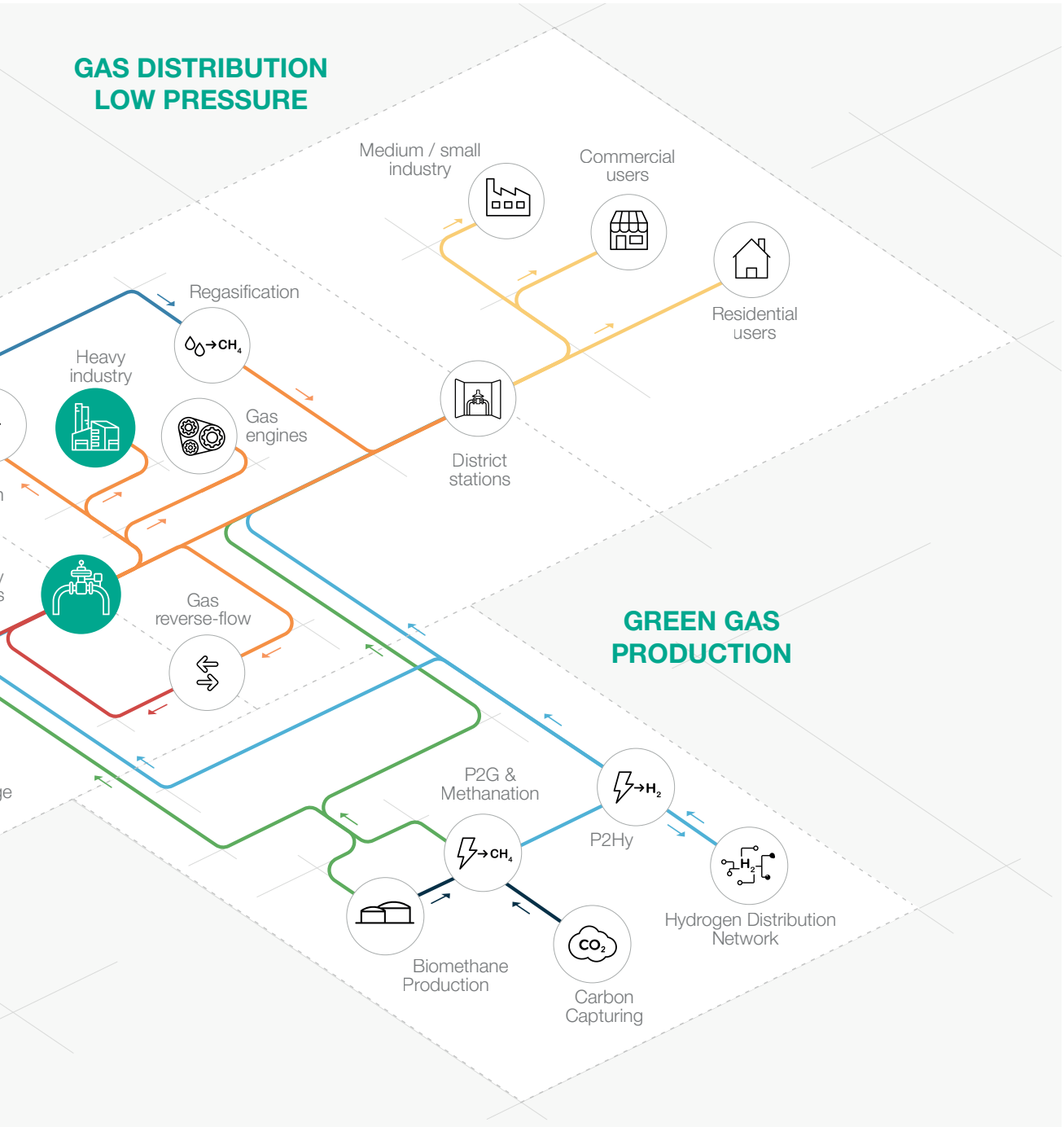


Figure 1 Area of Application Map

Introduction

GEDRA (Gas Energy Density Raman Analyser) is a **real time gas analyser** tailored for natural gas, biomethane, and hydrogen analysis.

The decarbonization of gas supply and subsequent reconfiguration of gas flows through the grid will substantially affect the gas network operator business. The shared goal is to increase the use of alternative green gas sources such as biogas, biomethane and hydrogen-enriched natural gas.

In this future with a such **heterogeneous gas network**, GEDRA will play a crucial role on the way to renewables in **monitoring fundamental gas parameters**. It measure a wide range of gas mixtures without any hardware reconfiguration or any needs of consumable supplies, ready for remote monitoring and control.

Designed to **withstand harsh environmental conditions**, GEDRA can be installed **anywhere** along the gas pipelines, including **remote unmanned locations**. Thanks to its peculiar features, it represents an effective alternative to gas chromatographs for monitoring calorific value.

Figure 2 GEDRA

How it works?

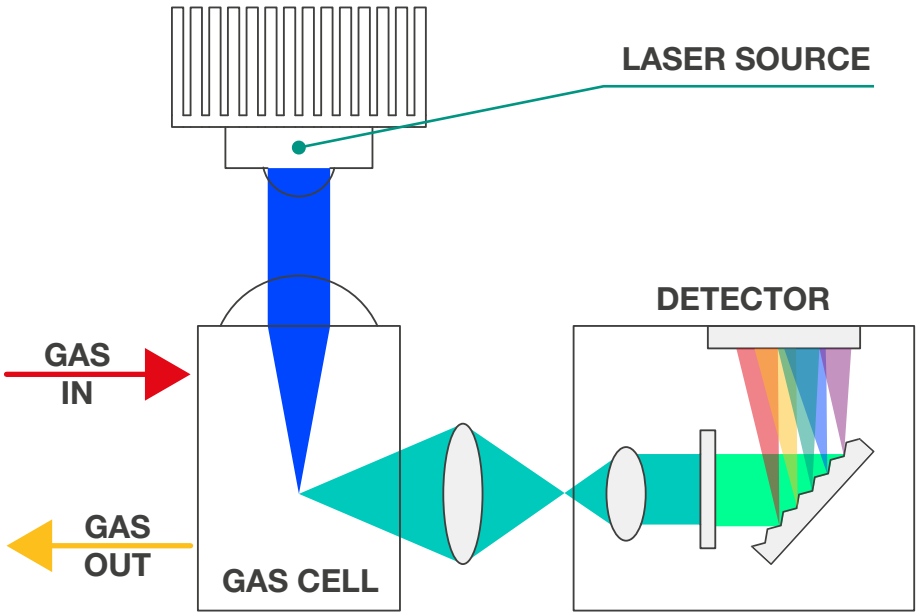


Figure 3 GEDRA - working principle

The operating principle of GEDRA is based on Raman spectroscopy, a technique that exploit the ability of light to interact with matter.

When a beam of light from a laser source hits the gas in the cell, the gas responds by scattering part of the light. A small part of the scattered light has a peculiar wavelength as a result of the interaction of the light with gas molecules: different molecules have a characteristic Raman emission, a 'fingerprint' of the gas. This phenomenon is called Raman scattering.

Through an optical system, the Raman emission is captured, split by wavelengths and read by the detector. In this way, the instrument detects simultaneously the signals of all components of the gas mixture.

These signals are then separated, analysed and used to calculate the concentrations of the components and the calorific value.

Gas analisys

The primary function of GEDRA is to measure the heating value of gas mixture.

GEDRA patented measurement technology is based on optical Raman spectroscopy, with no gas release in atmosphere (for installation type 1) and no need of calibration and carrier gas.

As a by-product provides natural gas main components, including hydrogen, and provides gas mixture's calorific value, density, Z-factor and many other parameters with high accuracy.

The output gas parameters are:

- **HHV** (Higher heating value / Gross calorific value) with accuracy in natural gas +0.5% and repeatability 0.2% (rel.).
- **LHV** (Lower heating value / Net calorific value)
- **HWI** (Higher Wobbe index)
- **LWI** (Lower Wobbe index)
- **RD** (Relative density)
- **Z-factor**

Substance	**Concentration detection** (mol/mol %)	
	MIN	**MAX**
Methane	80	100
Ethane	0.05	15
Propane	0.05	4
n-Butane	0.05	4
i-Butane	0.05	4
Heavier hydrocarbons (>C_4)	*NOTE 1*	*NOTE 1*
Nitrogen	0.05	10
Carbon dioxide	0.05	4
Hydrogen	0.05	20

NOTE 1: Hydrocarbons heavier than butanes are detected by GEDRA. Their typical concentration in natural gas is far lower than 0.05%, thus their calibration could be added according to customer requirements.

Table 1 Substance and their concentration detection

GEDRA competitive advantages

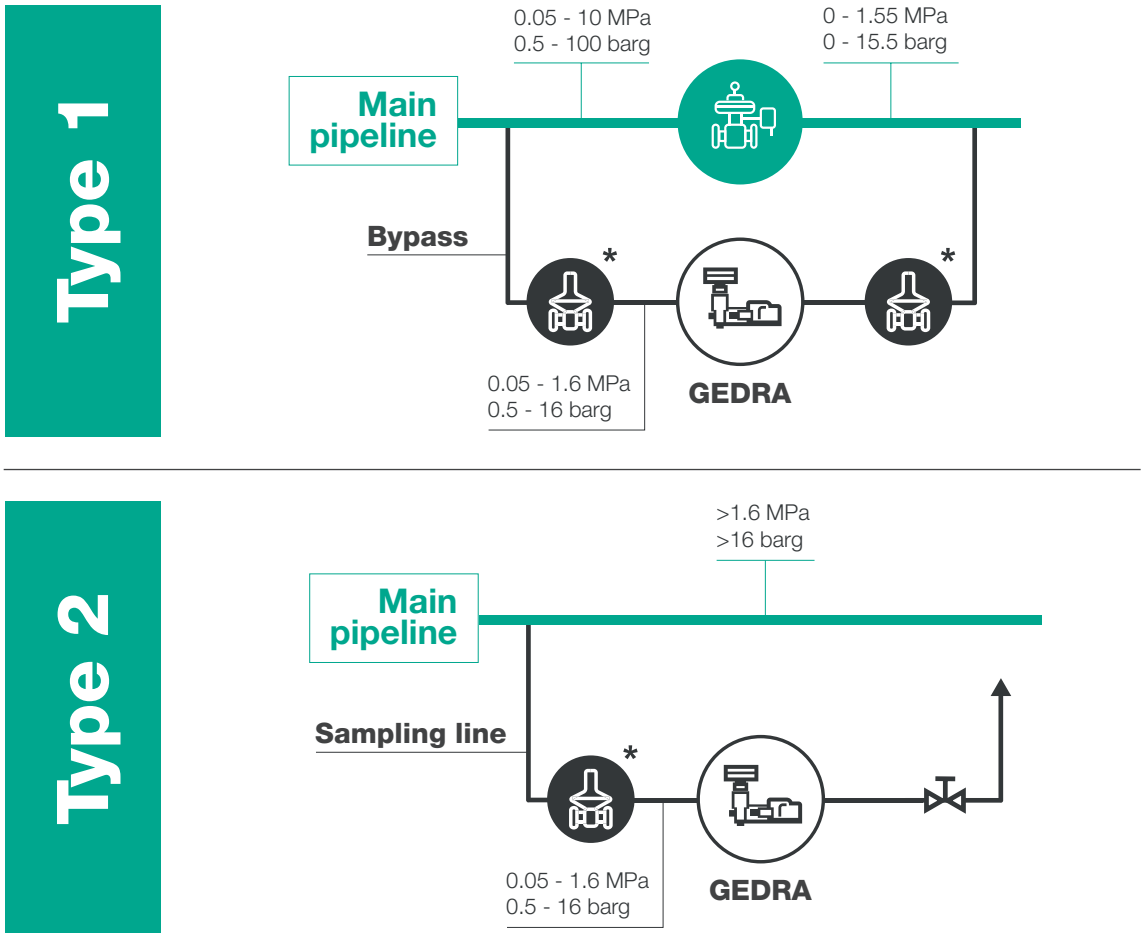
- High accuracy
- Fast response time
- High repeatability
- H_2 ready
- No carrier gas
  No calibration gas mix
- No gas release in atmosphere with installation type 1
- In-line installation

Features

Features	Values
Accuracy (OIML R 140)	class A (0.5 %)
Pressure range	see "Figure 4 Installation scheme"
Flow rate	max 180 NL/h
Temperature range	from -20 °C to +50 °C from -4 °F to +122°F
Power supply	24 VDC | 220 VAC
Power consumption	average 30 W
Communication ports	• 2x Ethernet • 4x Serial (RS 485)
Lower limit of quantification (LOQ)	500 ppm
Communication interfaces	• Modbus ASCII according to UNI 11885 • Integrated web server • Field display (available upon request)
Detectable compounds	Methane;heavier hydrocarbons (ethane, propane, butanes, n-butane, i-butane); nitrogen; carbon dioxide; hydrogen
Installation in hazardous area	Zone 1, II B+H2, T6 | Zone 1, II C, T6
NOTE: Different functional features available on request.	

Table 2 Features

Installation



* To be defined according to the use case

Figure 4 Installation scheme

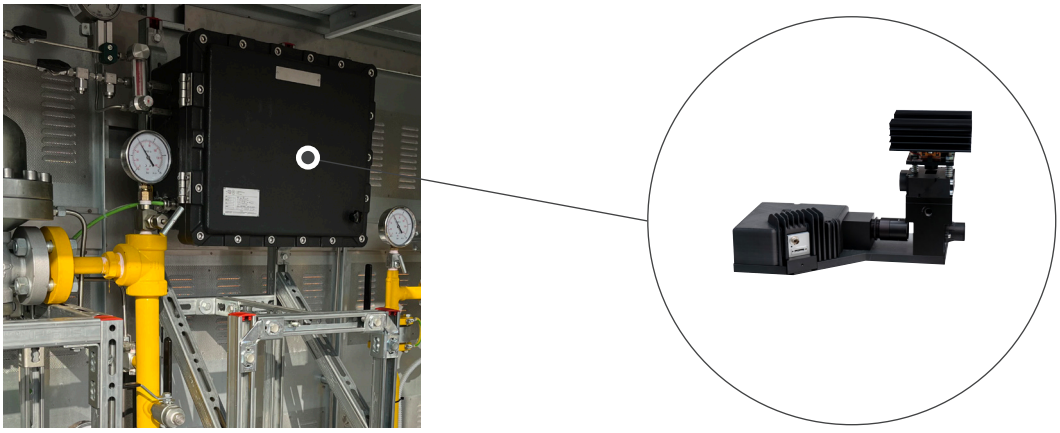


Figure 5 GEDRA real installation

GEDRA® *VS* Gas chromatograph

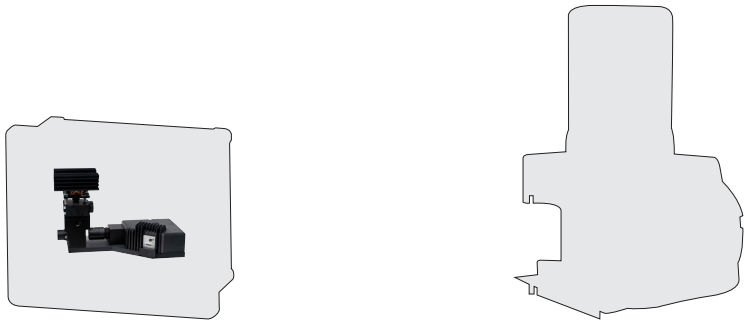


Figure 6 Dimensions comparison - GEDRA on the left; a gas chromatograph on the right

Both instruments quantify the main components of **natural gas, H_2 blending and biomethane**, calculating calorific values and other quantities according to ISO 6976:2016.

Gas chromatography uses separation techniques of the mixture at low pressure using carrier gas (such as He or Ar). Different chemical species reach the detector at different times, which quantify each component of the mixture.

GEDRA uses a technique that provides an **instantaneous image of the gas mixture** without the need to reduce pressure or use a carrier gas. When a laser is directed onto the gas sample, the light is scattered, some of which has a unique characteristic closely linked to the gas composition, Raman frequencies, similar to a fingerprint. GEDRA is able to detect these frequencies of main components of the gas mixture. These signals are then separated, analysed and used to calculate the concentrations of the components.

GEDRA provides a **good balance between accuracy, sensitivity and response**, needs only a power supply and avoids the use of carrier gases.

	GEDRA	Micro GC	GC
Measurement principle	Raman spectroscopy	Gas chromatography	Gas chromatography
CAPEX	medium	medium	high
OPEX	low	variable	high
Accuracy (OIML R 140)	class A (0.5 %)	class A (0.5%)	class A (0.1 %)
Operating pressure	up to 1.6 MPa up to 16 barg	up to 0.4 MPa up to 4 barg	up to 0.4 MPa up to 4 barg
Power consumption	medium	medium	high
Response time	1 min	< 3 min	5 min

Table 3 Technology comparison

Operation and **maintenance**

Particulate filters to be replaced during periodic maintenance or when clogged

The laser source estimated minimum life is 40,000 hours (equivalent to approximately 3.5 years with every 15 min measuring cycle and 0.5 MPa (5 barg) of operating pressure)

O-ring every 6 years

GEDRA approvals

GEDRA is designed according to UNI 9167-3 and UNI 1776.
Calorific values and other quantities are calculated according to ISO 6976:2016.
The product is certified according to European Directives 2014/34/EU (ATEX) (pending), 2004/22/CE (EMC) (pending), 2014/35/EU (LVD) (pending), OIML R140 and European Directive 2004/22/CE (WELLMEC 7.2) (pending).

UNI 9167-3 | UNI 1776 | ISO 6976:2016 | ATEX | OIML R 140 | EMC | LVD

Field connections

GEDRA is divided in two modules:

- The **Acquisition Module (AM)** performs the measurement and send the results to the Interface Module (IM). It can be equipped with a pneumatic panel with integrated pressure regulators, according to the use case.
- The **Interface Module (IM)** provides Human-Machine Interface (HMI), remote communication and power supply for the Acquisition Module (AM).

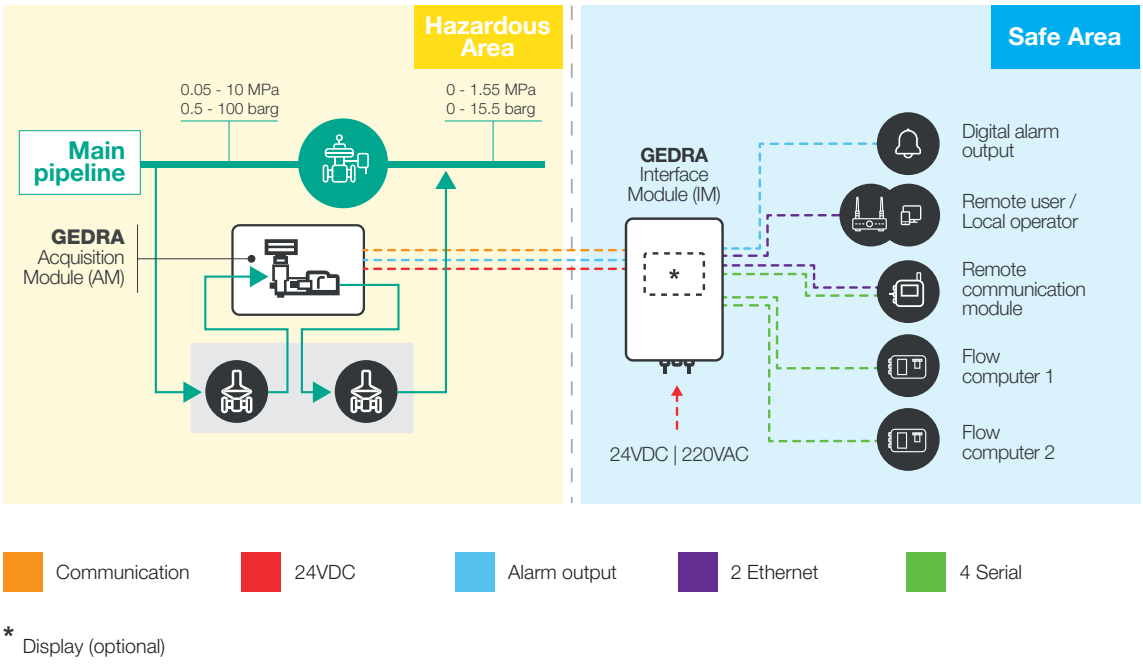


Figure 7 GEDRA field connection scheme

Weights and Dimensions

GEDRA acquisition module for hazardous area

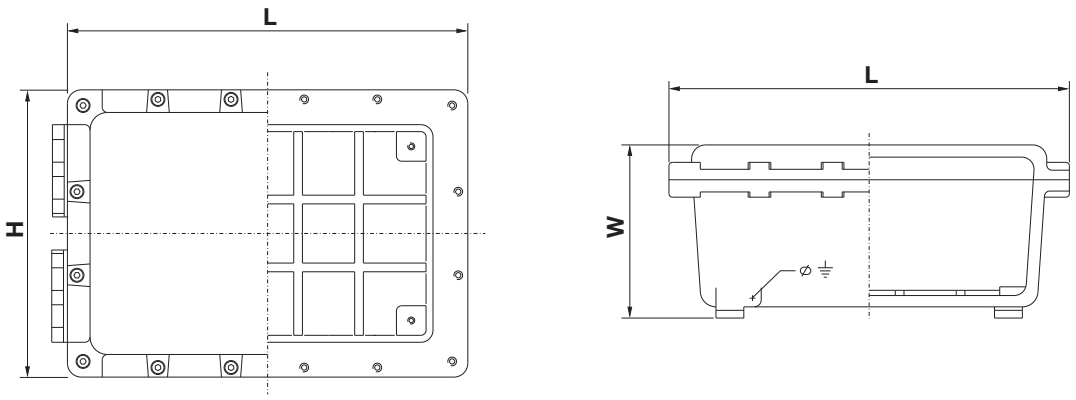


Figure 8 GEDRA (acquisition module for hazardous area) dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)		
	[mm]	inches
H	440	17.3”
L	640	25.2”
W	278	10.9”
Weight	Kg	lbs
	65	143.3

Table 4 Weights and dimensions

GEDRA interface module for safe area

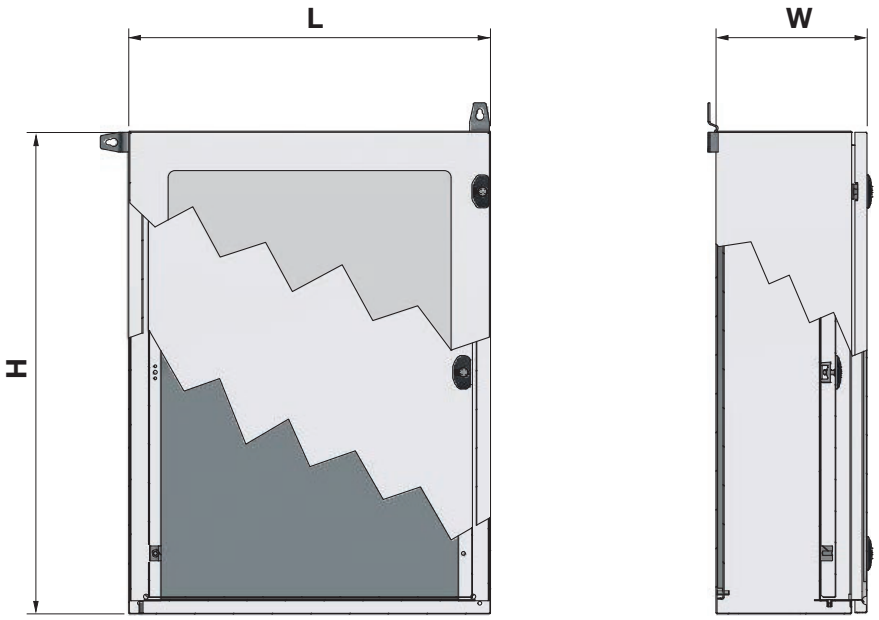


Figure 9 GEDRA (interface module for safe area) dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)		
	[mm]	inches
H	500	19.7”
L	400	15.7”
W	200	7.9”
Weight	Kg	lbs
	15	33.1

Table 5 Weights and dimensions

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