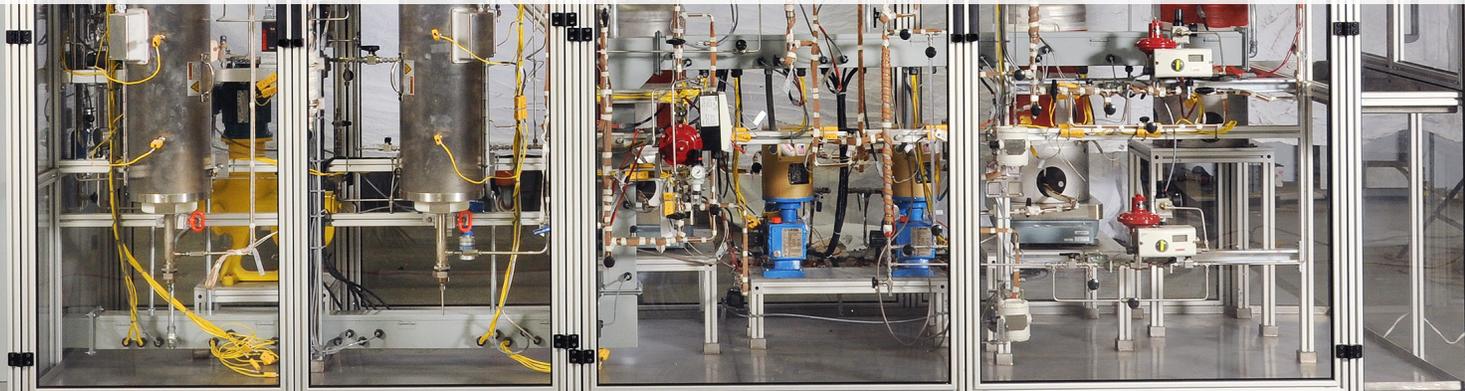


uniteltechnologies

Your Partner in the Pursuit of Process Innovations



OCTAVE: Catalyst Research System.....

How good is your catalyst?

There is only one way to tell. You must generate and evaluate accurate performance data: activity, conversion, selectivity, deactivation rates, longevity, regeneration, attrition and ruggedness.

The CRS/Octave is the most powerful and versatile catalyst test platform in the market today. Whether it's a short run or an extended 24/7 program, the reliability and repeatability of the Octave are unmatched by any other bench-scale system.

Confirming your catalyst recipe on the Octave test bench is an essential first step before spending millions of dollars on a large pilot- or demo-scale plant.

The basic requirement in the analysis of catalytic reactors is to determine the rate equations. The choice of a suitable reactor for carrying out experiments under conditions where meaningful kinetic rate expressions can be obtained is of great importance.

This is particularly true of catalytic reactions in which considerations such as external and pore diffusional resistances come into play.

In addition, radial and axial transport effects must also be accounted for. Therefore, the choice of an appropriate laboratory catalytic reactor is of critical importance.



Octave Levenspiel

Dr. Seuss of Chemical Engineering

The Catalyst Testing System/Octave is named in honor of Octave Levenspiel, Emeritus Professor of Chemical Engineering at Oregon State University.

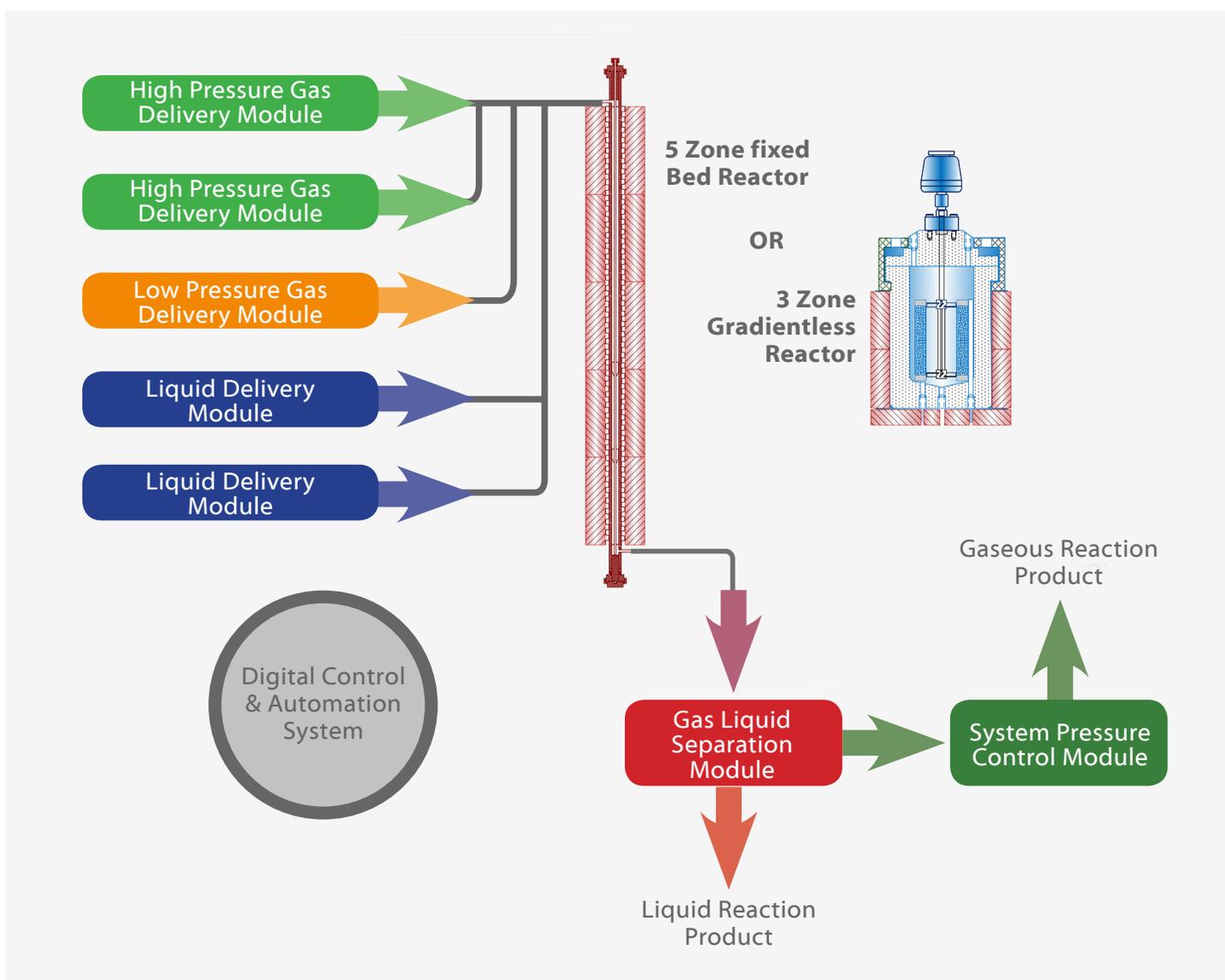
Getting a head start on research is critical. In the R&D business, you're always fighting time... the pressure to be the first in the market with a new product, the demands of analyzing catalyst performance, and the need to develop a new process are all urgent considerations.

Get your research off to a quick start with a high performance, general purpose reaction system

from Unitel. The Octave is the most cost-effective tool in the world today for catalyst and process research. Depending upon your needs, you can choose between three different types of reactors. With its unattended operation and exceptionally tight mass balance, the Octave will give you the competitive edge that you are looking for.



OCTAVE: SYSTEM CONFIGURATION



Features & Options

- Configured to maximize the experimental operating envelope.
- High pressure gas delivery module: pressure regulator, thermal mass flow controller, differential pressure regulator for maintaining constant pressure across the flow controller, all enabling a wide turndown range with a single flow control valve.
- Liquid delivery module: feed storage & weight monitoring, scale accuracy 0.1 gram, high pressure pump equipped with shutoff & safety devices.
- Nitrogen delivery module: low pressure gas for flushing and inert blanketing. Inert blanketing helps maintain constant pump suction conditions ensuring accuracy regardless of the height of the

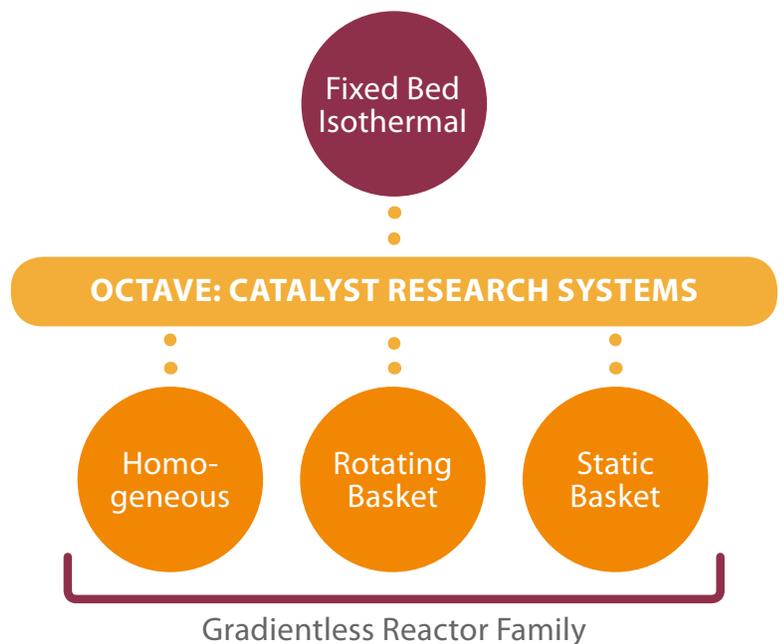
liquid in the feed tank.

- Gas-liquid separation module: gas cooler/condenser, gas liquid separator, automatic liquid level control, product day storage with weight monitoring.
- System pressure control module: features a two-stage pressure control system – manual pressure regulator followed by an automatic pressure control valve. This configuration enables excellent control because the automated valve is buffered from reactor pressure variations. Additionally, a wide turndown range can be achieved with a single control valve. Gas flow rate monitoring, automatic sample stream control, automatic emergency pressure let down.

The basic Octave system is offered in two reactor configurations to meet the challenge of a wide array of technical applications.



One option includes a fixed bed reactor mounted in an electrically heated isothermal furnace. For back-mixed homogeneous or heterogeneous studies, we offer the Spectrum reactor. By simply changing its internals, you can operate in three different modes: homogeneous, kinetic basket or static basket.



Spectrum Gradientless Reactor



- Reaction is free of diffusional falsification
- Pure rates can be readily determined since the rate equation is very simple:

r: Global Rate of Reaction
C_{in}: Inlet Concentration
C_{out}: Outlet Concentration
V: Catalyst Volume
F: Volumetric Feed Rate

$$r = \frac{C_{in} - C_{out}}{V/F}$$

- Magnetically driven agitator
- Simple reactor closure
- Material of construction: 316 SS
- Reactor furnace: electrically heated
- Number of zones: 3

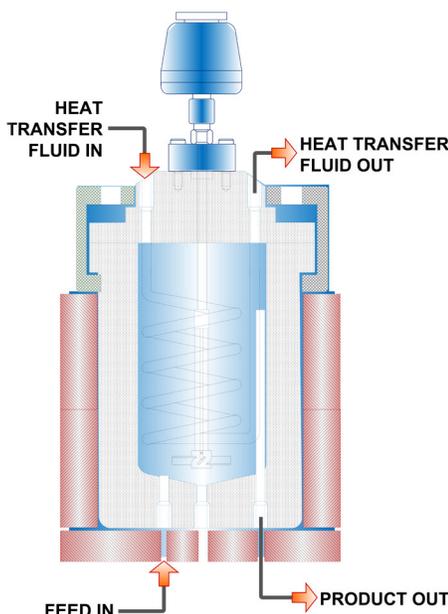
Fixed Bed Isothermal Reactor



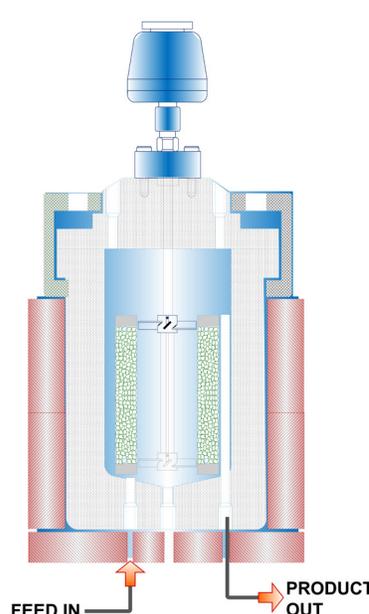
- Low torque bubble type closures
- Leak free o-ring seals
- Unlimited make & break capabilities
- Material of construction: 316 SS
- Reactor furnace: split electrically heated
- Number of zones: 5



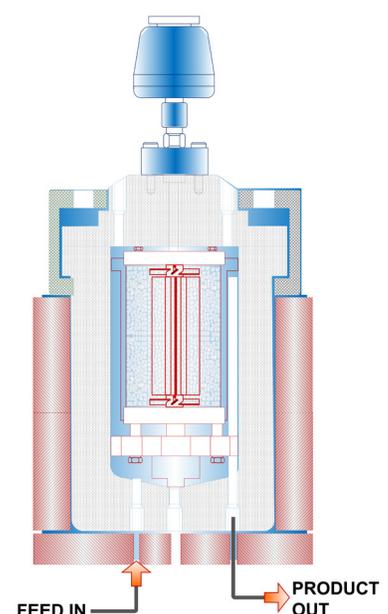
Interchangeable Spectrum Configurations



HOMOGENEOUS CONFIGURATION



KINETIC BASKET CONFIGURATION



STATIC BASKET CONFIGURATION

OCTAVE: SYSTEM SPECIFICATIONS

Option 1: Packed tube reactor

Nominal catalyst charge ...50 mL

Nominal reactor volume...500 mL

Operation modeDownflow

Electric furnace5 zone
isothermal

Option 2: Gradientless reactor

Nominal catalyst charge ...50 mL

Nominal reactor volume...250 mL

Electric furnace3 zone isothermal

Reactor internals

- Static basket for light & heavy liquid/gas reactions
- Kinetic basket for light liquid/gas or gas-gas reactions
- Slurry reactions
- Homogeneous reactions

Maximum system pressure	100 barg (1,450 psig) or 200 barg (2,900 psig)
Maximum reactor temperature	500°C (approx. 950°F)
High pressure gas delivery modules	Two (2)
High pressure gas flow rate	50-1,200 SLPH
Gas flow rate, accuracy	±1% of full scale
Low pressure nitrogen	One (1)
Liquid delivery module	Two (2)
Liquid feed rate, standard	3-600 mL/hr
Liquid feed rate, accuracy	±0.5% of rate
Liquid feed rate, optional*	0.6-300 mL/hr
Pressure control module, accuracy	±0.5% of full scale
Effluent gas measurement, accuracy	±0.25% of full scale
Standard materials of construction	316 SS

Option: One of the liquid delivery modules can be heat traced up to 150°C.

* *interchangeable pump head*

If you are interested in learning more about **Octave Catalyst Research Systems**, please contact Unitel Technologies:

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