

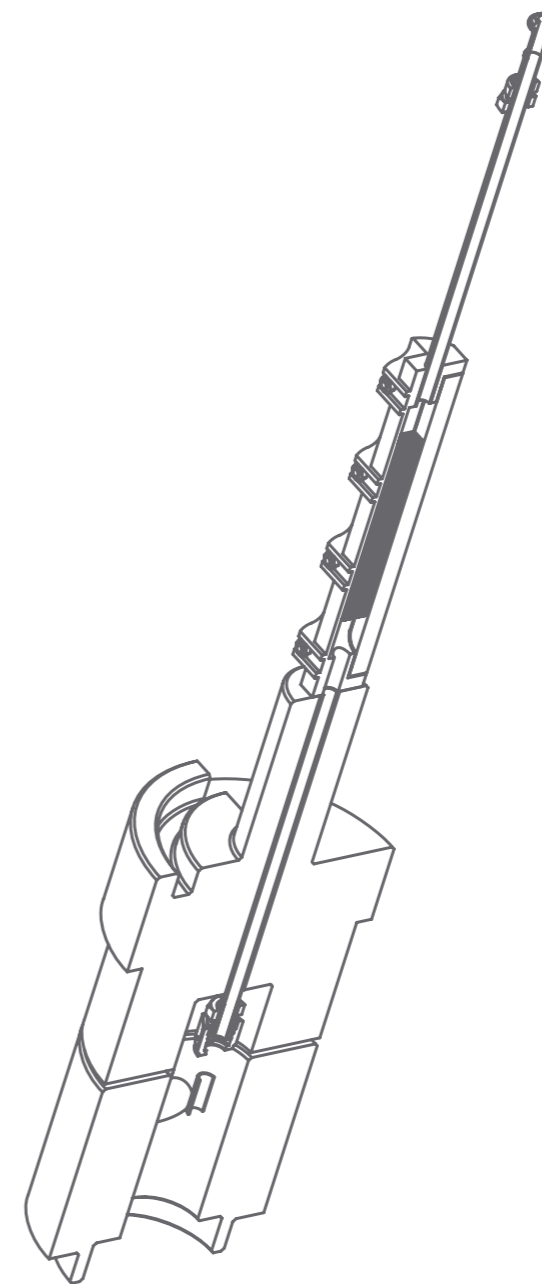
**SPHYNX**  
Quality Monitoring  
of Automotive  
Catalysts



Product Information

**SPHYNX**  
Quality Monitoring  
of Automotive  
Catalysts

SPHYNX  
strap your production process  
ensure product quality



**Designed for**

- *Screening of Catalyst Monoliths under Automotive Exhaust Gas Conditions*
- *Reproducibility and Quality Monitoring*
- *Processoptimisation in Automotive Catalyst Production*

**... unattended and automated 24/7 operation**

## Introduction

SPHYNX allows automated parallel testing and quality monitoring of automotive catalyst monoliths. A parallel reactor rig in combination with downstream online analysis shortens test cycle time by an order of magnitude comparing to standard manual tests and guarantees reliability and reproducibility in catalyst manufacturing processes. Extensive data logging and recording capability based on calibrated built-in measuring of all relevant process parameters ensures compliance to automotive industry standards in product quality. The system performs activity and selectivity tests of representative catalyst monoliths according to predefined, reproducible test programs. Variables such as temperature, space velocity and gas concentrations can be programmed and varied. An additional function allows a controlled and fully automated adjustment of the reaction parameters.

The parameters which affect the catalytic reaction are precisely logged and controlled by the system, guaranteeing reliable test results under the same conditions from sample to sample.

The SPHYNX system includes two to eight reactors, the media supply periphery, the control module consisting of PLC and a PC for experiment design, scheduling and data management. The system is linked to an external third-party equipment for online analysis. A feature of the equipment is the ability to monitor and integrate analytical results and change the process conditions (e.g. flow rate) respectively. Analytical results are matched to the sample ID numbers and correlated with the process parameters in the system process log database. An export function enables the generation of a clearly arranged \*.csv file including all necessary information about the test (sample number, reaction parameter, analytical results ...)

## Applications

The system can be programmed to cover a wide range of applications and reaction conditions. One example is tests of catalysts with SCR reactions. In combination with an external analysis device (e.g. FT-IR, mass spec.) the system can be used for quality control in catalyst production but also for the verification of the characteristics of newly developed catalysts. It is therefore a highly productive tool for both R&D and production quality management.

## System

### Gas & Liquid Feed Supply

Each reactor module has an independent medium supply. The gas feed through the reaction chamber can be mixed using up to 10 gas lines. The concentration of the gas mix can be set and adjusted automatically using individual electronic flow controller for each gas line. The gas feed can further be mixed with steam in different concentrations using a separate liquid vaporiser for each reaction module. This arrangement guarantees highly accurate flows. An installed cooler and condenser installed downstream the reactors separates the liquid waste from the gaseous waste.

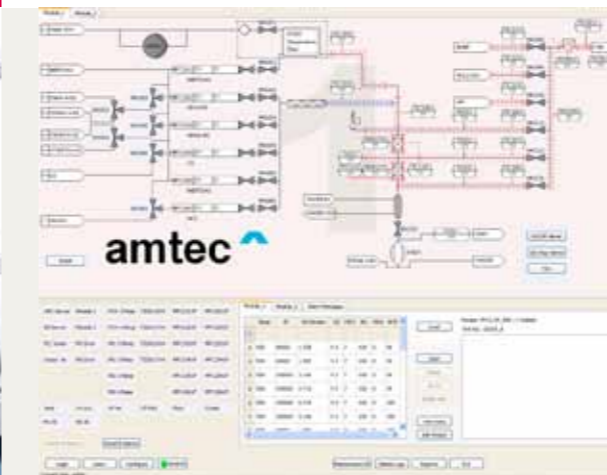
### Heating & Temperature Control

The reaction chamber with the catalyst monolith can be heated using different oven concepts. Either an electrical furnace or an IR furnace for fast heating (up to 50 K·min<sup>-1</sup>) and cooling can be applied. Gas preheating is installed to ensure uniform and isothermal gas flow conditions before entering the reactor chamber.

All gas lines towards and from the reactor chamber and to the analysis devices are electrically heated to prevent condensation. Temperature is measured inside the reactor directly at the catalyst monolith. For temperature measurement N-type thermocouples are used.

# SPHYNX Quality Monitoring of Automotive Catalysts

*SPHYNX – Reactor System  
for Parallel Testing of Catalyst  
Monoliths under Real Exhaust  
Gas Conditions*



## Specifications

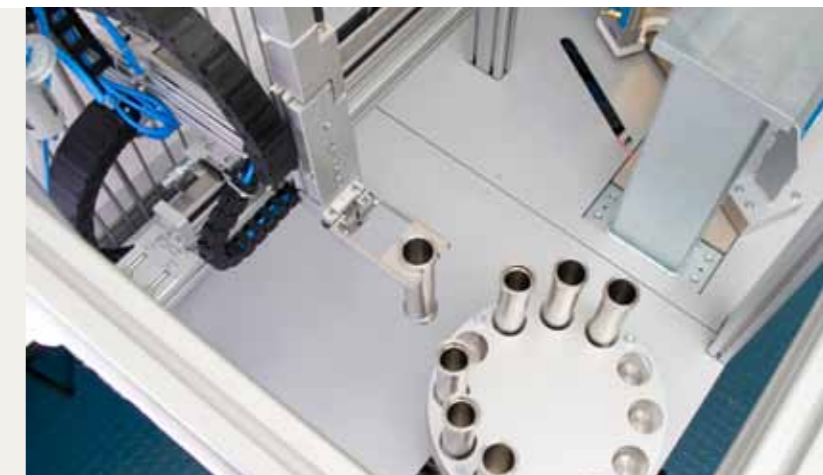
The specifications presented are for the standard model, other systems can be built on request for specific applications.

### System Specifications

- > Restek® coated stainless steel or Nicrofer reactor
- > Maximum operating temperature 750°C
- > Working pressure: atmospheric
- > Maximum monolith size: 150 mm length x 28 mm width, 35 mm diameter
- > Up to 15 different gases can be mixed
- > Maximum wet gas flow rate 100 l/min
- > Liquid flow rate 10 ml/min per reactor
- > Other flow ranges and operating limits on request

### Dimensions & Supplies Required

- > Up to 6 samples can be tested automatically
- > Single Reactor module: 900 x 1000 x 2000 mm (Width x Depth x Height)
- > Control Module: 900 x 1000 x 2000 mm (Width x Depth x Height)



### Reactors

The reactors are made from stainless steel or Inconel and are optionally coated with a Sulfinert Restek® coating to prevent self reaction in case of SCR reactions. The reactors allow catalytic tests on samples with a maximum length of 140 mm and a maximum diameter of 28 mm. For easy handling the reactors are closed with screws and sealed with circular graphite seals. With this configuration samples can be tested up to temperatures of 750 °C.

### Analysis

A branch before preheating, before and after the reactor, is connected to the external analysis device. Each line is heated and equipped with a fully automated valve.

Using one common analysis device gas streams from up to 4 reactors are fed controlled to common analysis device according to a predefined flexible sequence. The analysis procedure is automatically optimised to minimise the total cycle time using the analysis configuration tool. Sample information and results from most analysis devices can be integrated within the process log database.

### Data Management & Automation

The entire system is controlled via a PLC in combination with a control PC for visualisation, experiment selection and manual control. The graphical user interface allows manual operation and visual depiction of the system status. A scheduling tool is provided for experimental planning, the specific experimental subroutines can be adapted to meet the specific application requirements. Process and sample data are stored in a MySQL database. Analysis results from most analysis devices can be imported and matched to sample data. All process parameters can be viewed in tabular and graphical form during experiments. System status can be remotely monitored via a LAN connection using a standard web browser. All results can be exported.

### Safety

A programmable safety PLC is integrated within the system to manage alarms. Multiple alarm classes are featured, and the alarm settings and responses can be adapted to meet on-site safety regulations.