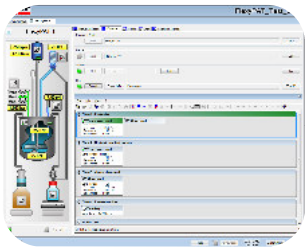
FlexyPAT

Covers all your automation needs

FlexyPAT stands for a modular and flexible process automation technology (PAT). In addition to customised all-in-one solutions, the modular concept facilitates the integration of existing customer-owned hardware. Not only does this reduce the cost but it also speeds up the automation process and increases user acceptance.

Your advantages

- Maximum possible availability for use thanks to intelligent interfacing
- Perfect for "on-demand" use thanks to plug & play philosophy
- Existing devices can be integrated
- Forward-looking thanks to easy, economically priced expansion options
- Up to 6 reactors can be controlled via a single PC



Typical areas of application

- Process development
- Process engineering
- Process Analytical Technology (PAT)
- Scale-up/Scale-down
- Kilo-lab/small-scale production
- Morphology
- Thermal-physical process technology

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The Tool

Turn-key

A standardised, automated lab reactor is also available as a product-based turn-key system (process automation tool) that is also ideally suited for use as an "on-demand" solution in rotating laboratories – for rotating users.

System Components

The FlexyPAT as a turn-key product contains the following components:

- Reactor frame with integrated electronics and docking mechanism for the mobile sub-frame
- FlexySys application software with basic functionality
- Computer with Windows 7 and MS Office [1]
- Mobile sub-frame for use in a floor-standing cubicle or for transport [1]
- 1 litre double-jacketed reactor, glass, complete [2]
- Heating/cooling thermostat for –20°C to 200°C, complete [2]
- Stirrer motor up to 2000 rpm [2]
- One function set for gravimetric metered addition, with pump and balance [2]

Applications

- Process development
- Process engineering
- Process Analytical Technology (PAT)
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[1] optional
[2] other ranges/volumes/materials on request

The Technology

Customized

FlexyPAT is a modular process automation technology that enables automated customer-specific lab reactor systems to be implemented in a very cost-effective manner, including with the integration of existing devices.

Functions/Options

- Temperature regulation, jacket or reactor
- Stirrer revolution speed measurement and regulation
- Stirrer torque measurement
- Gravimetric or volumetric controlled addition
- pH measurement and control
- Meticulous logging
- Automatic distillation with reflux divider and boiling point detection [1]
- Pressure/vacuum measurement and control [1]
- Hydrogenation function [1]
- Isothermal heat flow calorimetry [1]
- Automatic solubility curve calculation [1]
- Option to integrate online sensors (turbidity measurement, midIR FTIR, particle size measuring device, etc.) [1]

Modules

- UVM universal module
- 8x universal plug-in slot space for measuring input of temperature, voltage and current or measuring output of voltage, current, digital On/Off
- COM communication module
- 4x RS232 connections to communicate with peripheral devices
- NET network module
- 5x network connections for 10/100M Ethernet
- PSM power supply module

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Layouts

FlexyPAT Caddy as bench-top model

Operation using a tablet (Wi-Fi)

FlexyPAT Trolley

FlexyPAT modules

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FlexyPAT - the advantages

Smart Interfacing

FlexyPAT uses „$F_{connect}$“ connection technology. Its intelligent sensor identification function makes it easy to connect the required sensors and enables the universal use of the available inputs/outputs – a philosophy of high cost-efficiency combined with a high level of user-friendliness.

User-Friendly

The basic functions can be expanded in a great variety of ways

- A customer-specific, cost-efficient solution thanks to its modular concept
- A secure, forward-looking investment thanks to expandability at any time
- User-friendly thanks to built-in intelligent interfacing using „$F_{connect}$“

FlexyPAT Tool - technical specifications

Supply voltage	100 – 240V ±10%, 50 – 60Hz
Power consumption (max.)	2,400W (10A)
Power capacity (provided for stirrer, metered addition, scales, etc.)	2,000W
Temperature range	10 – 35°C
Humidity	80% (non-condensing)
Protection class	IP44
Surface finish	stainless electro-polished/powder-coated
Dimensions of FlexyPAT Tool (excl. mobile trolley)	550 mm (W) x 835 mm[1] (H) x 500 mm (D)
Weight	30 kg (depends on expansion stage)
Measuring input, temperature	x4, resolution 0.01 K, range −150°C – 400°C
Measuring input, voltage	x8[2], resolution 25 mV, range 0 – 10 V
Measuring input, current	x8[2], resolution 50 mA, range 0 (4) – 20 mA
Control output, voltage	x8[2], resolution 25 mV, range 0 –10 V
Control output, current	x8[2], resolution 50 mA, range 0 (4) – 20 mA
Control output, digital On/Off	x8[2], 24V, 2A
FlexyBUS expansion connections	x2
Network connections for 10/100M Ethernet	x2, RJ45, for CAT 5e cable
RS-232 connections (to communicate with stirrer, thermostat, scales, etc.)	x4

[1] Arch height and suspension mast can be dismantled if necessary, lower heights also available

[2] Two measuring inputs for current and voltage and three control outputs for current, voltage and “digital On/Off” are available for each socket. The number of inputs and outputs actually accessible when using preassembled cables (recommended) is smaller.

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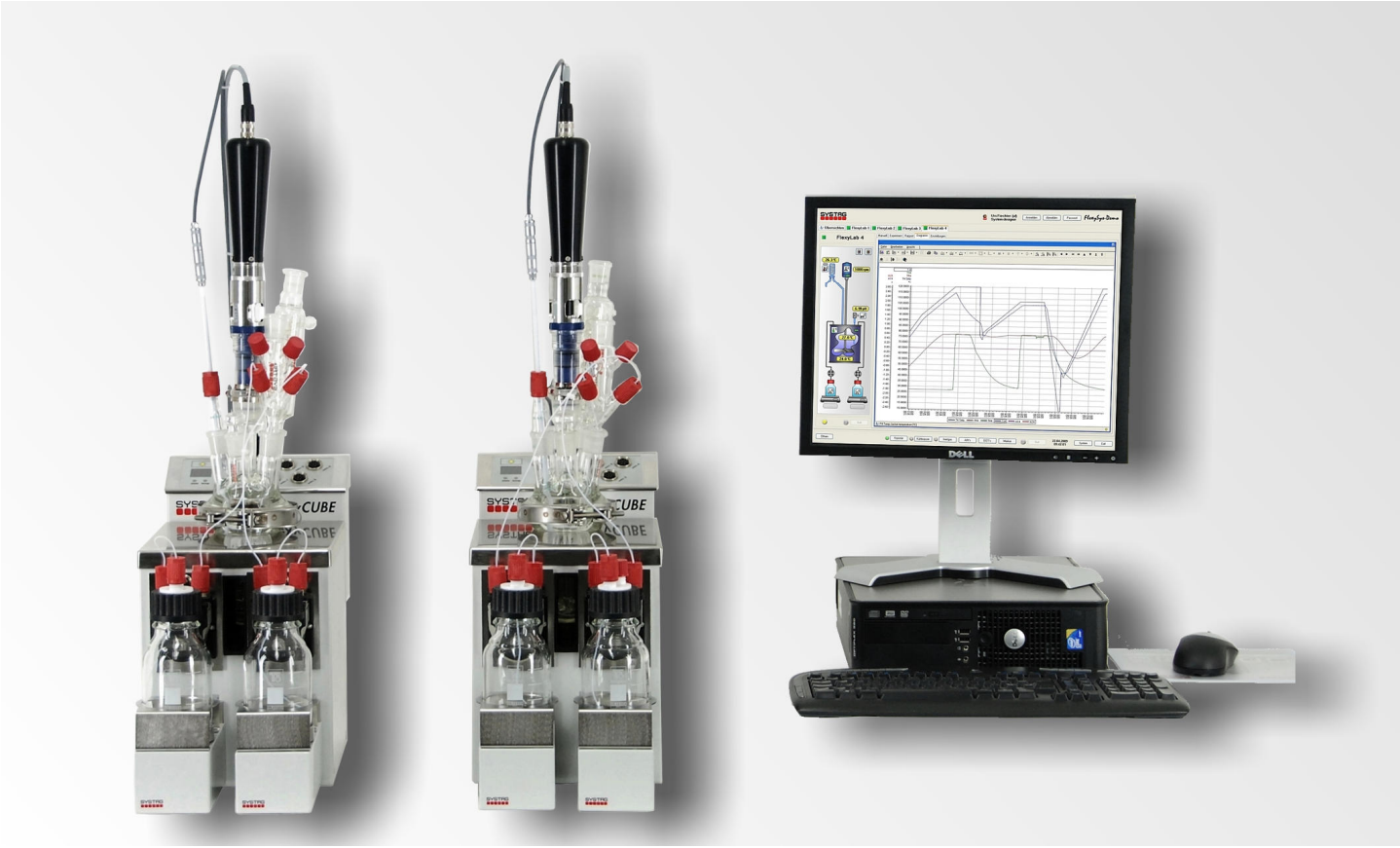
FlexyCUBE

The Modular Tool Tailored to Suit any Laboratory Automation Needs



Parallel Process Development

- High reproducibility and productivity, ideally suited for DoE (Design of Experiments)
- Operation resembling production environment, as required for Scale-Up and Scale-Down
- User friendly operation due to intuitive user interface
- High modularity, offering competitive pricing and allowing for demand-oriented use
- Configurable in the type and number of dosages used
- High acceptance through the use of Plug & Play technology
- Sophisticated fault diagnosis enables fast and efficient support
- A maximum temperature range is achieved by using a refrigerated circulator

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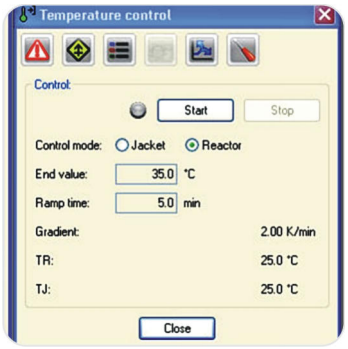
FlexyCUBE

Reactor opening, designed for a single-walled vessel. Behind the interface panel and status display

FlexyCUBE operating with a single peristaltic pump, used for volumetric dosage

FlexyCUBE operating with one each pump and balance, allowing gravimetric dosage



Manual operation, for example temperature control

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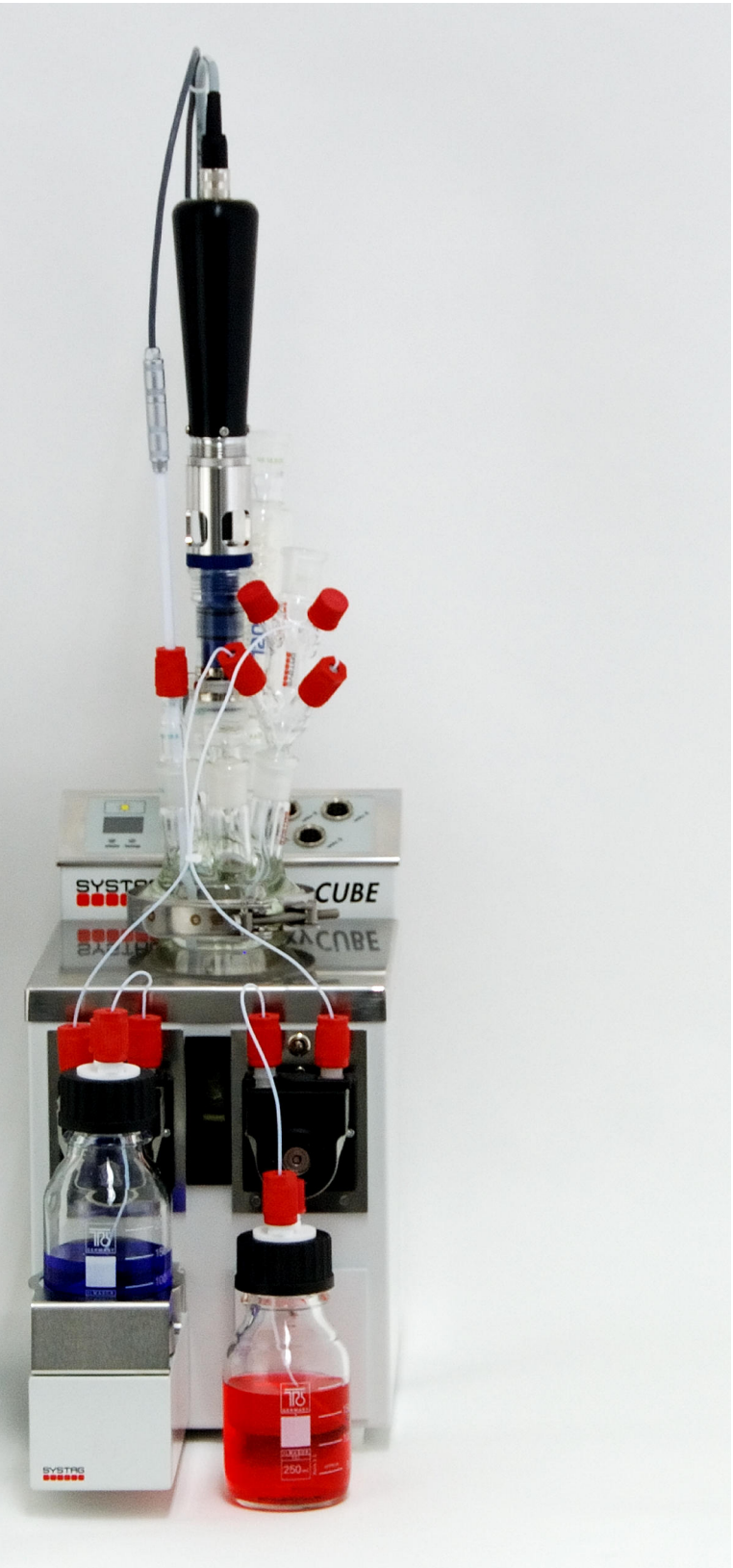
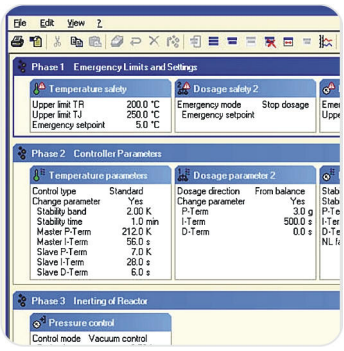
at a Glance



Rear connector panel: PC networking (top), auxiliary devices, i.e solenoid valves for cooling water and purge gas (middle), mains power and switch (bottom)

Reactor illumination and inspection opening, enabling an unobstructed view into the reactor

Convenient reactor handling; simply place the reactor assembly into the receptacle provided



Recipe controlled automation of experiments

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FlexyCUBE - Key Advantages

The new Concept for Chemical Process Development

- 1 PC controls up to 6 reactor units
- Parallel (DoE) or individual operation
- Compact and space-saving design
- Intuitive operation through manual mode
- Includes all necessary tools and functions to enable the user to simulate complex processes
- Definition of SOPs (Standard Operation Procedures)
- Consistent and automatic journaling, compatible with MS-Word® or Excel® (csv format)
- Integrated calibration tools help safeguarding quality-relevant signals
- Alarm and event recording to assist service & support
- Remote support through internet

Functionality

- Reactor or jacket based temperature control
- Gravimetric dosage(s) through the use of balance, pump and/or solenoid valve
- Single-sided (standard) or double-sided* pH control, with or without mass detection
- Autom. distillation, based on detection of boiling point*
- Autom. pressure-vacuum-vent control*
- Automatically establish solubility properties through clarity or turbidity measurement*
- Isothermal heat flow calorimetry for thermal process optimisation*
- Pressure range from 10 mbar .... 100 bar*

* optional

FlexyCUBE - Product Specification

Reactor(s)	Volume	250 ml (70, 100 or 400 ml optional); 6 bar glass or 100 bar SS optional
	Material	Borosilicate glass, 6 bar or 100 bar SS/Hastelloy optional
	Reactor Lid Tapers	NS29 for stirrer, NS19 for each of the following items: temperature sensor, pH sensor, pressure sensor, reflux cooler and dosage adaptor with 4 GL14 connectors
	Temperature Range	-80°C to +280°C
	Heating	Electric heater 230 VAC, 500 W
	Cooling	By means of refrigerated circulator, shared among all reactors
	Stirrer	Speed controlled, 80 to 650rpm/200-1600rpm, 10 Ncm (fast transmission) or 35 Ncm (slow)
	Equipment Venting	Using dry air or nitrogen through connectors provided at the rear of the unit
	Equipment Cooling (Surfaces)	Cooling water, 20 l/h; incl. reflux coolers, all units daisy-chained
In-/Outputs	Types (number)	Pt-100 (2x), 4-20 mA (4x), 24 VDC (2x)
	Measurement	TR, TH, pH, pressure/vacuum ... with automatic recognition of sensor and units
	Actuators	Cooling water and purging gas solenoid valves
	Balances	Max. weight 2000 g, 0.1 g resolution
Dosages	Number / type of dosage	Max. 2 per FlexyCUBE, alternatively with pump or valve, with balance or w/o (=volumetric)
	Dosage pump	Electronically controlled peristaltic pump, ranging from 0...100 %
	Dosage rate	Flow depending on tube dia., max. 250 ml/h
	Dosage tubes	Material: Silicon, Viton, Novoprene (standard), Chemsure (PTFE-like)
Control Unit	Electronic	Built-in electronics, no additional interface hardware required
	Network	LAN interface, either directly from PC or through switch
	Expansion modules	Universal I/O-modules, RS-232 interface, Calorimetry, etc. can be connected at rear of FlexyCUBE
PC Software	Operating system	Windows XP, Windows 7/8, MS-Office
	Application	FlexySys Rel. 2.x / Release 3.x, SysGraph
Techn. Specification	Ambient temperature	10°C...35°C
	Power input	230 VAC, 5 A, 50/60 Hz, single phase
	Power input / unit	Single phase, 600 VA
	Dimensions and weight	330 (height) x 200 (width) x 340 (depth) mm, approx. 20 kg. Depth with pump only: 395 mm, depth with pump and balance: 490 mm

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