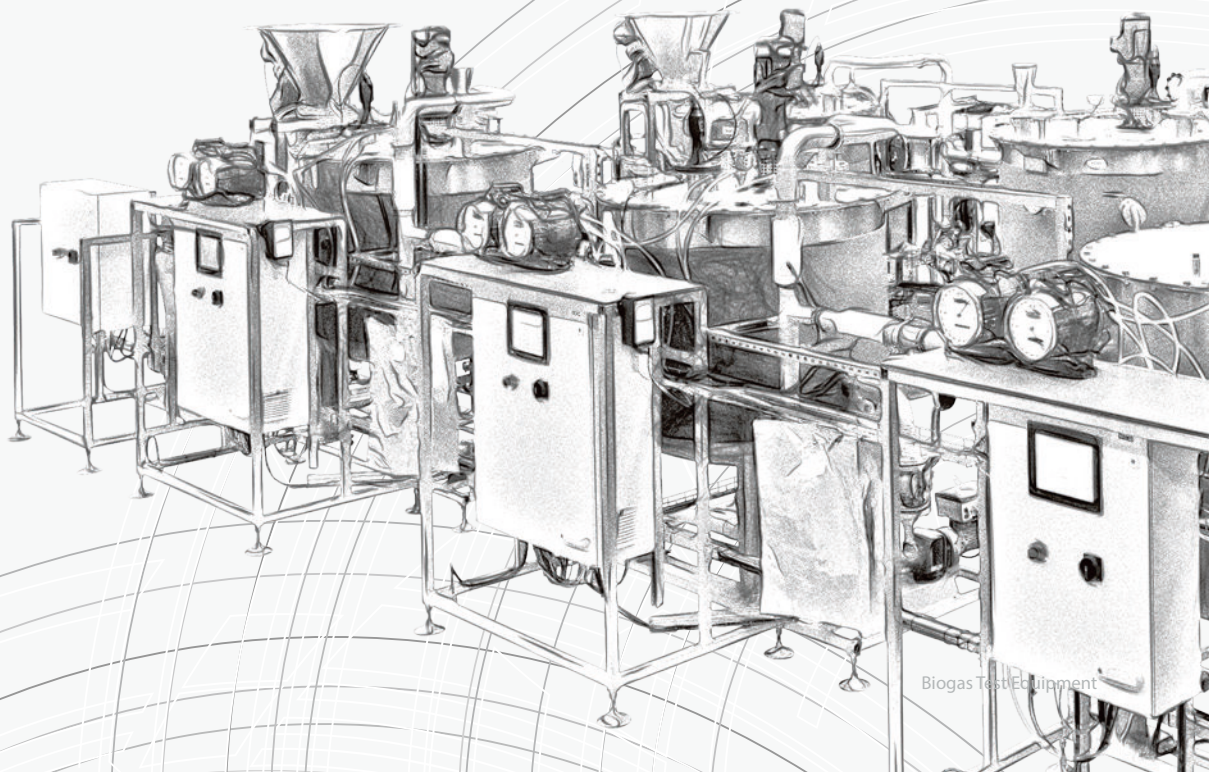


„We have what it takes...
from Laboratory plants to Pilot plants“

**BIOREACTOR PLANTS
& BIOGAS TEST PLANTS**



INNOVATIVE BIOREACTORS AND BIOGAS TEST EQUIPMENT

Umwelt- und Ingenieurtechnik GmbH Dresden (UIT) is a German manufacturer and supplier of Bioreactors and Biogas Test Equipment and provides also various environmental monitoring solutions.

With the focus to provide **high quality** and reliable equipment we are helping to **optimize processes** for biogas plant operations and provide useful tools for **biogas analysis, research and development** with the goal to optimize digester operation and maximize methane production.

As a classic engineering company with own production facilities we are in position to provide standard equipment, but also custom-made bioreactors and biogas test systems that is specific to your technical requirements and within your budget and your timeline.

UIT Bioreactors and Biogas Test Equipment is made in Dresden, Germany. We produce all systems according to highest level of quality and ship it to our customers worldwide.

DETERMINATION OF BIOGAS POTENTIAL

Our laboratory-based Test Plants determine the potential biogas output of fermentation substrates in several modes. Depending on the design the test plant comes with a **bioreactor made of glass** in a cylindrical shape and **different working volumes**.

Sensors for temperature control and measurement of pH as well as gas amount, speed and torque of mixer (other parameters on request) provide important information to the **Data Acquisition System SENSOcontrol**.

The plastic top cover provides ports in different sizes to take all standard electrodes and fittings for sampling or feeding.

The gas quantity is measured through a high quality gas drum meter.

In addition to our basic systems we provide a more complex version which additionally includes a **central gas analysis module**.

With this add on module we supply an option for the **online analysis** of gas composition of **methane, carbon dioxide, oxygen, hydrosulfide and hydrogen**.

Because of its **modular design** the number of reactors and therefore the total working volume is flexible and, optionally, it can be upgraded with further sensors to monitor other parameters.

Almost any measurable probe can be added at a later time. Our Biogas Test Equipment provides a tailored solution with **integrated gas analysis module** combined with the **flexibility of a rack-mounted modular system**.

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STANDARD AND CUSTOMIZED SOLUTIONS
COMBINED WITH THE FLEXIBILITY OF A MODULAR SYSTEM

BIOGAS TEST PLANT



BTP 2

Standardized and customized lab test facilities for biogas research, product development (enzymes, nutrients), process optimization and biotechnology.

We deliver test plants of 5 liter reactor volume up to 1,000 liter reactor volume with different range of measurement and control equipment.

THE PERFECT ENTRY MODEL

BTP 2

The biogas pilot plant BTP2 is the base system for substrate testing and gas potential tests.

Furthermore, this system is ideally suited for product development (enzymes, nutrients) or for process optimization.

This system is characterized by an extensive basic equipment, e.g. SENSOcontrol or optional pumps for feeding or control of pH.

Available standard bioreactor sizes

Volume 5l – AD 200*9*250 mm/ gross volume 6,5 l
Volume 15l – AD 270*9*350 mm/ gross volume 17,44 l
Volume 30l – AD 325*9*450 mm/ gross volume 33,3 l
Volume 60l – AD 420*9,5*550 mm/ gross volume 69,8 l
Other sizes on request

BTP 2

BTP 2

FEATURES

- Glass reactor with different working volume
- Continuous operation with AUTO feeding
- Electrical heating
- Two level stirrer with gastight shaft
- Dosage pumps for pH-control
- Gas bag to collect gas samples
- Measurement equipment
 - Gas quantity
 - pH/ Redox / temperature
- SENSOcontrol with touch panel
- Optional accessories listed



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COMBINING A BASIC PLANT WITH GAS ANALYSES MODULE

BTP 2 ANALYZER

BTP 2 analyzer

FEATURES

- Glass reactor with different working volume
- Continuous operation with AUTO feeding
- Electrical heating
- Two level stirrer with gastight shaft
- Dosage pumps for pH-control
- Gas bag to collect gas samples
- Measurement equipment
 - Gas quantity
 - pH / Redox / temperature
 - gas quality measurement system
- SENSOcontrol with touch panel
- Optional accessories listed



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BTP 2 analyzer

The biogas pilot plant BTP2-analyzer is the first upgrade of BTP2 and is used mainly in research as well as for practical substrate or gas potential tests.

This system is equipped with one gas quality analyzer module. In contrast to the BTP2-control this system is not expandable with additional reactors.

Furthermore, this system is ideally suited for research, product development (enzymes, nutrients) or for process optimization.

BTP 2 volumes 90 - 1000 l

Available standard bioreactor sizes – made in stainless steel

Volume 80 l – ID 474 * 3 * 545 mm (h) / gross volume 96 l
Volume 120 l – ID 520 * 3 * 700 mm (h) / gross volume 148 l
Volume 150 l – ID 640 * 3 * 554 mm (h) / gross volume 177 l
Volume 400 l – ID 800 * 3 * 1000 mm (h) / gross volume 502 l
Volume 1000 l – ID 1200 * 3 * 1150 mm (h) / gross volume 1300 l
with torospherical bottom (only volume 1000 l)



Reactor – volume 400 litre
shown without rack

Reactor volume 90 litre
with rack and additional balances

Standardized and customized bioreactors lab and pilot test facilities for biogas research, product development (enzymes, nutrients), process optimization and biotechnology application (research and piloting).

We deliver reactor test plants of 5 liter reactor volume up to 1,000 liter reactor volume with different range of measurement and control equipment.

BTP2-control FEATURES

- Stainless steel reactor
- Balance
- Continuous operation with AUTO feeding
- Electrical heating
- Two level stirrer with gastight shaft
- Dosage pumps for pH-control
- Gas bag to collect gas samples
- Measurement equipment:
 - Gas quantity
 - pH/ Redox/ LDO/ temperature
 - gas quality measurement system
- SENSOcontrol with touch panel
- Optional accessories listed



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SENSOcontrol FEATURES

- Display of the actual values
- Storage of data
- Control of
 - Mixer
 - Pump for pH-control
 - Pump for feed and discharge
- Calibration support for sensors
- Calculation of Nm³ of produced biogas
- Touch panel functionality
- Ethernet interface



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DATA ACQUISITION AND CONTROL UNIT

SENSOcontrol



Screenshots

The universal automation system SENSOcontrol is used for data acquisition applications and control of units (pumps, mixer) of the test plant.

A touch panel for intuitive operation is integrated for user-friendly parameter set-up and real time visualization of measured data.

FOR FEED, DISCHARGE AND PH-CONTROL

BTP2-CONTROL with pump modules



BTP2-control with pump modules

The individual BTP modules can also be equipped with pump modules. The pump modules are controlled by the SENSOcontrol units.

BTP2-control
with pump modules

FEATURES

- Tube pumps for pH-control and feeding/ discharge
- Available tube pumps SP 4 and SP 5
- High quality pumps with 6 rolls – SP4/ 3 rolls – SP5
- Suitability of the tube pump SP 5 (feeding/ discharge) depends on the substrate
- Control of tube pumps via SENSOcontrol:
 - Asynchronous time control for feeding and discharge
 - Control system for pH-control
- Basic pump cabinet with doors and individual vessels
- Useable as transfer-pumps for two-stage fermentation tests
- Optional accessories listed



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PUMP MODULES

FEATURES

- pH-control software with the possibility to define the wished pH-value and the control parameters
- feeding control software with the possibility to define the pumping time and the break time (asynchronous time control)
- discharge control software with the possibility to define the pumping time and the break time (asynchronous time control)
- storage of the pumping sequences and vizualization



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SENSO CONTROL FOR PUMP MODULES

PUMP MODULES pH-control • feed • discharge

Modbus



SENSOcontrol

- Touchscreen Display 10,4"
- Industrial-grade
- Compact fanless design
- USB and LAN-Interface
- Stainless steel frame



Tube Pump SP4

- with stepping motor - suitable for asynchronous use
- Number of rolls: 6
- rotational speed control 0,1...100 rpm continuous
- flow rate 0,00014...41,52 ml/min with several tubes
- tube sizes (inner diameter x thickness) 0,13 x 0,9 mm up to 2,79 x 0,85 mm



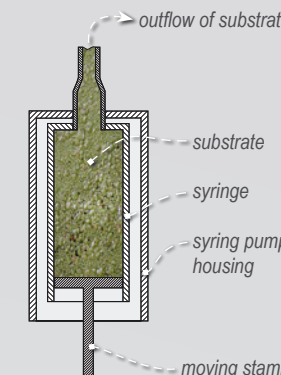
Tube Pump SP5

- with stepping motor - suitable for asynchronous use
- Number of rolls: 3
- rotational speed control 0,1...100 rpm continuous
- flow rate 0,00633...367 ml/min with several tubes
- tube sizes (inner diameter x thickness) 0,8 x 1,6 mm up to 8 x 1,6 mm



Syringe Pump KP250

- Cartridge dimensions: 2,4 liters/ AD 100 mm; L 330 mm
- Inner diameter of outlet 12-20 mm
- Dimensions: 900 x 250 x 150 mm
- Modes: Time setting or Volume flow setting



The universal automation system SENSOcontrol is also used for control of pumps of the test plant. A touch panel for intuitive operation is integrated for user friendly parameter set-up and real time visualization of measured data.

COMBINING UP TO 10 BASIC PLANTS WITH ONLY ONE GAS ANALYSES MODULE

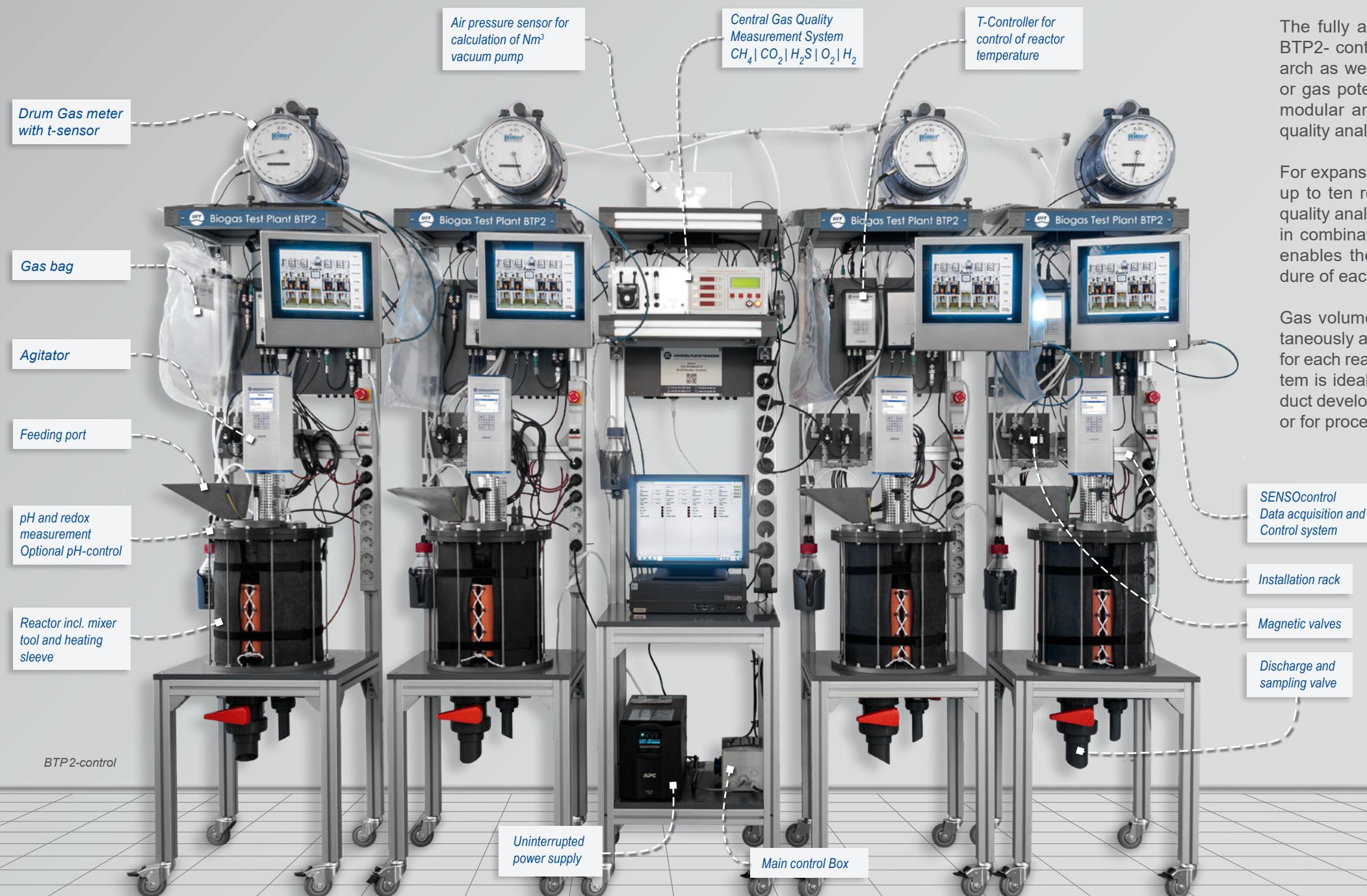
BTP2-CONTROL

BTP2-control FEATURES

- Up to 10 bioreactors on one gas quality measurement system
- Glass reactor with different-working volume
- Continuous operation with AUTO feeding
- Electrical heating and optional cooling
- Two level stirrer with gastight shaft
- Dosage pumps for pH-control
- Gas bag to collect gas samples
- Measurement equipment:
 - Gas quantity
 - pH/ Redox / temperature
 - gas quality measurement system
- SENSOcontrol with touch panel
- Optional accessories listed



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The fully automated bioreactor plant BTP2- control is mainly used in research as well as for practical substrate or gas potential tests. This system is modular and equipped with one gas quality analyzer module.

For expansion it is possible to connect up to ten reactors with only one gas quality analyzer. One central computer in combination with a multiplexer unit enables the independent test procedure of each individual reactor.

Gas volume and gas quality is simultaneously and automatically measured for each reactor. Furthermore, this system is ideally suited for research, product development (enzymes, nutrients) or for process optimization.

BTP2 with feeding FEATURES

- Eccentric screw pumps suitable for larger quantities and particle sizes
- Size of solids content: 6 mm – max. ball passage cross section - other max. sizes of solid on request
- Max. fiber length: 30 mm - other max. fibre length on request
- Nominal flow rate: 51 l/h with additional frequency converter for change of the flow rate (minimum 20 l/h)
- external ventilation of frequency converter – necessary for use of minimum range (5 l/h) of the pumps
- Control of pumps via SENSOcontrol:
 - Asynchronous time control for feeding and discharge
 - Monitor of scales
- SENSOcontrol with touch panel
- Optional accessories listed



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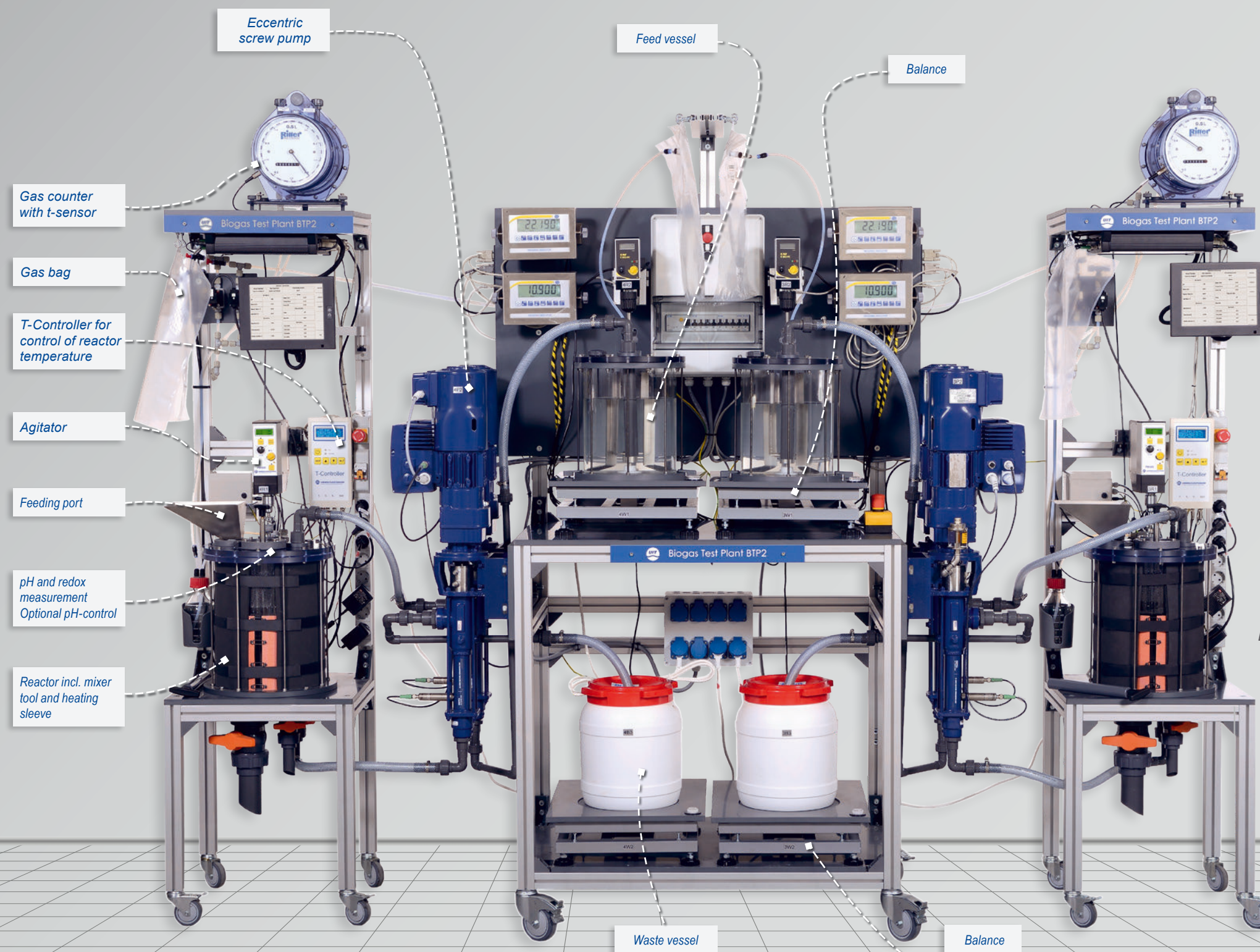
USE OF ECCENTRIC SCREW PUMPS AND SCALES FOR ACCURATE FEEDING

BTP2 with feeding

The individual BTP modules can also be equipped with eccentric screw pumps.

Additionally, the system is equipped with scales for an exact feeding result.

The pumps modules and the scale modules are controlled by the SENSOcontrol units.



BTP2-control with feeding

**BTP-sterile
Modular Bioreactor Plant**

FEATURES

- Bioreactor sterilizable
- Glass reactor with different volume 5/8/10 Litre – other sizes on request
- Double wall reactor (jacked) or unjacked reactor
- Stirrer with gastight shaft
- Heating optional cooling of reactor
- Dosage pumps for pH-control/ feeding/discharge
- Gas inlet for 3 gases with mixing unit plus one Mass Flow Controller
- Measurement equipment:
 - pH/ LDO/ Redox/ CO_2 / cell density temperature
 - Gas quality measurement System - optional
- SENSOcontrol with touch panel
- Optional accessories listed



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TEST PLANTS FOR EXPERIMENTS UNDER STERILE CONDITIONS

**BTP-STERILE
Modular Bioreactor Plant**

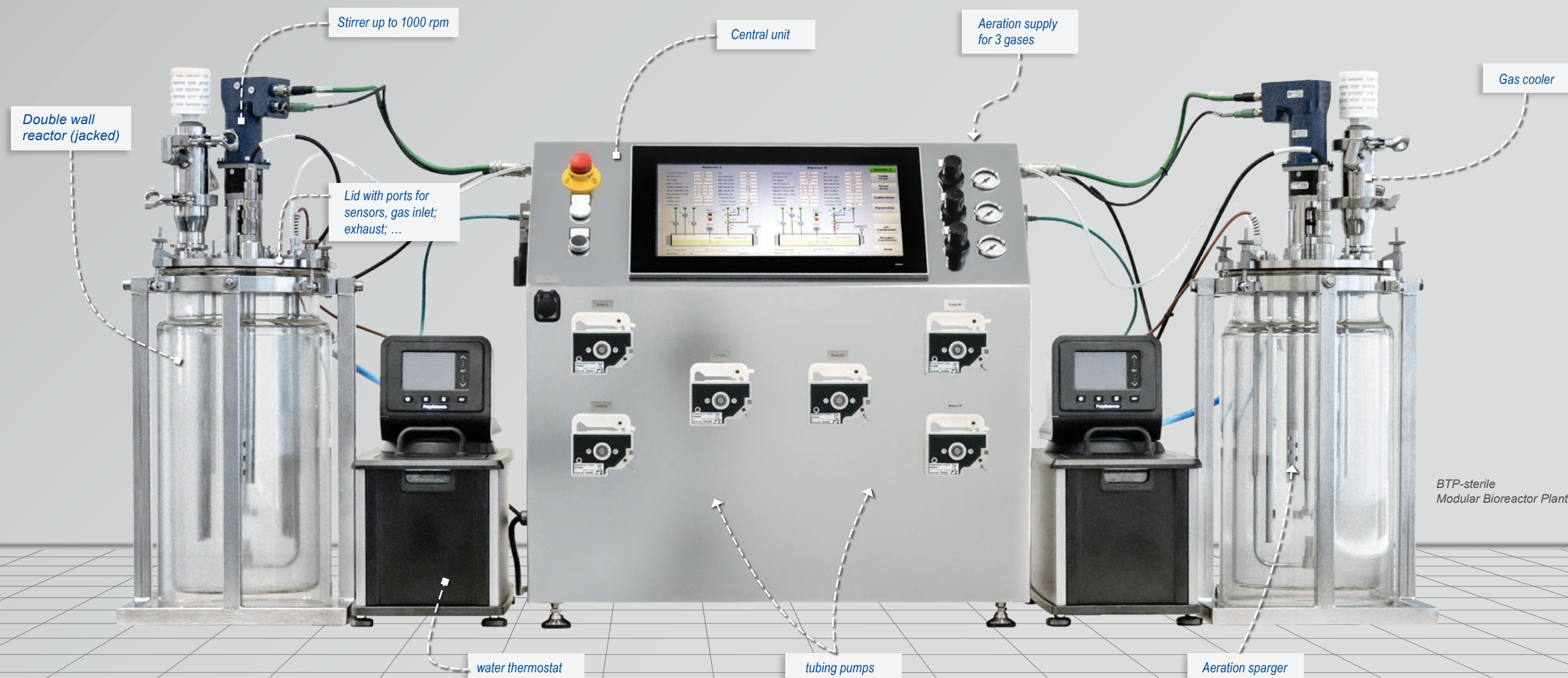
The BTP-sterile reactor is made in glass and of stainless steel. This offers the possibilities to sterilize (autoclave) the bioreactor before the start of the experiment. It is equipped with an advanced gastight shaft.

The reactors are available in the following sizes: 5/8/10 litre – other sizes on request.

Furthermore, this system is ideally suited for product development (enzymes, nutrients), process optimization and biotechnology applications.

This system is characterized by an extensive basic equipment, e.g. sensors, SENSOcontrol, pumps for pH-control and optional pumps for feeding and discharge.

Additional it is possible to inlet 3 gases in the bioreactor. These gases can be mixed before. A valve matrix is used for this purpose. The whole volume flow is controlled by a mass flow controller.



BTP-sterile
Modular Bioreactor Plant

FOR BTP MODULES

GAS QUALITY measurement technology



Handheld gas quality measurement device



BTP2-control with pump modules

Stationary gas quality measurement system

Gas quality
measurement technology

FEATURES

- Possible Measurement parameter
- (handheld or stationary gas quality measurement system):
 - CH_4 0...100 vol %
IR sensor
 - CO_2 0...100 vol %
IR sensor
 - O_2 0...25 vol %
electro chemical sensor
 - H_2S 0...5000 ppm
electro chemical sensor
 - H_2 0...2000 ppm¹⁾
electro chemical sensor
 - H_2 0...100 vol%¹⁾
thermal conductivity sensor
- Equipping status:
 - Measurement gas cooler¹⁾
 - Internal membrane pump
 - Pressure sensor for control of emptying of gas bag¹⁾

¹⁾... only valid for stationary gas quality measurement system not available for hand held gas quality measurement device



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BTP-1000
Pilot plant/ pilot container

FEATURES

- Reactor size up to 1000 litre;
steel reactors
- Electrical heating for bioreactors
- Feeding and discharge pumps
- Dosage pumps for pH-control
- Measurement equipment:
 - Gas quality
 - Gas quantity
 - Mass flow controller
 - pH/redox/ temperature
- SENSOcontrol with touch panel



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CUSTOMIZED PILOT PLANT

BTP-1000 Pilot plant/pilot container



Pilot plant

Pilot plants for biotechnology application will be produced fully customized. Biotechnology pilot plants offers innovative, high-performing and safe biological process solutions for several applications.

Equipment for pre- and post-fermentation treatment, as well as storage solution can be realized within the container.

The reactors are available in the different sizes up to 1000 litre

This system is characterized by an extensive basic equipment, e.g. SENSOcontrol and optional pumps for feeding, discharge or control of pH. The pilot plants can be equipped with an additional gas quality measurement equipment.

CUSTOMIZED PILOT CONTAINER

PILOT CONTAINER *Biogas*



Pilot container - Biogas

Pilot containers will be produced fully customized. Pilot containers are offered for wet/dry fermentation and also for percolator requirements and can be used under continuous or batch operation.

For this test facility we offer the whole working package incorporating the complete planning procedure incl. HAZOP (hazard and operability study) analysis up to delivery turn-key solutions.

The equipment features of the pilot container (measurement devices, control equipment, feeding devices) will be realized according to the customer requirements. The bio reactor including electrical heating and mixing system is made of stainless steel.

For health and safety compliance the test facility is equipped with a gas warning system.

Depending on the design the test plant is mounted in a 20 ft. maritime container which is CSC compliant.

BTP2-control
with pump modules

FEATURES

- Available for wet/dry fermentation also for percolator requirements
- Container fully equipped (air condition, electrical installation, etc.)
- Bioreactor, stainless steel with different working volume
- Automatically feed and discharge
- Electrical heating
- Dosage pumps for pH-control
- Measurement equipment:
 - Gas quantity
 - pH/ Redox / temperature
 - gas quality measurement system
- **SENSOcontrol** with touch panel



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BTP-1000
Pilot plant/ pilot container

FEATURES

- Sterile bio reactors with agitator
- Container full equipped (air condition, electrical installation, gas warning system)
- Electrical heating for bio reactors
- Dosage pumps
- Measurement equipment:
 - Gas quality
 - Mass flow controller
 - Gas quantity
 - pH/redox/ temperature
- **SENSOcontrol** with touch panel



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CUSTOMIZED PILOT CONTAINER

PILOT CONTAINER *Biotechnology*



Internal view of a Pilot container – Biotechnology

Pilotcontainer for biotechnology application will be produced fully customized. Biotechnology pilot container offers innovative, high-performing and safe biological process solutions for several applications.

Equipment for pre- and post-fermentation treatment, as well as storage solution can be realized within the container.

Overview

	BTP 2 basic	BTP 2	BTP 2 analyzer	BTP 2 control	BTP sterile	Pilot plant
Reactor volumes						
5 liter	●	●	●	●	●	
15/30/60 liter	●	●	●	●	○	
90-1,000 liter; stainless steel						●
Electrical heating system incl. temperature controller	●	●	●	●	●	●
Suitable to be sterilized					●	
Mixer incl. gas-tight shaft feedthrough						
Gas-tight shaft feedthrough	●	●	●	●	●	●
Shaft feedthrough	●	●	●	●	●	●
Mixer suitable to operate asynchronous	●	●	●	●	●	●
Measuring instrumentation						
Gas quantity (gas drum counter or Milli gas counter)	●	●	●	●	○	●
Automatic gas quality measurement (CH ₄ , CO ₂ , H ₂ S, O ₂)			●	●	○	●
• Use of measuring instrumentation for up to 8 reactor units				●	○	●
• Measuring of H ₂ in gas phase			○	○	○	○
Air pressure sensor			●	●	○	○
pH-measurement in substrate	●	●	●	●	●	●
ORP-measurement in substrate		○	○	○	○	○
Dissolved CO ₂ - measurement in substrate		○	○	○	○	○
Temperature in reactor	●	●	●	●	●	●
Temperature of gas	●	●	●	●	○	●
Speed and torque of mixer	●	●	●	●	●	○
Feed and discharge pumps						
Tube pump	○	○	○	○	○	○
Eccentric screw pump	○	○	○	○		○
SENSOcontrol - data storage, visualization and control						
SENSOcontrol incl. touch-display		●	●	●	●	●
pH-control - automatic pH setting		○	○	○	●	○
Control of ORP					○	
Automatic time-triggered feeding		○	○	○	○	○
Control of additional pumps		○	○	○	○	○
Torque measurement, not on BTP sterile						
Explanation ○ means option						

The equipment features of the test plants will be defined by individual quotations!

