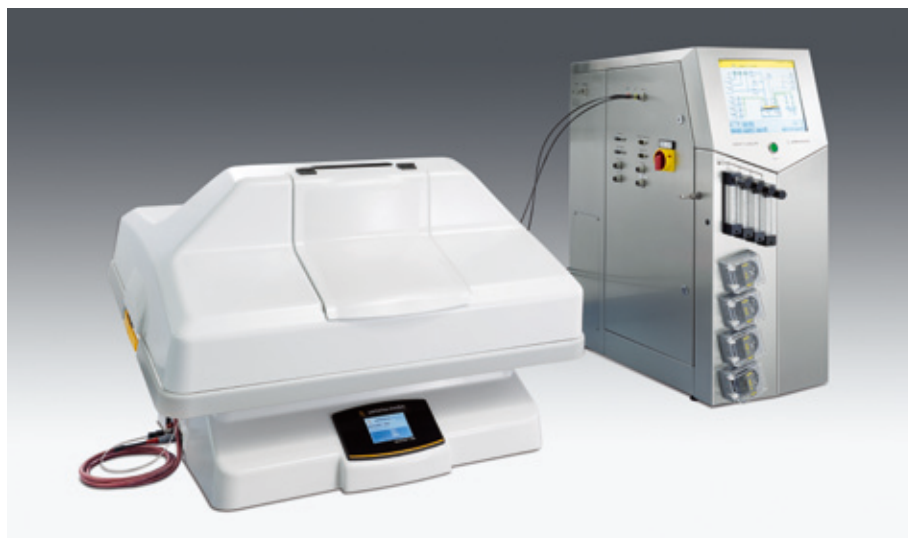# BIOSTAT® RM

Fermentation Technologies

Features of the BIOSTAT® RM basic include:

– Setting of rocking rate and angle

– Individual temperature control of two bags (2 L, 10 L) or one bag (20 L, 50 L)

– Independent gassing of two bags (0–500 ml/min) or one bag (0–1000 ml/min)

– Setting of the bag configuration: will automatically select the right gassing and temperature control parameters of the system

– Integrated Air │ CO_2 mixing by optional gassing module

– Air supply, switchable between internal air pump or process gas

– Positioning of the platform for harvest and sampling

– 2 Filter heaters made of PC, plug directly into rocker base

– Color coded plugs and socket for easy operation

– Tube and cable organizer at the sides of the bag holder

– Security function, check plug in of filter heater when gassing is switched on

– Alarm display

– 3 different user level (Administrator, User, Locked)

– Trend display for data visualization

– Time and date display

– Selection of control mode: Local or DCU

– Potential free alarm contact

– RS232 serial interface for communication with PC running

– Optional Ethernet interface with communication protocol for connection to third party software

– Optional ProfiBus DP interface with communication protocol for connection to third party software

– Service Interval Display

Introduction
The BIOSTAT® RM is a single use, wave-mixed bioreactor for culture volumes from 100 mL to 300 L. The system consists of a rocker unit with bag holder, a digital controller and a disposable bag. The bag, which forms the cultivation chamber, is mounted on the rocker platform and contains the medium and the cells. Due to the wave in the bag, generated by the moving platform, the media surface is renewed constantly, providing bubble-free aeration with low sheer.

Applications
– Cultivation with or without pH and DO feedback control

– Cultivation of mammalian, insect and plant cells

– Cultivation of stem cells

– Seed bioreactor

– Cost efficient cell mass, protein, Mab & vaccine production

BIOSTAT® RM Product family description
The RM product family comprises four different bioreactor sizes, 20 L, 50 L, 200 L and 600 L in different configurations. For applications where advanced control is not required instruments are available without pH and DO measurement (basic systems). For more complex processes optical systems with sophisticated feedback control for all process parameters including pH and DO are available as well as perfusion systems for fully automated continuous cultivations. BIOSTAT® RM 20 and 50 share the identical rocker unit and differ in size of the bag holder, which can be exchanged from 20 L to 50 L and vice versa.

Basic systems
Basic systems are designed for stand alone bench top use and allow controlling rocking rate, angle, and temperature. An internal gassing module can be added for aeration with air and CO_2 to work with a fixed CO_2 concentration of 0–15% in the process gas. The digital controller is directly integrated into the rocker unit and operated with an easy to use colour touch screen directly on the rocker.

Optical systems
The BIOSTAT® RM Optical provides full process automation with sophisticated feed back control. In addition to the rocker unit, it comprises a BIOSTAT® DCU (digital control unit) tower. The control tower is connected to the rocking unit for monitoring and controlling the culture, including pO_2, pH, agitation, and temperature in batch and fed batch mode of operation. Pre-calibrated, single-use optical sensors are included in the bag for the measurement of DO and pH.

Perfusion systems
The BIOSTAT® RM Perfusion systems allow fully automated, continuous processes. The single-use bag is equipped with optical pH and DO probes. It contains an internal perfusion membrane for efficient cell retention. The feed and harvest pumps are controlled by gravimetric flow controllers, which monitor the weight of the feed and harvest containers to ensure precise flow rates.

Different perfusion configurations are available depending on the working volume, the required perfusion rate and the maximum feed and harvest container weight.

Order Code	Description	Perfusion Rate (L/day)	Type of Pump	Weighing Capacity Balances (kg)	Readability Balances (g)
DH-----PRM11	Perfusion Option 1 – 120 VAC	2–55	int. WM102	60	1
DH-----PRM12	Perfusion Option 1 – 230 VAC	2–55	int. WM102	60	1
DH-----PRM21	Perfusion Option 2 – 120 VAC	2–55	int. WM102	300	10
DH-----PRM22	Perfusion Option 2 – 230 VAC	2–55	int. WM102	300	10
DH-----PRM31	Perfusion Option 3 – 120 VAC	23–1100	ext. WM323	300	10
DH-----PRM32	Perfusion Option 3 – 230 VAC	23–1100	ext. WM323	300	10
DH-----PRM41	Perfusion Option 4 – 120 VAC	23–1100	ext. WM323	600	20
DH-----PRM42	Perfusion Option 4 – 230 VAC	23–1100	ext. WM323	600	20
DH-----PRM51	Perfusion Option 5 – 120 VAC	23–1100	ext. WM323	1500	20
DH-----PRM52	Perfusion Option 5 – 230 VAC	23–1100	ext. WM323	1500	20

BIOSTAT® RM 200, single-use bioreactor

BIOSTAT® RM 600 optical, large scale single-use bioreactor

Twin systems
The BIOSTAT® RM 20, RM 50 and RM 200 systems are available as Single and Twin systems. One controller can independently control the temperature, gas flow, pH and DO of two bags. The bags can be mounted on two different rockers (Twin Rocker) or on the same rocker (Twin Controller). The BIOSTAT® RM 20 and RM 50 are available either in Twin Rocker or Twin Controller configuration, also as mixed RM 20 | RM 50 Twin variants. The BIOSTAT® RM200 always comes as Twin Controller model.

Model	max. working volume (L)	system type basic	optical	perfusion	Twin availability Twin rocker	Twin controller	temperature control* heating only	heating| cooling
20	10	×	×	×	×*	×	×	×
50	25	×	×	×	×*	×	×	×
200	100	×				×	×	×**
600	300	×					×	×**

* only for optical and perfusion
** on request

BIOSTAT® RM digital control unit (DCU)
– Cabinet contains measurement & control hardware, pumps & gassing system

– Separate from rocker unit (RM 20, RM 50, RM 600) or installed on a same skid (RM 200)

– Graphical user interface with colour display and touch screen operation

– Integrated amplifiers for temperature, pressure, single use DO and pH sensors

– Integrated control loops for temperature, DO, pH, rocker speed, rocker angle, gas flow and substrate

– Fully automated perfusion control using gravimetric flow controllers (Perfusion systems)

– Multi-channel DO cascade control

– Calibration of DO and pH sensors

– In-process DO and pH recalibration

– Time-controlled profile function for all process parameters

– Optional password and logbook function

– Trend display for up to 6 process values

Gassing module
– Outlet to overlay aeration

– 4-fold gas mixing of air, N_2, O_2 and CO_2

– One mass flow min for total flow (see technical data for flow rates)

– One separate mass flow controller for CO_2 (see technical data for flow rates)

– Rotameters for air, N_2, O_2, and CO_2

– Control via pH/DO controller

– Measurement of bag pressure (RM 20, RM 50, RM 200). Control of bag pressure (RM 600)

– Double safety feature: Electronic shut off plus mechanical pressure release valve to protect from overpressure

– Filter Heater on exhaust filter to prevent formation of condensate and avoid filter blockage

Pumps
– Two integrated digital peristaltic pumps

– Two additional integrated or external analogue feed pumps available on request (standard with perfusion configuration)

Temperature control
Choice between heating only and heating | cooling by optional thermostat unit

Heating Only
– Electrical heating blankets on bag holder

– Simultaneous, independent control of two bags on one platform (RM 20, RM 50, RM 200) or one bag (RM 600)

– Temperature range: ambient to 40°C

– Automatic safety shutdown for prevention of overheating

Heating | Cooling
– Stainless steel temperature coil mounted on bag holder.

– Thermostat for heating

– Cooling water to be connected to cooling water supply or external chiller

– Circulation pump

– Quick coupling connectors

– Temperature range: 8°C above cooling water to 40°C

– Automatic safety shutdown for prevention of overheating

Agitation System & Bag Holder
– Bag holder mounted on rocking platform

– Clamping rails to hold down bag

– Material stainless steel or ABS

– Detachable or swivelling top for easy access probes, ports and sample lines

Sensors
– Disposable optical chemical sensors DO are installed in every optical and perfusion bag

– Sensors are pre-calibrated and supplied with calibration parameters

– Range: pH: 6.5 – 8.5
       DO: 0 – 100%

– PT100 reusable sensors for temperature measurement

SCADA Software BioPAT® MFC S/DA
– Part of every bioreactor package

– Plug and play configuration

– Online data acquisition

– Sample data management

– Enhanced plotting

– Export functions

– Easy to use programming interface

– Upgrade to advanced BioPAT® MFCS/Win control software possible

Features & Benefits
– Single use Bioreactor with very low operation costs

– Based on proven rocking motion ("wave induced motion") principle

– Basic systems provide flexible, autonomous stand-alone systems for simple cultivations

– Optical and Perfusion systems are designed for high end applications

– Large working volume range in one bag

– Flexible gassing system

– Gas flow adjustments via rotameters and mass flow controllers

– Double pressure safety control to avoid overpressure in bag

– Advanced cascaded DO control

– Intuitive touch screen interface for easy operation

– Easy bag installation

– Supervisory Process Control software (BioPAT® MFCS/DA) included

BIOSTAT® RM 20 basic, with mounted lid

BIOSTAT® RM 20 basic, without lid

BIOSTAT® RM 20

Technical Specifications

	BIOSTAT® RM 20│50 basic	BIOSTAT® RM 20│50 optical & perfusion	BIOSTAT® RM 200 optical & perfusion	BIOSTAT® RM 600 optical
Volume				
Total volume	up to 20 L (RM50:50 L)	up to 20 L (RM50:50 L)	up to 200 L	600 L
Minimum working volume (bags with sensors may require higher minimum volumes)	0.1 L (RM50:5 L)	0.1 L (RM50:5 L)	10 L	60 L
Maximum working volume	10 L (RM50:25 L)	10 L (RM50:25 L)	100 L	300 L
Bag Holder				
ABS	×	×		
Stainless steel			×	×
Clamping rails for bag fixation	×	×	×	×
Pressure sensor with gassing safety shut off	×	×	×	×
Proportional valve to maintain bag pressure at constant level	N/A	N/A	N/A	×
Redundant overpressure relieve valve	–	×	×	×
Sensor clamps for secure fixation of glass fiber cables	N/A	2	4	2
Filter heater	2	2	2	2
Controller				
Integrated into rocker	×			
DCU control tower	N/A	×	×	×
Potential free alarm contact	× [max 0.5 A]	(×)	(×)	(×)
Color touch screen	×	×	×	×
Different user level log in	×	(×)	(×)	(×)
Logbook function	N/A	(×)	(×)	(×)
Temperature Control				
Temperature modes	Heating Only	Only Heating or Heating│Cooling	Only Heating or (Heating│Cooling)	Only Heating or (Heating│Cooling)
Temperature range, heating only	RT –40℃	RT –40℃	RT –40℃	RT –40℃
Temperature range heating│cooling	N/A	8℃ above cooling water –40℃	8℃ above cooling water –40℃	8℃ above cooling water –40℃
pT 100 probes and temperature amplifiers	2	2	2	1
Heating power, heating only	2 × 140 W (48 VAC)	2 × 140 W (48 VAC)	2 × 650 W	1 × 1500 W
Heating power, heating│cooling	N/A	1 × 1000 W	2 × 1000 W	2 × 1000 W
Overtemperature protection	×	×	×	×
Gassing module basic rocker				
Maximum total flow (ml/min)	(0–1000, or 2 × 0–500), ± 5%	N/A	N/A	N/A
Fixed CO_2 gassing (%)	(0–15)	N/A	N/A	N/A
Internal air pump	×	N/A	N/A	N/A

	BIOSTAT® RM 20 | 50 basic	BIOSTAT® RM 20 | 50 optical & perfusion	BIOSTAT® RM 200 optical & perfusion	BIOSTAT® RM 600 optical
Gassing module optical systems				
Rotameter				
– O$_2$	N/A	×	×	×
– N$_2$	N/A	×	×	×
– CO$_2$	N/A	×	×	×
– Air	N/A	×	×	×
Mass flow controllers for:				
– CO$_2$	N/A	0–500 mL/min	×	×
– total flow (Air, O$_2$, N$_2$)	N/A	RM20: 0.02–1 L/min RM50: 0.2–10 L/min	×	×
Multi-channel DO cascade control	N/A	×	×	×
Agitation				
Rocker speed (rpm), electronic adjustment	8–42 ± 1	8–42 ± 1	6–20 ± 1	2–16 ± 1
Rocker angle (°), electronic adjustment	4–10°, ± 0,3°,	4–10°, ± 0,3°,	4–10° ± 0.3°	4–10° ± 0.3°
DO and pH Measurement				
pH range	N/A	6.5–8.5	6.5–8.5	6.5–8.5
DO range	N/A	0–100%	0–100%	0–100%
Amplier for optical single-use DO sensor	N/A	1	2	2
Amplier for optical single-use pH sensor	N/A	1	2	2
Recalibration function for:				
– Disposable DO sensor	N/A	×	×	×
– Disposable pH sensor	N/A	×	×	×
Interface:				
– RS232	1	2	2	2
– Ethernet	(1)	1	1	1
– Profibus DB	(1)	N/A	N/A	N/A
– Analogue IN	N/A	2	2	2
– Analogue OUT	N/A	2	2	2
BioPAT® MFCS/DA	×	×	×	×
Pumps & Balances				
Digital pumps WM102	N/A	3		
Analogue pumps WM313D	N/A	(2)		
Analogue pumps (via analogue OUT)	N/A	(up to 2)		
External balances	N/A	(up to 2)		
Measurement of media weight (integrated balance)	(×)	(×)	(×)	(×)

	BIOSTAT® RM 20│50 basic	BIOSTAT® RM 20│50 optical & perfusion	BIOSTAT® RM 200 optical & perfusion	BIOSTAT® RM 600 optical
Power Supply				
Rocker 120 V–230 VAC │ 1-phase │ 6.3 A	×	×	N/A	N/A
Control tower: 120 VAC │ 1-phase │ 16 A	N/A	country specific	N/A	N/A
Control tower: 230 VAC │ 1-phase │ 16 A	N/A	country specific	N/A	N/A
Complete System: 208 VAC │ 3-phase TN-S │ 32 A	N/A	N/A	country specific	country specific
Complete system: 400 VAC │ 3-phase TN-S │ 32 A	N/A	N/A	country specific	country specific
Laboratory Supply				
Process gasses pressure (barg)	1.0–1–5	1.3–1.5	1.3–1.5	1.3–1.5
Gas specifications according to ISO 8573-1				
– Particle size: < 0.1 mm amount: max. 0.1 mg/m³ (class 1)	×	×	×	×
– Condensate: dew point < ×3°C (Class 4)	×	×	×	×
– Oil: < 0.01 mg/m³ (Class 1)	×	×	×	×
– Germs Class 0	×	×	×	×
Quick Couling for gas tubes, Festo Type (OD 4 mm)	×			
Hose barb for gas tubing, ID 6 mm	N/A	×	×	x
Cooling water (for heating cooling system only)	N/A	(×)	(×)	(×)
Hardware Dimensions & Weight				
W × H × D (mm)	RM20: 765 × 600 × 400 mm RM50: 1085 × 600 × 450 mm	BIOSTAT® RM Control Tower 320 × 735 × 565 mm plus size of basic rocker	1998 × 1241 × 830 mm	1790 × 1470 × 1330 cm
Weight	RM 20: 30 kg RM 50: 32.2 kg	BIOSTAT® RM Control Tower 60 kg plus weight of basic rocker	272 kg	340 kg