



Hardware Manual  
**my-Control**  
for MiniBio Reactors 250, 500, 1000 mL

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# 1 SAFETY

## 1.1 SAFETY SYMBOLS

The following symbols are used on the equipment and in this manual.



**WARNING**

Important issue concerning personnel health and device safety. Refer to this manual.



**WARNING**

Risk of electrical shock hazard.



**WARNING**

Hot surface.



**INFORMATION**

Additional information.



Disposal instructions

## 1.2 SAFETY WARNINGS



### GENERAL

- This equipment has been designed in accordance with EN61010-1 "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use", and has been supplied in a safe condition.
- The Hardware manual contains information and warnings, which have to be followed by the user to ensure safe installation, operation and to retain the equipment in safe condition. Carefully read this manual before putting the *my-Control* into operation!
- Before switching-on the equipment, make sure that the rating of the mounted fuses is appropriate for the line voltage (for fuse details, refer to the section on the rear view of the controller).
- This equipment is designed for bioprocess control; it must not be used for other purposes!



### WARNING

Risk of electrical shock hazard.

- The colored metal front panel (with any mounted pumps or micro valves) of the *my-Control* cabinet can be replaced by a panel with a different color. However, removing the metal panel will make hazardous parts accessible and must therefore be performed by qualified personnel. The *my-Control* must not be switched on or used when the colored metal front panel is not properly in place.
- Any interruption of the protective conductor inside or outside the *my-Control* or disconnection of the protective conductor terminal will make the device hazardous. Intentional interruption is prohibited.
- Capacitors inside the *my-Control* may still be charged, even if the apparatus has been disconnected from all voltage sources.
- It is not allowed to perform maintenance and/or repair on the opened device under voltage. Before removing the metal front panel or the rear panel, the power cord must be removed from the power entry socket of the *my-Control*.
- Make sure that only fuses with the required rated current and of the specified type (International Standard IEC 127) are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders is prohibited.
- It is not permitted to connect equipment to the *my-Control* or the bioreactor without the double isolation qualification or without the SELV (Safety Extra Low Voltage) qualification.



### WARNING

The rear of the *my-Control* cabinet must be accessible.

- The power switch of the *my-Control* is located at the rear of the cabinet. Make sure that the *my-Control* is installed in such a way that, in case of emergency, the power switch can be easily reached!



### WARNING

Risk of overpressure in the glass bioreactor.

- The glass reactor may be easily damaged; scratches on the surface will weaken the vessel. Therefore, do not apply a process pressure that exceeds 0.5 barg (7 psig). Do not obstruct the off-gas line! Make sure that the off-gas filter is not clogged.

## SAFETY



### WARNING

Risk of damaging the equipment.

- In most cases, one or more pumps are installed in the *my*-Control.
- Application of damaged tubes may result in fluid leaking into the pump drive.
- Verify the tube quality inside the pump head before every fermentation run.
- Do not use the tubing pump drives for other purposes than displacement of fluids (or gas).
- Advised pump tubing (pharmed) has its limitation in physical and chemical resistance. Make sure that the pump tubing and the selected reagent type are compatible.



### WARNING

Hot Surface.

- A Heating Blanket may be used around the bioreactor as an actuator for temperature control. During heating up the bioreactor, the outer surface of this Heating Blanket will be hot.



### WARNING

Make sure to use a proper power cord.

- The *my*-Control comes with a detachable power cord with 3 x 1.0mm<sup>2</sup> wires (for the USA, the power cord complies with 18AWG which is equal to 3 x 0.82mm<sup>2</sup> wires).
- When the original power cord needs to be replaced by another one, make sure that the replacement cable has the same (or better) specifications than the original.



### WARNING

Do not use flammable substances in the vicinity of the *my*-Control while in operation.

- The *my*-Control is an electr(on)ic control device that contains relays for switching power and actuator signals. These relays may generate sparks during operation. It is therefore not allowed to use flammable substances in the vicinity of the *my*-Control while this device is in operation.



### Additional information

- Although the *my*-Control as a whole is not UL-certified, all used components have been selected based on conformance with the standard UL 60950 (Underwriters Laboratories Inc. Standard for Safety of Information Technology Equipment).



### Disposal instructions

- This product must not be disposed of together with domestic waste.
- All users are obliged to hand in all electrical or electronic devices, regardless of whether or not they contain toxic substances, at a municipal or commercial collection point so that they can be disposed of in an environmentally acceptable manner.
- Consult your local authority or your supplier for information about disposal.

**WARNING**

Sensor is fragile. **Handle with care!**

- For measuring the dissolved oxygen concentration in the bioreactor, the LumiSens Optical dO<sub>2</sub> sensor is used. This sensor is fragile; the replaceable LumiSens sensor tip is made of glass and can break easily.

### 1.3 EU DECLARATION OF CONFORMITY

The company Applikon Biotechnology B.V., residing in Delft, The Netherlands, hereby certifies that the design of the instrument:

## *my*-Control for MiniBio Reactors (Z310210014)

meets the requirements of the following Directive of the European Union:

- ✓ Directive 2006/42/EC on Machinery
- ✓ Directive 2014/30/EU on Electromagnetic Compatibility (EMC)
- ✓ Directive 2011/65/EU and 2015/863/EU on Restriction of Hazardous Substances (RoHS)
- ✓ Regulation (EC) No 1907/2006 on Restriction of Chemicals (REACH)

The compliance of the *my*-Control has been based on the following harmonized standards:

Directive	Harmonized Standard
2006/42/EC (Machinery)	EN 60204-1:2018 / EN 12100:2010
2014/35/EU (Low Voltage)*	EN 61010-1:2010 / EN 61010-2-010:2020 / EN 61010-2-051:2021 / EN 62311:2020
2014/30/EU (EMC)	EN 61326-1:2021 / EN 61000-3-2:2019 / EN 61000-3-3:2013

\*For the *my*-Control, the Machinery Directive includes the requirements of the Low Voltage Directive.

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## 2 GENERAL

### 2.1 INTRODUCTION

The Applikon autoclavable MiniBio Reactor Systems basically consist of the following parts:

- an autoclavable MiniBio Reactor with the appropriate auxiliaries such as a stirrer assembly, sensors, an aeration assembly, etc.
- a *my-Control* bio controller for measurement and control of process variables (like pH, temperature, DO, level and stirrer speed) with corresponding controller outputs in order to keep process conditions at set point.

The *my-Control* combines and supports actuators like pumps, mass flow controllers and valves in order to optimize the use of limited bench space.

Typical characteristics of the *my-Control* with the MiniBio Reactor Systems:

- Easy setup and operation
- Cultivate using a small amount of medium
- Generation of scalable results
- Easy data handling

### 2.2 THE USER INTERFACE

Through a network that is connected to the *my-Control* (TCP/IP communication), different kind of devices can be used as a User Interface (UI). Since the *my-Control* is addressed by using its IP address, the User Interface is also called the Web UI.

Examples:

Web UI Device Type	Connecting Network
PC	LAN / WAN or Peer-to-Peer
Tablet	Wireless connection with WIFI-Router
Smartphone	Wireless connection with WIFI-Router

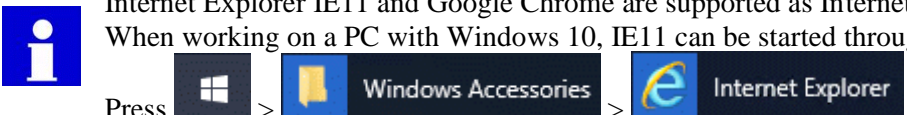
The *my-Control* is addressed by using its IP-address.




Start the Internet Browser at the WebUI-device and surf to the following address: [http://IP-address\\*/](http://IP-address*/). The *my-Control* WebUI will be displayed.

**\*The IP-address of the *my-Control*. The *my-Control* comes with a preset IP-address. This address can easily be customized. Refer to the section on customizing the IP address and to Appendix A in the Software Reference Manual.**

**Refer to Appendix D of the software manual in order to prevent instabilities in the network connection when the *my-Control* is the only controller directly connected to its controlling PC.**

Internet Explorer IE11 and Google Chrome are supported as Internet browsers.  
When working on a PC with Windows 10, IE11 can be started through the Accessories.



Press  >  Windows Accessories >  Internet Explorer

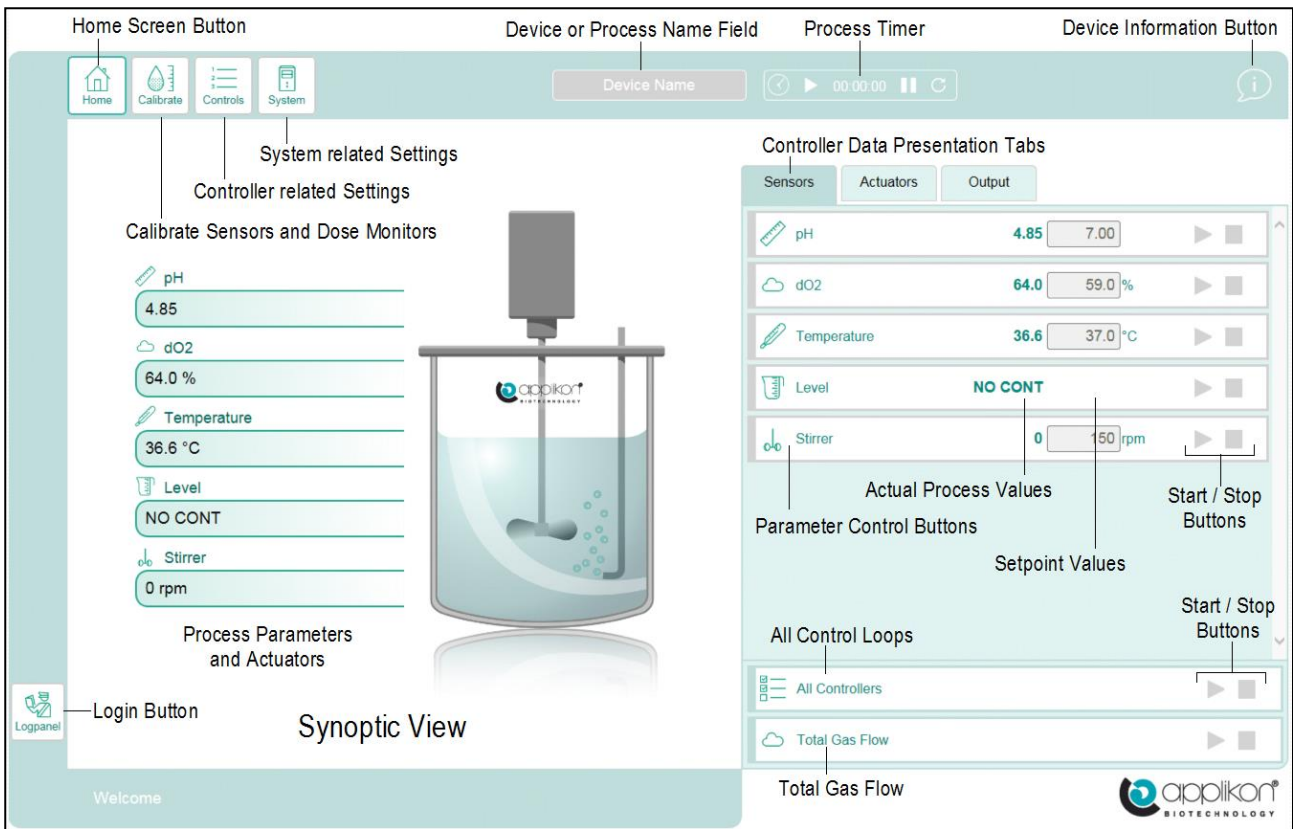
After switching on the power of the *my-Control* and invoking the Web Interface through the Internet browser on the PC, the *my-Control* displays its Home Screen (see next page).

In this Hardware Manual, it is assumed that a PC is used as Web UI (*my-Control* is operated with mouse-clicks).

## GENERAL

After switching on the power of the *my*-Control and invoking the Web UI with the Internet browser, the *my*-Control displays its Home Screen.

Example of the Home Screen in View mode (no user is logged in, control loops are “Idle”):



Use the mouse pointer to press the virtual buttons at the Web UI of the *my*-Control.

## 2.3 RELATED MANUALS

Also refer to the following manuals:

- Software Reference Manual *my*-Control for Autoclavable and Single Use Bioreactors
- Operator Manual *my*-Control with MiniBio Bioreactor Systems
- PID Control Manual

### 3 THE *my*-CONTROL

The *my*-Control is a full-size biocontroller dedicated to controlling a bioreactor process. It contains:

- Fixed and adaptive PID control for pH, dO<sub>2</sub> and Temperature
- Stirrer Speed control
- Foam and/or Level control
- Additional (freely configurable) measuring channels / PID control loops, such as:
  - (max. 4) Analog Inputs for sensors / measuring devices
  - (max. 4) Scales (USB) for Feed Control
  - Additional sensors for pH and dO<sub>2</sub> (USB)
  - Biomass Monitor (USB)

Inside the *my*-Control, the following actuators are supported:

- Variable speed Micro Valve tubing pumps / connections (max. four mounting positions)
- Gas Solenoid Valves with Tuning Valve for aeration (max. four internal mounting positions)
- Mass Flow Controllers for aeration (internal mounting)
- Power Supply for heating (Heating Blanket or Thermo-Electric element) and cooling (Thermo-Electric element or a connection for an external cooling valve)

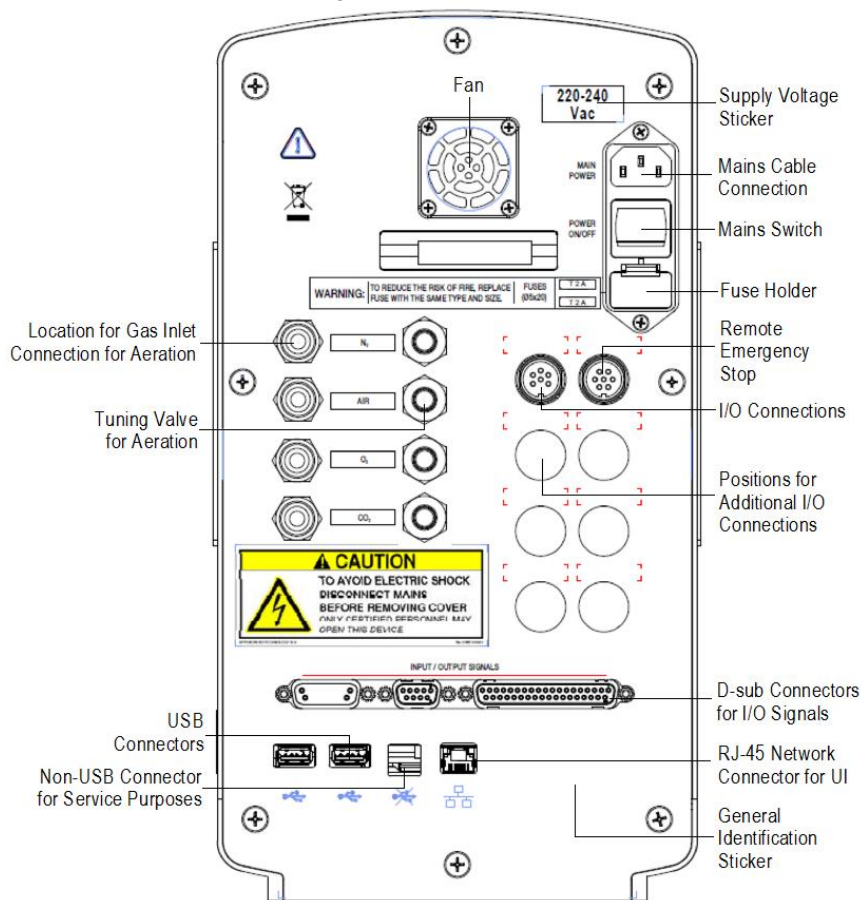
#### 3.1 FRONT VIEW OF THE *my*-CONTROL



The rear view of the *my*-Control is presented on the next page.

### 3.2 REAR VIEW OF THE *my*-CONTROL

At the rear of the control cabinet, the following connections can be found:



#### Power Supply section

The Power Supply Section of the *my*-Control contains:

- Mains Cable Connector for:
  - 220-240 VAC / 50 Hz or
  - 100-120 VAC / 60 Hz.
- Power Switch
- Fuse holders; fuses must comply with IEC 127:
  - 230 VAC: 2 x T 2A (5 x 20 mm)
  - 115 VAC: 2 x T 4A (5 x 20 mm)



The power switch of the *my*-Control is located at the rear of the cabinet. Make sure that the *my*-Control is installed in such a way that, in case of emergency, the power switch can be easily reached!

#### Optional Remote E-Stop Connector

Optional connector for the external Emergency Stop circuit (button).

By default, this connection is internally jumpered. A connector for an external button is available as an option. Opening the external Emergency Stop circuit will power down all actuators. Resetting the Emergency Stop status is achieved by closing the circuit again. A “Normally Closed” relay can be used as an external Emergency Stop button.

Z310210200 Control Cable for Emergency Stop for My/In

## Positions for Optional I/O Connections and Devices

- **Thermo Electric Condenser Connection**  
Connection for condenser with Thermo Electric cooler.
- **Connection for Temperature Control Actuators**  
Actuator connection for heating and cooling: Thermo Electric element or heating blanket and cooling valve.
- **Analog Inputs 0-10V**  
The four analog inputs can be used as inputs for additional control loops.  
A resistor of 500Ω (parallel with the input) can be used to convert a 0-20mA signal to 0-10V.
- **Sub-D Connectors for I/O Signals**  
For lay-out specification of the 37 pins D-sub connector, refer to the section on Analog and Digital I/O Connections of this Hardware Manual.

## Gas Inlets for aeration

The gas inlets (carbon dioxide, oxygen, air and nitrogen) are Quick Connectors for tubing OD = 6 mm. For information and specifications of the available gas supply hardware, refer to the section on Solenoid Valve with Tuning Valve and to the section on Mass Flow Controllers.



Required inlet pressure for the gasses: 2 barg.  
Required quality of the gasses: Instrument grade (dry and free of particles or oil).

## USB-Connectors

Can be used to connect:

- A USB-memory stick, to be used for customizing the IP-address or to export / import data or configuration files (refer to the Software Reference Manual).
- External devices such as scales, biomass monitors, optical sensors, etc. In case more than 2 USB inputs need to be connected, a USB-Hub is required.

## Non-USB-Connectors

A non-USB connector is used for service purposes.

## Network Connector for the Web User Interface

The RJ-45 network connector is used for connection to the Web User Interface / SCADA-application.



In order to comply with the European EMC Standards for “emission” and “immunity”, the maximum length of the Ethernet cable is 30 meters!

## 3.3 MODULES TO BE MOUNTED INSIDE THE *my*-CONTROL

The following modules can be mounted inside the *my*-Control:

Part #	Description	Remarks
Z310211020*	Heating Control Module	Supply for Heating Blanket
Z310211030*	Heating/Cooling Control Module	Supply for Thermo Electric Element
Z310211040*	Condenser Control Module	Supply for Thermo Electric Condenser
Z310213010*	Stirrer Control Module Stepper	Supply for Stepper Stirrer Motor
Z310216020*	Control Module for Pumps	Control Module for 2 Variable Speed Pumps
Z310216030*	Connection Module Micro Valve	Connection Plate for 1 Micro Valve
Z310216040*	Control Module Micro Valve	Control Module for 2 Micro Valves
Z310217050*	Redox Control Module	Amplifier Board for a Redox Sensor

\* Additional Modules must be installed by a certified Service Engineer.



### 3.4 COLORS OF THE FRONT PANEL

By default, the *my*-Control comes with a silver front panel. Other front panel colors are available on demand.



Ordering numbers of *my*-Controls with different colors:

Part #	Description	Part #	Description
Z310210130	Front Panel Silver V2	Z310210135	Front Panel Light Blue V2
Z310210131	Front Panel Yellow V2	Z310210136	Front Panel Green V2
Z310210132	Front Panel Orange V2	Z310210137	Front Panel Marine Blue V2
Z310210133	Front Panel Red V2	Z310210138	Front Panel Pink V2
Z310210134	Front Panel Purple V2		



#### WARNING

Risk of electrical shock hazard.

- The colored metal front panel (with any mounted pumps or micro valves) of the *my*-Control cabinet can be replaced by a panel with a different color. However, removing the metal panel will make hazardous parts accessible and must therefore be performed by qualified personnel. The *my*-Control must not be switched on or used when the colored metal front panel is not properly in place.



The Condenser Support on top of the Reactor Stand is available in the same colors as the Front Panels. For information concerning the Condenser Support, refer to the section about the condenser on the stand.

### 3.5 FRONT PANEL ILLUMINATION

The front panel of the *my*-Control is illuminated from the rear by LED-array. The LED's color indicate the status of the *my*-Control.

Color LED-array	Status of the <i>my</i> -Control.
White	Booting
Blue	Ready (controllers are idle)
Green	Controller(s) are running (no alarms)
Red	Controllers are idle: System Alarm Controller(s) running: Process Alarm
Orange	Update available: - Web User Interface software, - Control software or - Licenses



### 3.6 ACTUATOR CONTROL

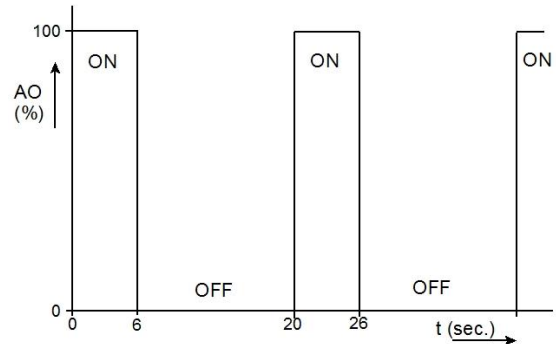
#### 3.6.1 DIGITAL ACTUATORS VERSUS CONTINUOUS ACTUATORS

Discrete (digital) actuators such as valves are controlled in a “Pulse-Width Modulated” manner (PWM):

- within a predefined “cycle time”, the output (Actuator) is switched on during the “On-time” and off during the rest of the cycle.

**Example 1**

If Cycle time = 20 sec. and  
 Actuator Output = 30 %  
 then On/Off Output will be repeatedly switched:  
 on during 6 sec (30 % of 20 seconds).  
 off during 14 sec.

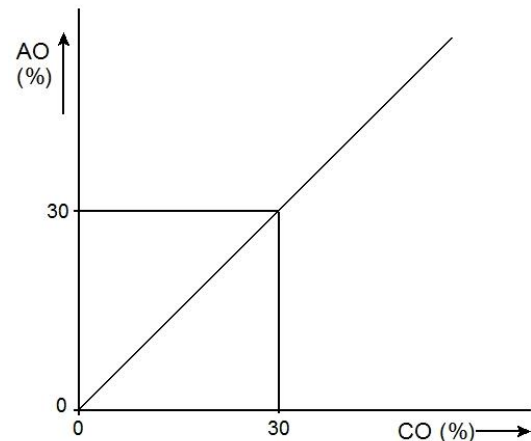


Continuous (analog) actuators like pumps, mass flow controllers and stirrers do not have a “cycle time” or an “on-time”.

Deviation from set point results in a controller output that relates to the actuator output in a linear way.

**Example 2**

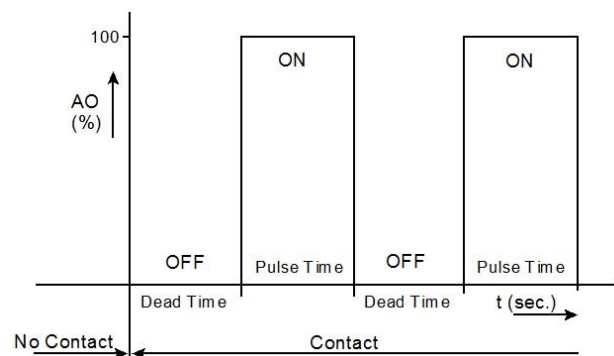
If Controller Output = 30 %  
 Then Continuous output has an Actuator Output = 30 %.



#### 3.6.2 ACTUATOR FOR LEVEL / FOAM CONTROL

The actuator for the level / anti-foam controller is either off (AO = 0 %) or on (AO = 100 %). In most cases the desired situation is “No Contact”.

When the status “No Contact” changes into “Contact”, first a “Dead Time” elapses after which the actuator is switched on during the “Pulse Time” interval. This sequence is repeated until the status changes into “No Contact” again.



- Values for Dead Time and Pulse Time and the parameters of the level/foam sensor can be adjusted by navigating to System > Settings > Controller Setup.
  - Since a 200 rpm pump is used for antifoam agent, the upper limit of the pump speed can best be limited to 50% resulting in a maximum pump speed of 100 rpm.
- Refer to the section about actuator limits and inhibit in the Software Reference Manual.

### 3.7 SENSOR INPUT SPECIFICATIONS

The applied sensor input amplifiers have the following specifications.

pH amplifier:	Range:	0 pH ... 14 pH
	Accuracy:	± 0.01 pH
	R <sub>in</sub> :	> 10 <sup>15</sup> Ω
	Resolution:	0.01
Temperature amplifier:	Type:	Pt-100 (3-wire type)
	Range:	0 °C ... +150 °C
	Accuracy:	± 0.1 °C
	Resolution:	0.1 °C
DO amplifier:	Type:	Polarographic
	Range:	0 % ... 100 % (when calibrated with oxygen) 0 % ... 500 % (when calibrated with air)
	Accuracy:	± 0.1 %
	Resolution:	0.1 %
Level amplifier:	Type:	On/Off signal
	Sensitivity:	Software-selectable: High Sensitivity: Conductivity ≥ 26 μS equals “Contact” Low Sensitivity: Conductivity ≥ 200 μS equals “Contact” Refer to section about Level / Foam Sensor Settings in the Software Reference Manual.



The Redox Sensor can be used as an option (the Redox Amplifier Board is required; refer to the section about modules to be mounted inside the *my*-Control). It will be connected to the Level 2 sensor connection at the front of the *my*-Control cabinet. It in fact substitutes the Level 2 sensor.

Redox amplifier:	Range:	0 ± 2000 mV
	Accuracy:	± 1 mV
	Resolution:	1 mV



### 3.8 ANALOG AND DIGITAL I/O CONNECTIONS

The analog and digital I/O connections are located at the rear of the *my*-Control:

#### Analog Inputs

The (max. 4) analog input connectors contain four pins:

- Pin 1 = Analog input
- Pin 2 = Ground
- Pin 3 = Spare
- Pin 4 = Spare

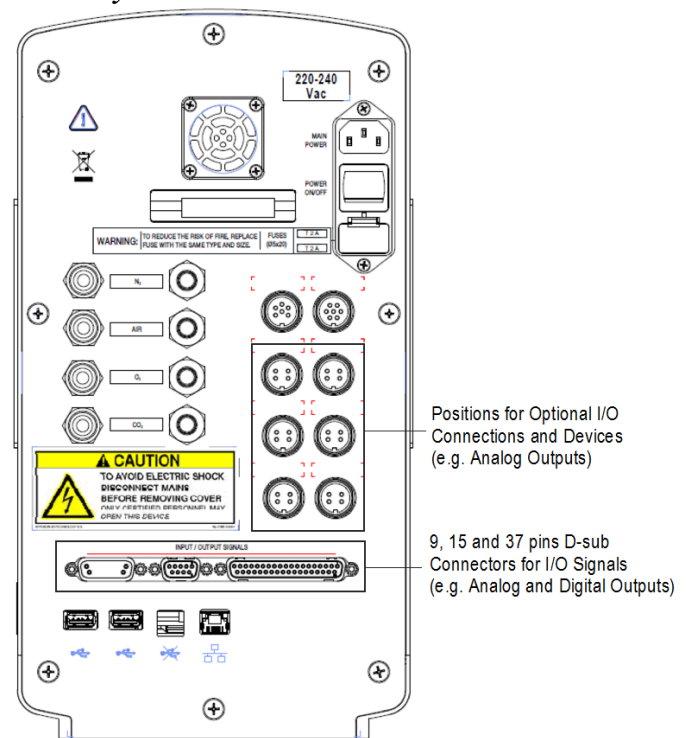


Input range: 0 – 10 V  
Impedance: > 100 kΩ

Analog input for the *my*-Control including external cable and license:

Z310214010\* Analog Input *my*-Control

\*The above mentioned part consists of one internal cable and two external cables: one for V-signals and one for mA signals (with a 500 Ohm resistor in its connector to convert the mA signal to a V-signal)). Additional Analog Inputs must be installed by a certified Service Engineer.



#### Analog and Digital Outputs (37 pins sub-connector):

Pin #	Description	Pin #	Description
1	DIGITAL OUTPUT 6+	17	ANALOG OUTPUT 3
2	DIGITAL OUTPUT 6-	18	ANALOG OUTPUT 1
3	DIGITAL OUTPUT 7+	19	ANALOG OUTPUT 2
4	DIGITAL OUTPUT 7-	20	ANALOG OUTPUT 4
5	DIGITAL OUTPUT 4+	21	GND
6	DIGITAL OUTPUT 4-	22	GND
7	DIGITAL OUTPUT 5+	23 / 24	SYSTEM ALARM OUTPUT (NO / COM)
8	DIGITAL OUTPUT 5-	25 / 26	DEVIATION ALARM OUTPUT (NO / COM)
9	DIGITAL OUTPUT 1+	27	24V for Digital I/O (max. 0.5A)
10	DIGITAL OUTPUT 1-	28	GND
11	DIGITAL OUTPUT 2+	30	GND
12	DIGITAL OUTPUT 2-	32	GND
13	DIGITAL OUTPUT 3+	34	GND
14	DIGITAL OUTPUT 3-	35	15Vext. (max. 0.1 A)
15	DIGITAL OUTPUT 8+	36	GND
16	DIGITAL OUTPUT 8-		

- Analog output 5 can be found at the 9 pins D-sub connector: pin 2 (+) and pin 6 (GND)!
- The System Alarm output (pin 23/24) indicates that the process cannot be supported anymore.
- The Deviation Alarm output (pin 25/26) indicates that a process value is out-of-limits.
- The ground (GND) pins are used in combination with the analog outputs.

Analog Outputs: 0/4 – 20 mA (software selectable)  
Digital Outputs: 0/5 VDC, 100 mA each

### 3.9 ENVIRONMENTAL CONDITIONS

The *my*-Control may be used at locations with the following environmental conditions:

- Use indoor
- Altitude: up to 2000 m
- Temperature: 4 °C to 40 °C
- Relative humidity: maximum 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C
- Mains supply voltage: 220 – 240 / 100 - 120 VAC, 50/60 Hz
- Transient over voltages according to Installation category II
- Pollution: Pollution degree 2 in accordance with IEC 664
- Power consumption: P-max = 400 VA

### 3.10 STORAGE INSTRUCTIONS

When the *my*-Control, after being used, has to be stored for a longer time (> 1 month), follow the instructions below:

- Disconnect the sensor cables and stirrer motor cable from the *my*-Control. Store the sensors according to the instructions in the User Manual that comes with the sensor. Store the Stirrer Motor in its original box.
- Remove the pump tubing from the Pumps of the *my*-Control. Drain and rinse the pump tubing and store it together with the feed bottles.
- Disconnect the gas supply lines from the gas inlets at the rear panel of the *my*-Control cabinet.
- Purge the gas supply lines (especially the O<sub>2</sub> and CO<sub>2</sub> lines) inside the *my*-Control with instrument air. Cover the gas inlets and outlets with blind caps.
- (if necessary) Clean the outside of the *my*-Control cabinet according to the instructions below.
- Pack the *my*-Control in its original packaging (plastic bag and box).
- Store it at altitude, temperature and humidity as specified in the section on Environmental Conditions.
- Clean and dry the bioreactor with all its auxiliaries and store it, preferably in its original packaging.

### 3.11 CLEANING INSTRUCTIONS

The *my*-Control cabinet may be cleaned with a moist tissue in combination with a non-abrasive cleaner.

### 3.12 RELATED MANUALS

Also refer to the following Manuals:

- Software Reference Manual,
- Operator Manual,
- PID Control Manual,
- USB Sensor Manuals.

## 4 INTERNAL ACTUATORS

The *my*-Control may be equipped with different internal actuators for aeration and addition of liquid:

- Solenoid valve with tuning valve per gas inlet line (nitrogen, air, oxygen and carbon dioxide)
- 1-channel or 3-channel mass flow controller
- Tubing pump for liquid additions



Gasses that are used for aeration and pH control (CO<sub>2</sub>) must comply with the following specifications:

- Required inlet pressure for the gasses: 2 barg.
- Required quality of the gasses: Instrument grade (dry and free of particles or oil).

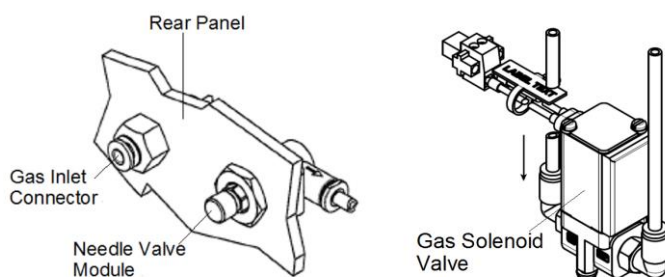
A micro valve may be applied as external actuator. Refer to the section about the micro valve.

### 4.1 SOLENOID VALVE WITH TUNING VALVE

Per gas inlet line, inside the *my*-Control a solenoid valve may be installed. The individual gas flows can be manually tuned by a Needle Valve Module. The needle valve module includes a Non-Return valve that prevents back-flow of gas.



By default, the tuning valve is set to the required gas flow.  
Changing the tuning valve setting must only be performed while using a flow meter.



Z310212012\* Gas Solenoid Valve Assembly 24 VDC SMC

Z310212022\* Gas Needle Valve Module (including the Non-Return Valve)

\*Additional (needle ) valves must be installed by a certified Service Engineer.

For gas flows up to 200 ml/min, a precision metering valve is available for more accurate gas flow regulation:

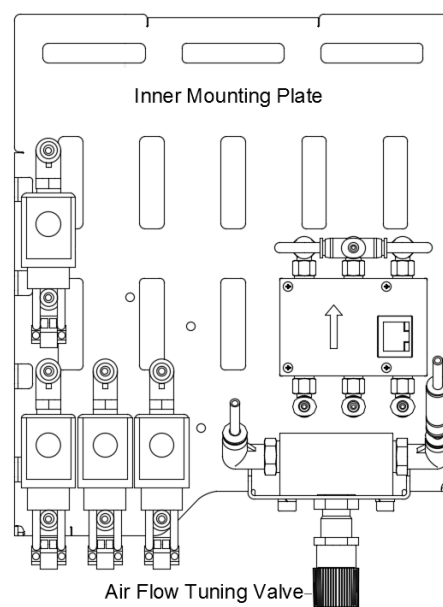
This metering valve is located inside the Control Console cabinet. Changing the default gas flow requires opening the cabinet and must only be performed by qualified personnel.

Top View image of the inner mounting plate with the precision air flow tuning valve(s) installed:

If two or more metering valves are installed, they are mounted on top of each other.

Z310212021\* Precision Metering Valve Module  
(including the Non-Return Valve)

\*Additional Metering Valves must be installed by a certified Service Engineer.



## 4.2 MASS FLOW CONTROLLERS

Two types of mass flow controllers are used in the *my*-Control.

- 3-Channel Mass Flow Controller (for controlling the flow of three individual gasses)
- 1-Channel Mass Flow Controller (for controlling the flow of one gas only)

Both Mass Flow Controllers (MFC) are applied for bioreactor aeration.

The following gasses may be applied:

- Nitrogen
- Air
- Oxygen
- Carbon dioxide



**Possible MFC configurations:**

3-Channel MFC

1-Channel MFC

- If the flow of only one gas supply line needs to be controlled, the 1 Channel MFC is mounted,
- If the flow of two gas supply lines need to be controlled, two pieces of the 1 Channel MFC are mounted,
- If the flow of three gas supply lines need to be controlled, the 3 Channel MFC is mounted,
- If the flow of four gas supply lines need to be controlled, a 1 Channel MFC and a 3 Channel MFC are mounted,

**MFC Specifications:**

Aeration range: for N<sub>2</sub>, air or O<sub>2</sub>: up to 1,500 ml/min  
for CO<sub>2</sub>: up to 800 ml/min

Gas flow accuracy: ± 2% full scale\*

\*The given accuracy is obtained under standard operating conditions (after at least 1 hour of operation):

Environmental temperature: 20 . . 25°C

Internal *my*-Control temperature: 35 . . 40°C

In case of different operating conditions, the accuracy may be less (theoretical temp. sensitivity for air, N<sub>2</sub> and O<sub>2</sub> = approx. 0.2%/°C, theoretical temp. sensitivity for CO<sub>2</sub> = approx. 0.6%/°C).

**Gas Specifications:**

Required gas inlet pressure: 2 barg

Required quality of the gasses: Instrument grade (dry and free of particles or oil).

**Rule of Thumb for the Gas Flow Rates for Sparging and Overlay:**

Gas	Cell Culture	Microbial Culture	Cell Culture	Microbial Culture
	Sparging		Overlay	
Air	Approx. 0.1 vvm	1 . . 2 vvm	Approx. 0.1 vvm	10% of sparger air flow
O <sub>2</sub>	10% of air flow	20 . . 30% of air flow	N.A.	N.A.
CO <sub>2</sub>	10 . . 25% of air flow	20 . . 30% of air flow	10% of sparger air flow	N.A.
N <sub>2</sub>	50 % of air flow	50 % of air flow	N.A.	N.A.

**MFC Ordering Information:**Z310212120\* 1-Channel MFC Assembly for *my-Control*Z310212320\* 3-Channel MFC Assembly for *my-Control*Z310212110\* Mounting Kit for 1-Channel MFC *my-Control*Z310212310\* Mounting Kit for 1-Channel MFC *my-Control*

When one or more MFCs must be added to an existing *my-Control*, one of the cables below must be ordered: VBL2080321\* Cable Act. Board MFC (to connect the 1- or 3-channel MFC with the actuator board)

VBL2080351\* Cable Act. Board MFC 2x (T-piece with extension cable to connect an additional MFX)

\* Additional Mass Flow Controllers must be installed by a certified Service Engineer.

### 4.3 CONNECTION FOR SPARGING

An Aeration Outlet for Sparging is located at the front of the *my-Control* cabinet.

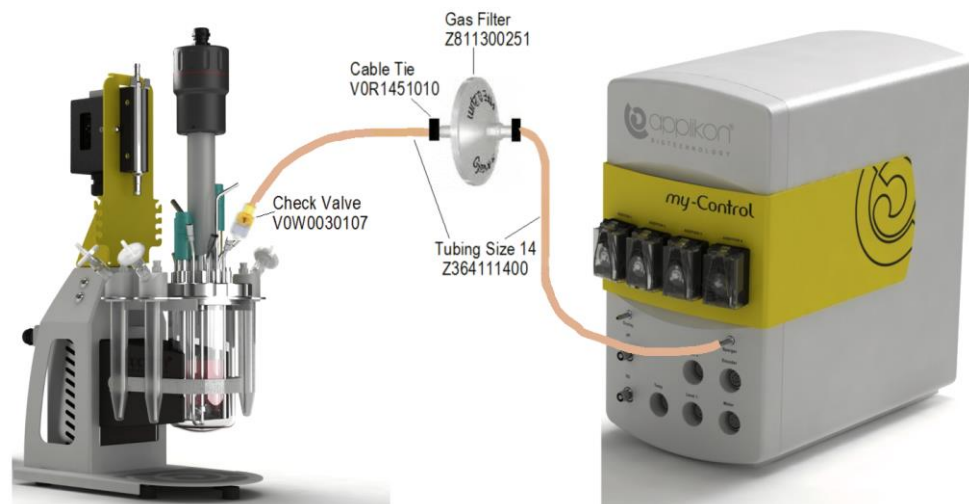
A second outlet for Overlay is optional.



Z310212071 Gas Overlay Connection

Z310212081 Gas Overlay Blind Plug

The connection between the *my-Control* and a MiniBio reactor can be made according to the image below:



If a CO<sub>2</sub> valve or mass flow controller is used as actuator in pH Control (instead of an acid pump), it is advised to mount Check Valve VOW0030107 at the inlet of the sparger pipe (see the above image). When the gas flow stops, CO<sub>2</sub> gas in the sparger pipe will slowly dissolve in the medium, causing a vacuum in the gas inlet line. As a result, medium can wet the Gas Inlet Filter.

VOW0030107 Duckbill Check Valve with Male and Female Luer Locks



The Check Valve (part of the Start-up Kits) has a yellow inlet (female Luer lock) and a clear outlet (male Luer lock).

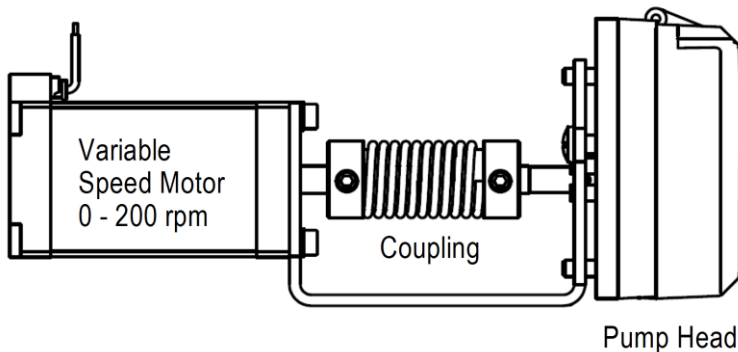
## 4.4 TUBING PUMP ASSEMBLY



**WARNING**

Risk of damaging the equipment.

- Application of damaged tubes may result in fluid leaking into the pump drive.
- Verify the tube quality inside the pump head before every new cultivation.
- Do not use the tubing pump drives for other purposes than displacement of fluids (or gas).



Microflex Pump Head with Closed and Open Cover

Total number of positions for tubing pump (and micro valves) at the front of the *my-Control* = 4.

The variable speed pump motor (0 – 200 rpm) drives a pump head.

Inside the pump head, Silicone or Pharmed tubing is applied.

Applicable tubing diameter:

- Microbore tubing size 48: ID = 2.79 mm

Tubing Type	Flow* at 200 rpm
Microbore tubing size 34	11 ml/min
Microbore tubing size 48	17 ml/min

\*the nominal flow may vary  $\pm 25\%$  due to tube tolerances and material characteristics (see remark below)!

When activated, the pump will rotate counterclockwise.

	<p>The loading procedure for new pump tubing is described on the next page.</p> <p>Due to stretching of the Pharmed tubing material, the liquid displacement of the tubing pump may show a decrease during the first few days after replacement of the tubing. When accurate dose monitoring is required, it is advisable to let the pump run continuously for approximately 24 hours before calibrating the Dose Monitor factor! Autoclaving may influence the liquid displacement as well!</p>
--	--

- Z310216011\* Pump & Pump Head Variable Speed *my-Control* V2
- Z360762534 Silicone Tubing Microbore Size 34 (L = 15m)
- Z369580934 Pharmed Tubing Microbore Size 34 (L = 30m)
- Z360762548 Silicone Tubing Microbore Size 48 (L = 15m)
- Z369580948 Pharmed Tubing Microbore Size 48 (L = 30m)
- Z310216051 Blind Plate Pump Position *my-Control* V2

\*Additional Pumps must be installed by a certified Service Engineer.



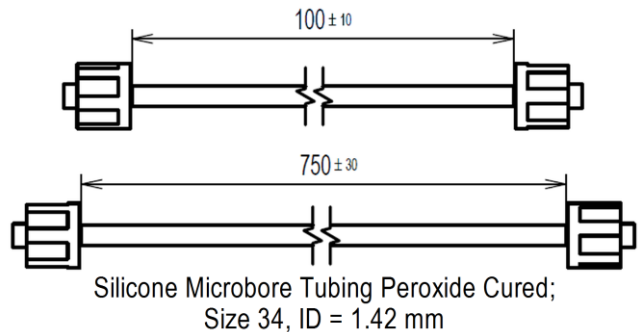
#### 4.4.1 MICROBORE TUBING SET WITH LUER LOCK CONNECTORS

Since the MiniBio Reactors are equipped with Luer Lock connections at the addition and sample ports, a Microbore Tubing Set with Luer Lock connectors has been prepared.

Z811000271 MiniBio Tubing Set Microbore

The Tubing Set consists of:

5 pieces of tubing with a length of 100 mm and  
10 pieces of tubing with a length of 750 mm.



The silicone tubing is peroxide cured and has size 34.  
The 750 mm pieces are used for addition with pumps.  
The 100 mm pieces can be used blinding two addition ports.

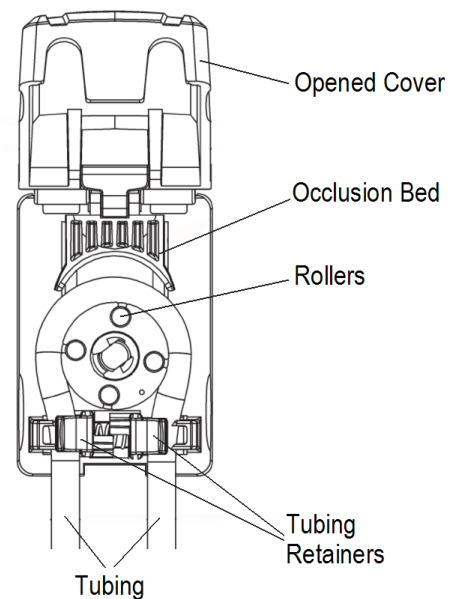
#### 4.4.2 LOADING THE PUMP TUBING



**WARNING:**

Before loading tubing into the Pump Head, switch off the power of the my-Control. Fingers or loose clothing could be caught in the rollers.

1. When the cover is opened, the Occlusion Bed moves upward, away from the rollers.
2. Holding both ends of the tubing in one hand, form a loop and wrap the tubing around the Rollers, making sure that the tubing is centered on the rollers and keeping the free ends of the tubing outside of the Tubing Retainers.
3. Once the tubing is in place, close the Door and the Occlusion Bed will automatically align itself within the pump.
4. Insert the tubing into one of the Tubing Retainers by moving the retainer toward the center of the pump and placing the tubing in the v-notch of the retainer. Release the retainer so that the tubing is secured in place.
5. Repeat the previous step for the other tubing retainer.
6. The tubing should be stretched slightly around the rollers so that there is no excess tubing between the rollers and the retainers – any excess can be removed by pulling slightly on the tubing outside of the Pump Head.

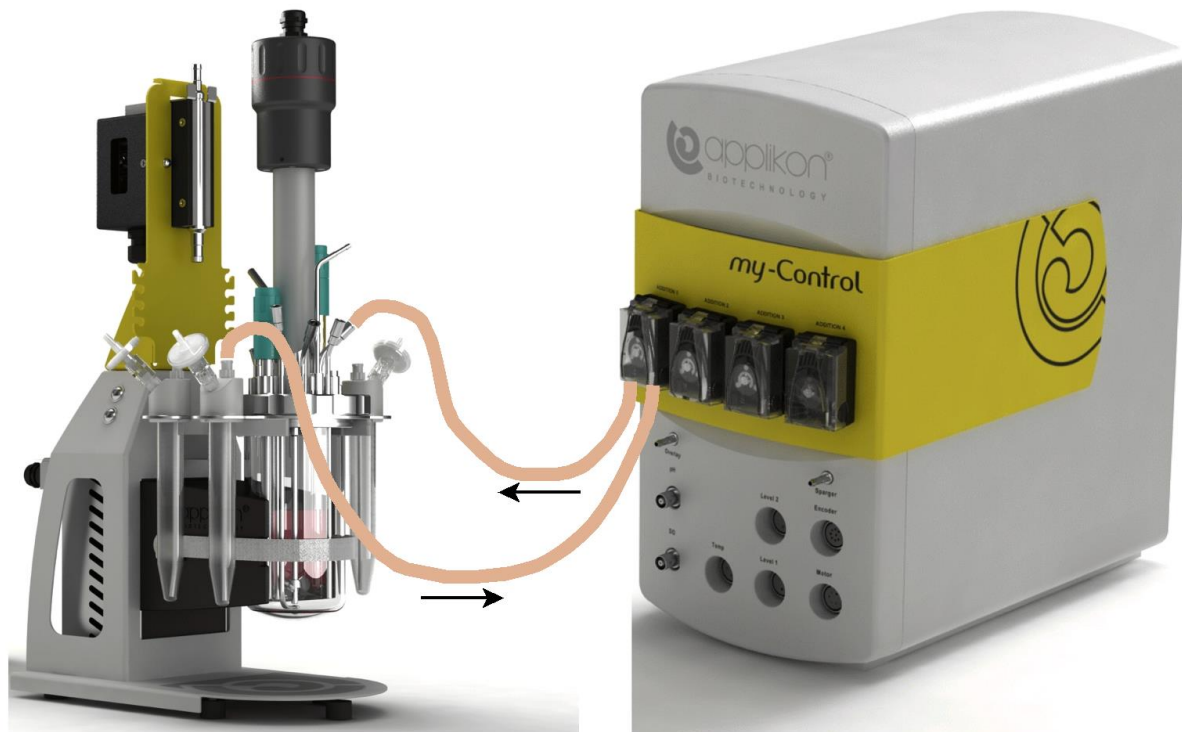


The Microbore Pump Tubing is now loaded in the Pump Head.

When activated, the pump will rotate counterclockwise.

## 4.5 PUMP TUBING CONNECTION

The liquid addition line between storage vial and MiniBio reactor can be realized according to the image below:



The rotor in the pump head turns counterclockwise. Make sure that the pump tubing is configured accordingly!

## 4.6 EXTERNAL PUMPS

- Z310214030 Analog Output, License and Pump Cable MiniFlex 7525-20
- Z310214035 Analog Output, License and Pump Cable for Second Miniflex 7525-20
- Z310214024 Analog Output, License and Pump Cable 7528-30 V2
- Z310214023 Analog Output, License and Pump Cable for Second 7528-30 V2



For specific information concerning the stand-alone pumps and pump heads, refer to the Masterflex User Manual that comes with the pump.

With a Watson Marlow WM120U pump the following cables are used:

- Z310214040 Analog Output, License and Pump Cable WM120U
- Z310214045 Analog Output, License and Pump Cable for Second WM120U



## 5 EXTERNAL ACTUATORS

### 5.1 HEATING BLANKET

The heating blanket is wrapped around the glass bioreactor.

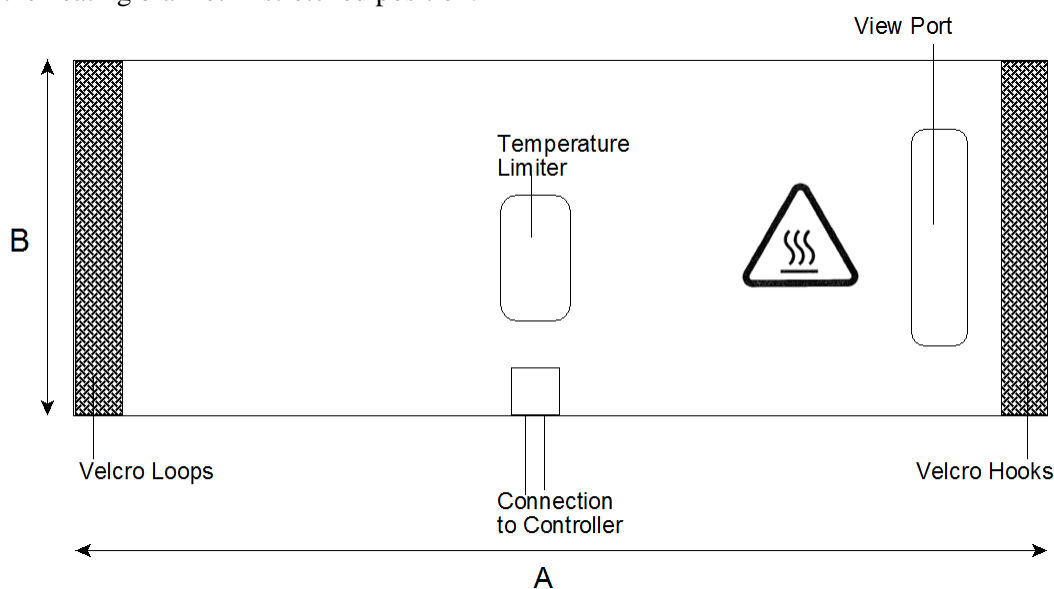
The maximum temperature of the outer surface is limited (by thermal cut-off) to 80 °C.

Maximum medium temperature that can be reached by heating with a heating blanket: 60 °C (or higher, depending on the reactor size).

The heating blanket is powered by the *my*-Control with a 48 VDC supply.

The heating blankets for the 250 and 500 ml MiniBio Reactors come pre-shaped for a better fit around the bioreactor.

Image of the heating blanket in stretched position:

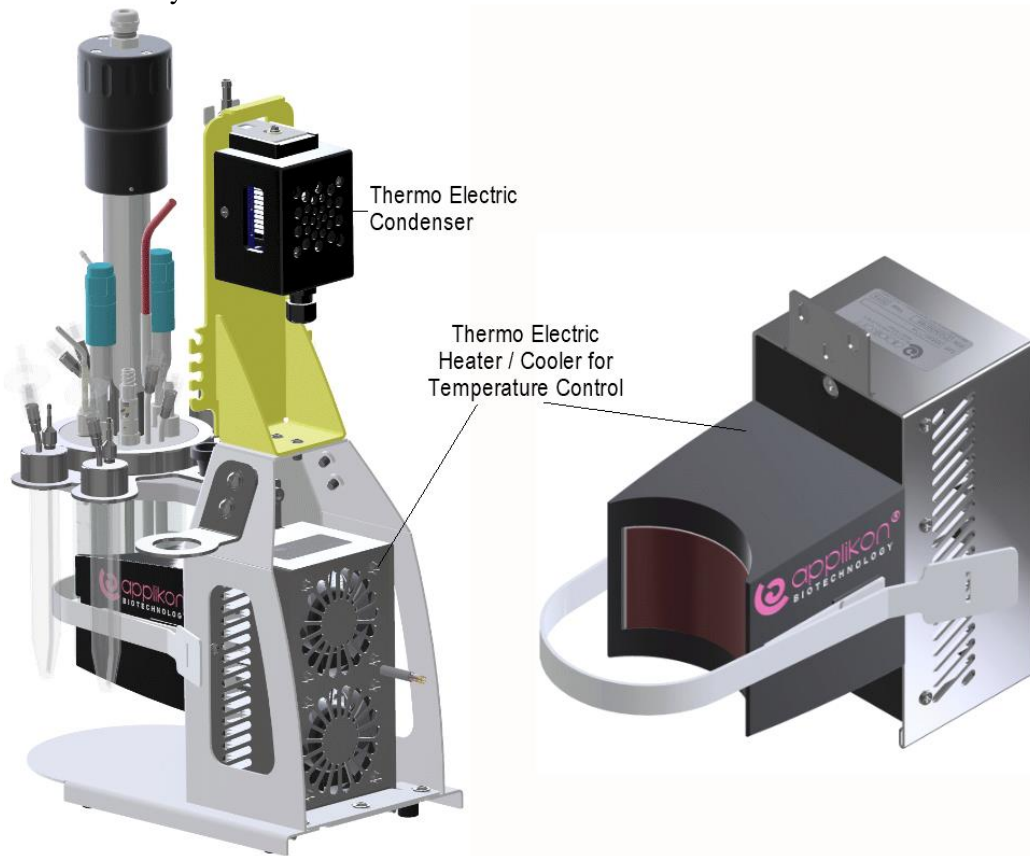


Reactor	Part #	Dimension A (mm)	Dimension B (mm)	Power (W)
250 ml	Z311021026	235	80	30
500 ml	Z311021051	280	80	50
1000 ml	Z311021100	360	100	80

The Heating Blanket is connected to the Heating Control Module, located at the rear of the *my*-Control. Refer to the section about the Rear View of the *my*-Control and to the section about Analog and Digital I/O Connections.

## 5.2 THERMO ELECTRIC ELEMENT FOR TEMPERATURE CONTROL

The temperature in the 250 and 500 ml MiniBio reactor can be controlled by using the Thermo Electric Heater / Cooler Assembly.



Specifications of the Thermo Electric Element:

Nominal power consumption: 80 W.  
Medium Heating Capacity: 18 to 37 °C: < 30 min.  
Medium Cooling Capacity: 37 to 30 °C: < 19 min.

The control cable is connected to the rear of the *my*-Control.

Z311021211 Thermo Electric Heater/Cooler Assembly for MiniBio reactor 250ml (OD60)

Z311021221 Thermo Electric Heater/Cooler Assembly for MiniBio reactor 500ml (OD75)



- A Thermo Electric Element for the 1000 ml MiniBio Reactor is not yet available.
- For information concerning the Thermo Electric Condenser, refer to the section about Off-gas Line Configuration.

### 5.3 MICRO VALVE

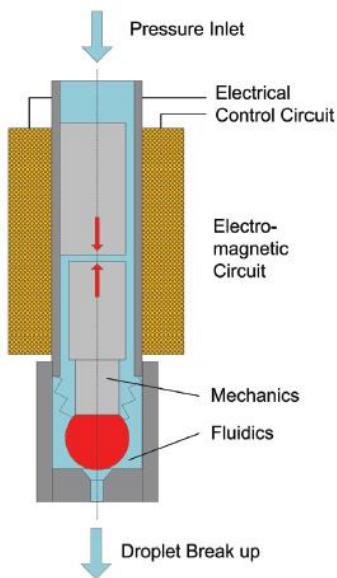
The Micro Valve is used for accurate “continuous” liquid additions at the micro scale (1 – 100 ml/hour) in the pharmaceutical and biotechnological industries.

It is suitable for additions of weak acids and bases or pH-neutral solutions. pH range of applicable solutions: pH = 4 ... 10.



The maximum number of applicable micro valves depends of the number of applied pumps. The *my*-Control has four positions for either a pump or a micro valve!

The schematic lay-out of the Micro Valve assembly is shown in the image below:



The Micro Valve contains a small spring that holds the valve seat in the closed position. When the solenoid is activated, the core is drawn into the solenoid base sub-assembly. When the solenoid is de-activated, the core assembly is returned by the force of the spring to the closed position.

When the valve opens, a tiny amount (approx. 0.5  $\mu$ l) of fluid shoots out of the valve, as a result of the pressurization of the addition liquid!

Varying the opening time of the valve will deliver variable amounts of reagent!

Z370000010 Micro Valve for MiniBio reactors

For the assembly instructions of the micro valve, refer to next page.



#### IMPORTANT NOTES

- This section contains important information on the Micro Valve Installation and Operation. It is strongly recommended that you read and follow these instructions carefully.
- Liquid must be filtered with a filter of pore size 0.45 $\mu$ m or less.
- The feed vessel should be able to withstand a pressure up to about 1.0 barg.
- The Micro Valve must never be operated dry.
- The Micro Valve should not be used to dose strong acid and alkaline solutions. The micro valve is severely damaged by 2M acid or base.

## EXTERNAL ACTUATORS

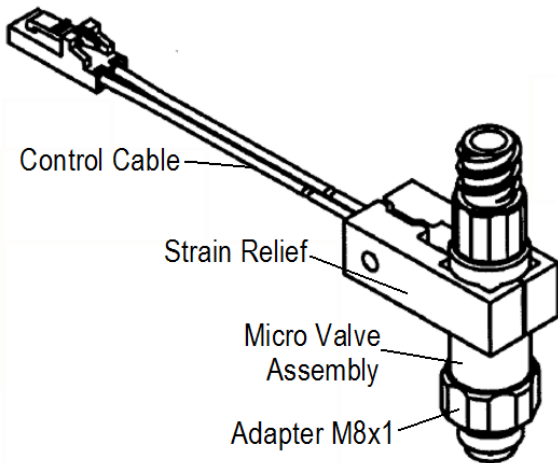
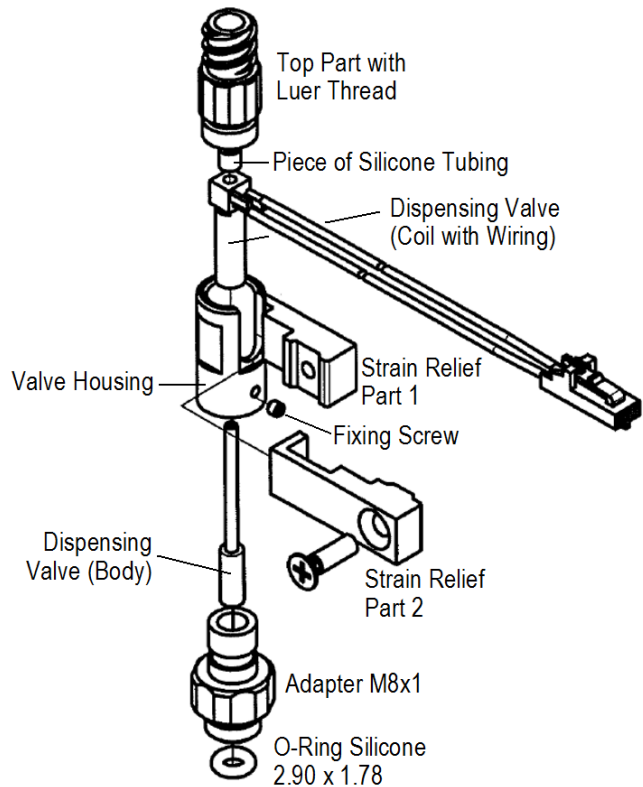
### 5.3.1 VALVE ASSEMBLY

Exploded View of the Micro Valve assembly:

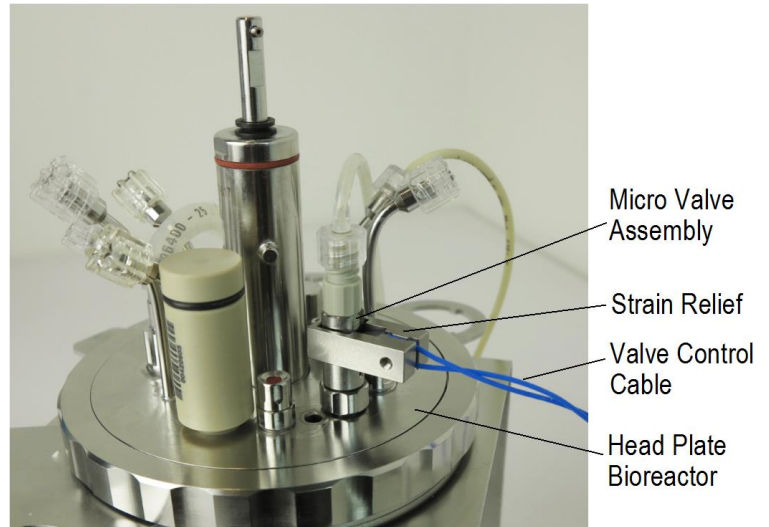


When assembling the micro valve, ensure that no foreign bodies are inadvertently included

1. The Dispensing Valve (Body) has been affixed to the Adapter M8x1 (with glue)  
Mount the Adapter M8x1 with O-Ring and Valve Body in one of the M8x1 ports in the reactor head plate.
2. Slide the Valve Housing on the Valve.
3. Insert the Dispensing Valve Coil in the Valve Housing Body and secure it by using the Fixing Screw.
4. Slide the piece of Silicone tubing on the Valve Shaft and mount the Top Part (this will compress the silicone gasket).
5. Attach the addition tubing.
6. The Micro Valve is now ready for use.



Micro Valve Assembly



Micro Valve assembly in the Head Plate

### 5.3.2 DISASSEMBLING THE VALVE

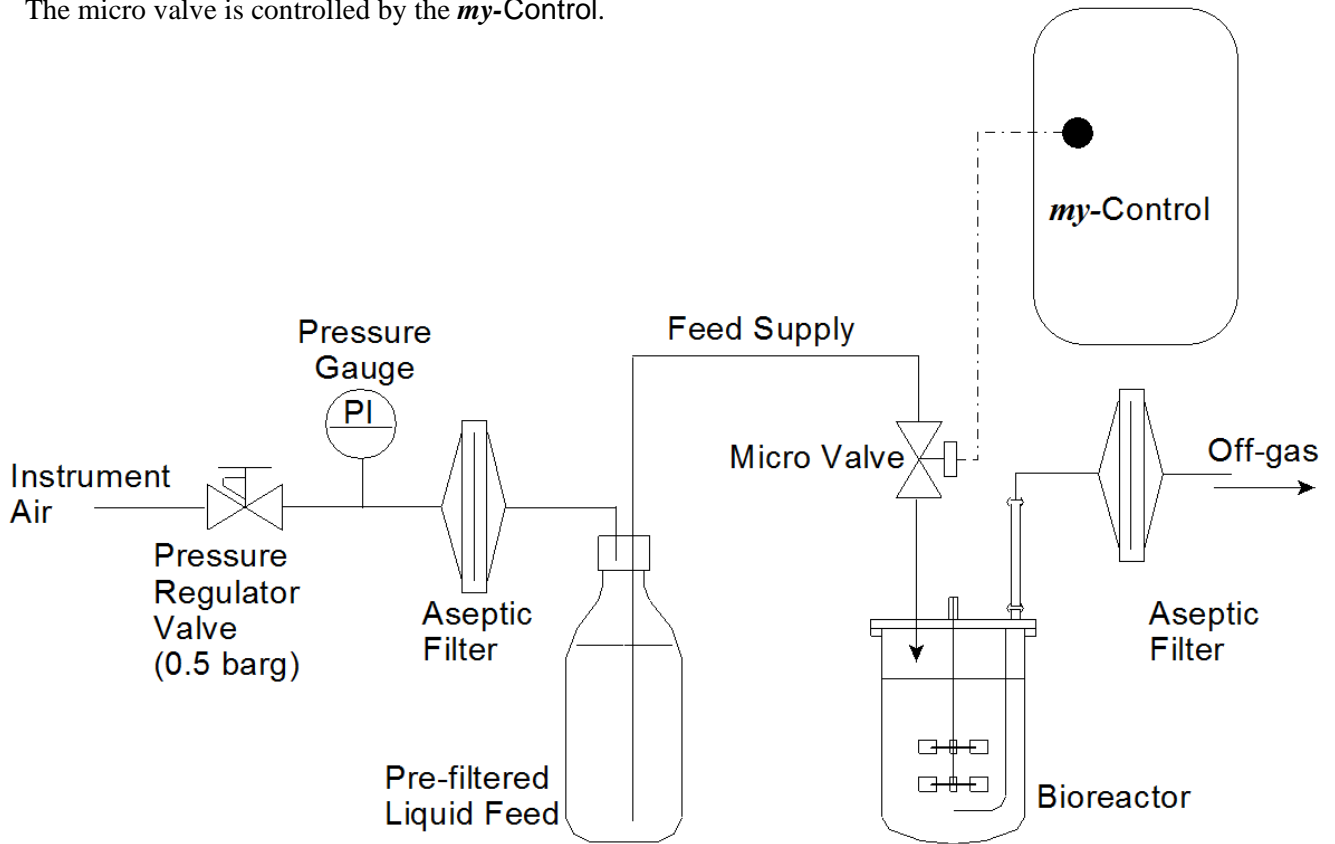
Depressurize the valve and turn off electrical power supply.

Disassemble the valve in reverse order of assembly according to the exploded view.

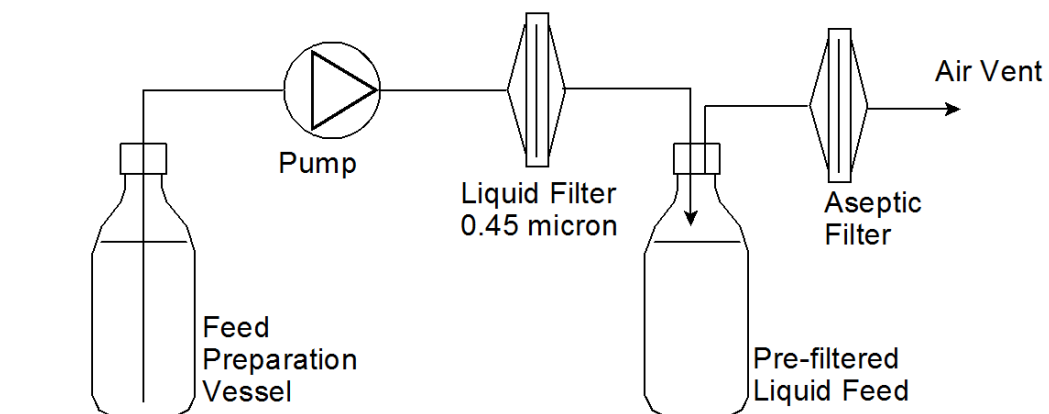
### 5.3.3 MICRO VALVE SETUP

The image below shows the micro valve liquid addition setup. The valve operates optimally with a differential pressure of 0.5 barg.

The micro valve is controlled by the *my-Control*.



The liquid feed is pre-filtered using 0.45µm as indicated in the image below.



### 5.3.4 FLOW RATE AS FUNCTION OF ON / OFF TIME PARAMETERS

The liquid addition rate depends on the opening time duration in relation to the cycle time of the Micro Valve. The time based parameters for controlling liquid flow rate are accessible and can be set at the HMI of the *my*-Control.

The liquid addition rate that can be achieved with the micro valve depends on the following parameters:

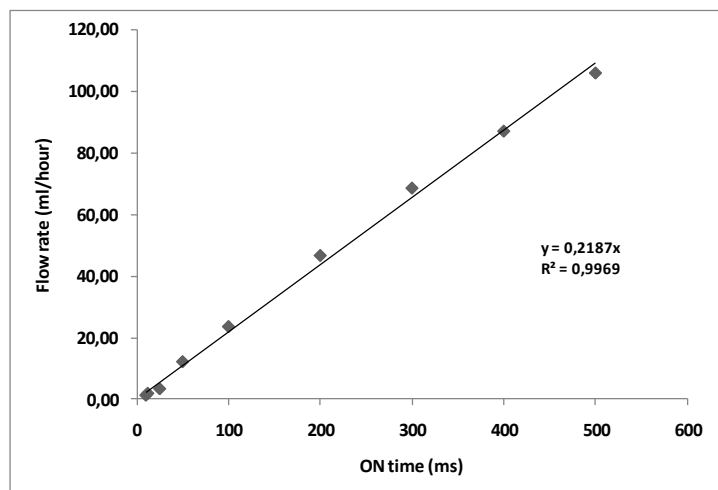
- ON and the OFF time intervals
- differential pressure across the micro valve
- liquid viscosity

Liquid addition rates at different ON and OFF times of the Micro valve have been determined with the following (aqueous) medium:

- $(\text{NH}_4)_2\text{SO}_4$  5 g/l
- $\text{KH}_2\text{PO}_4$  3 g/l
- $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  0.5 g/l
- 25-35 g/l (glucose)
- 3 ml/l antifoam

The resulting flow rates with corresponding ON and OFF times are presented in the table and graph below. The differential pressure across the micro valve during the test was 0.5 barg.

OFF Time (ms)	ON Time (ms)	Flow rate (ml/hr)
1690	10	1.4
1688	12	2.0
1675	25	3.5
1650	50	12.3
1600	100	23.7
1500	200	46.8
1400	300	68.7
1300	400	87.2
1200	500	106.1



The flow rate of the micro valve depends on:

- The specific micro valve
- Density and viscosity of the medium
- Pressure drop over the micro valve

Each valve must be calibrated using the liquid medium prior to use. The calibration conditions (pressure on liquid medium vessel, medium viscosity, etc) should be the same as in the operational setup.

### 5.3.5 CLEANING

The valve should be cleaned immediately after completing the fermentation or cultivation.

Flush the valve with sterile demineralized and filtered (0.45 micron) water with ON time = 5000 ms and OFF time = 10 ms.

Flush the valve for at least 10 minutes.

### 5.3.6 AUTOCLAVING

The micro valve is autoclavable at a temperature of approx. 121°C. The valve remains on the reactor top plate during autoclaving. The connector on the micro valve control cable can withstand steam but prolonged contact with water (e.g. at bottom of autoclave) must be avoided.

Wrap the micro valve cable around the auxiliaries in order to avoid contact with water in the autoclave.

In case of doubt, some foil can be wrapped around the connector.



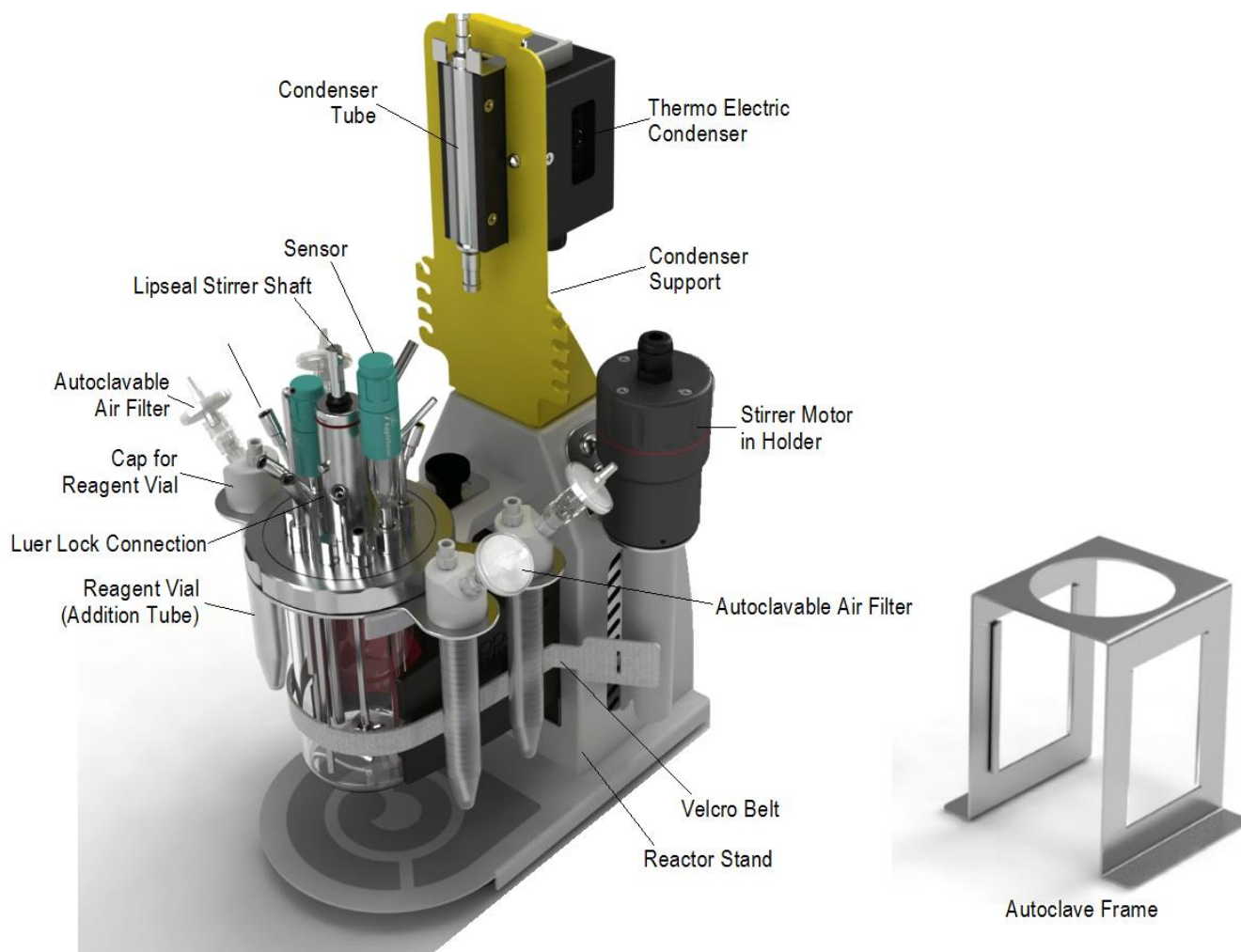
Before connecting the micro valve cable to the output cable of the *my-Control*, make sure that the connector of the micro valve is dry!





## 6 REACTORS AND AUXILIARIES

The 250 and 500 ml MiniBio Reactors and their Auxiliaries are represented by the image below. The 1000 ml MiniBio Reactor is an integrated assembly of stand and reactor and is described in the relevant section about MiniBio Reactor Assembly 1000 ml.



The assembled MiniBio Reactors may consist of the following parts:

Description	Part Number 250ml Reactor	Part number 500ml Reactor	Part number 1000ml Reactor
MiniBio Reactor V2	Z611025020	Z611050020	Z611100020
Thermo Electric Heater/Cooler Assembly	Z311021210	Z311021220	-
Lipseal Stirrer Assembly V2	Z813150255	Z813150505	Z813151001
Stepper Stirrer Motor for MiniBio Reactors V2	Z510002140	Z510002140	Z510002150
Marine Impeller ("V"-bent blades)	Z813140261	Z813140511	Z813141011
Flat Disc Impeller (6 blades)	Z813130261	Z813130511	Z813131011
Sample Pipe (Height Adj.) Luer Lock	Z813190252	Z813190252	Z813191052
Sample Pipe (Height Adj.) with Thread Luer Lock	Z813190260	Z813190260	Z813191060
Liquid Addition / Sample Bottle 15ml with Cap	Z812070253	Z812070253	Z812070253



## 6.1 MINIBIO REACTOR ASSEMBLY 250 ML

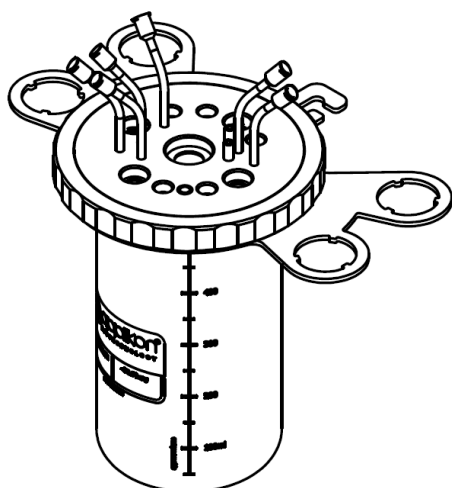
The 250 ml MiniBio Reactor consists of three major parts:

V3LP070501 Stand for 250ml MiniBio Reactor M2

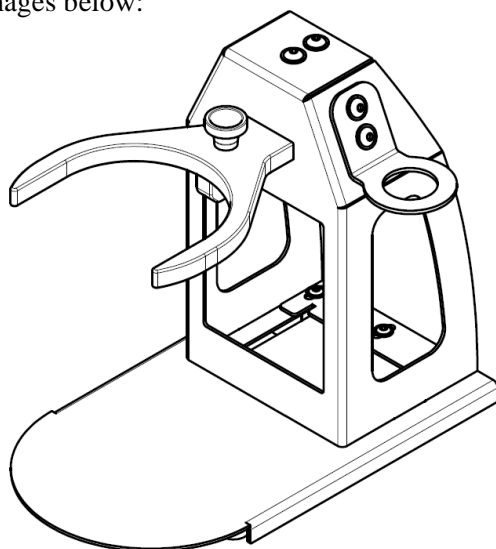
V3LP070701 Bioreactor Assembly 250ml MiniBio M2

V3MP078071 Autoclave Frame for 250ml MiniBio Reactor (frame for autoclaving the reactor)

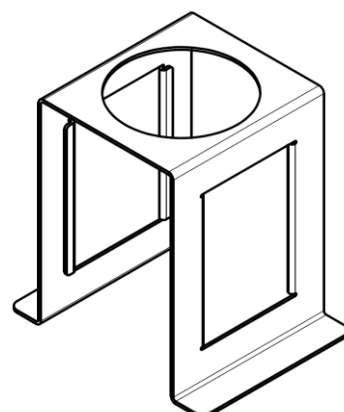
The three parts are presented in the images below:



MiniBio Reactor Assembly 250ml



Stand for 250ml Reactor

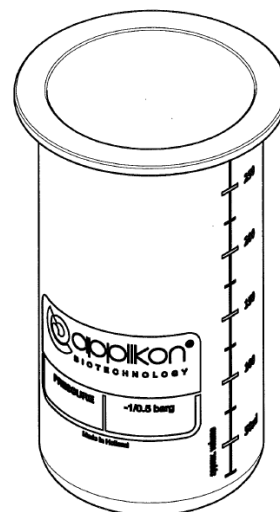


Autoclave Frame 250ml

### 6.1.1 GENERAL REACTOR SPECIFICATIONS

Reactor type: MiniBio 250 ml:

Total Volume Reactor*)	290 ml
Inside Total Height	125 mm
Inside Diameter	55 mm
H/D Ratio Total Volume	2.3
Working Volume Reactor*)	200 ml
Height Working Volume	86 mm
H/D Ratio Working Volume	1.6
Minimum Working Volume	50 ml
Material	Borosilicate glass
Minimum Reactor Safety Pressure	-1.0 barg
Maximum Reactor Safety Pressure	0.5 barg
Maximum Reactor Working Pressure **)	0.1 barg



\*) Reactor Volume without auxiliaries.

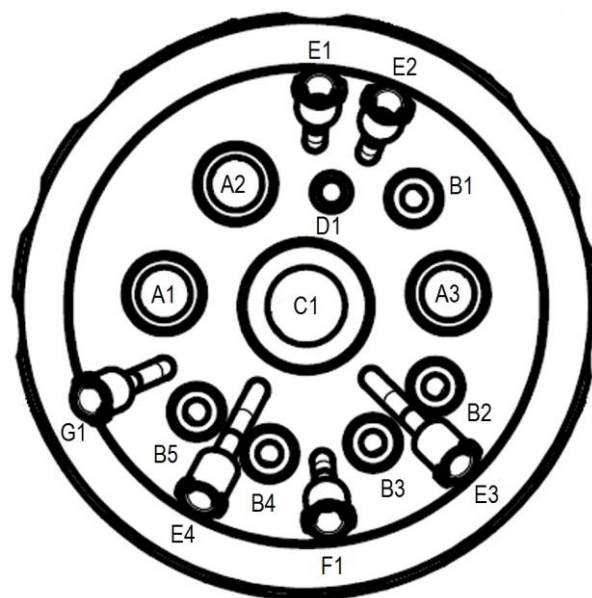
\*\*\*) The maximum working pressure is the guaranteed pressure that can be reached with a standard configuration with a default O-ring (part number V1S4054X15). It is possible to go up to a maximum safety pressure (0.5 barg) by replacing the default O-ring with a gasket.

### 6.1.2 250ML HEAD PLATE SPECIFICATIONS

The head plate comes with welded inserts for:

- Temperature measurement (thermometer pocket)
- Sparging and sampling
- Additions or overlay

Port #	Description
A1	Sensor / Condenser Port M12 x 1
A2	Sensor / Condenser Port M12 x 1
A3	Sensor / Condenser Port M12 x 1
B1	Universal Port M8x1
B2	Universal Port M8x1
B3	Universal Port M8x1
B4	Universal Port M8x1
B5	Universal Port M8x1
C1	Stirrer Port
D1	Temperature Pocket
E1 (Luer Lock)	Addition or Overlay Pipe
E2 (Luer Lock)	Addition or Overlay Pipe
E3 (Luer Lock)	Addition or Overlay Pipe
E4 (Luer Lock)	Addition or Overlay Pipe
F1 (Luer Lock)	Fixed Sample Pipe
G1 (Luer Lock)	Sparger Pipe



One of the four addition ports may be used for gas overlay.

For Microbial applications, the lower end of the sparger pipe is left open or a jet sparger tip is used:

Z813180252 Jet Sparger Tip

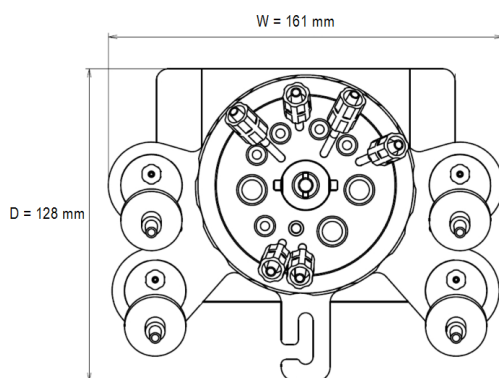
For Cell Culture applications, the lower end of the sparger pipe may be equipped with a porous sparger tip:

Z813180251 Porous Sparger Tip

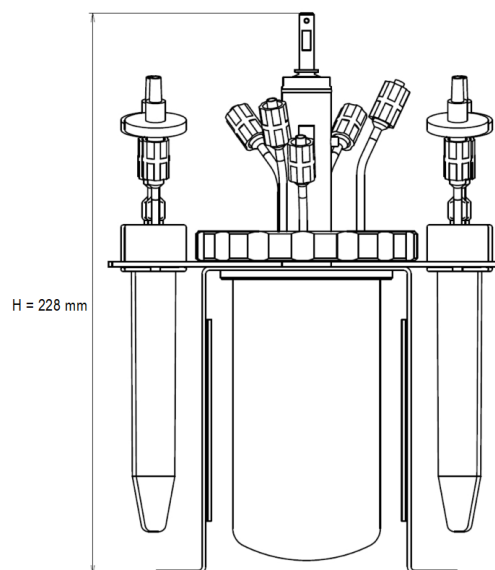
### 6.1.3 REQUIRED SPACE IN AUTOCLAVE

Required space in the autoclave (mm):

H x W x D = 240 x 180 x 150



Top View MiniBio Reactor Assembly 250 ml



Side View MiniBio Reactor Assembly 250 ml

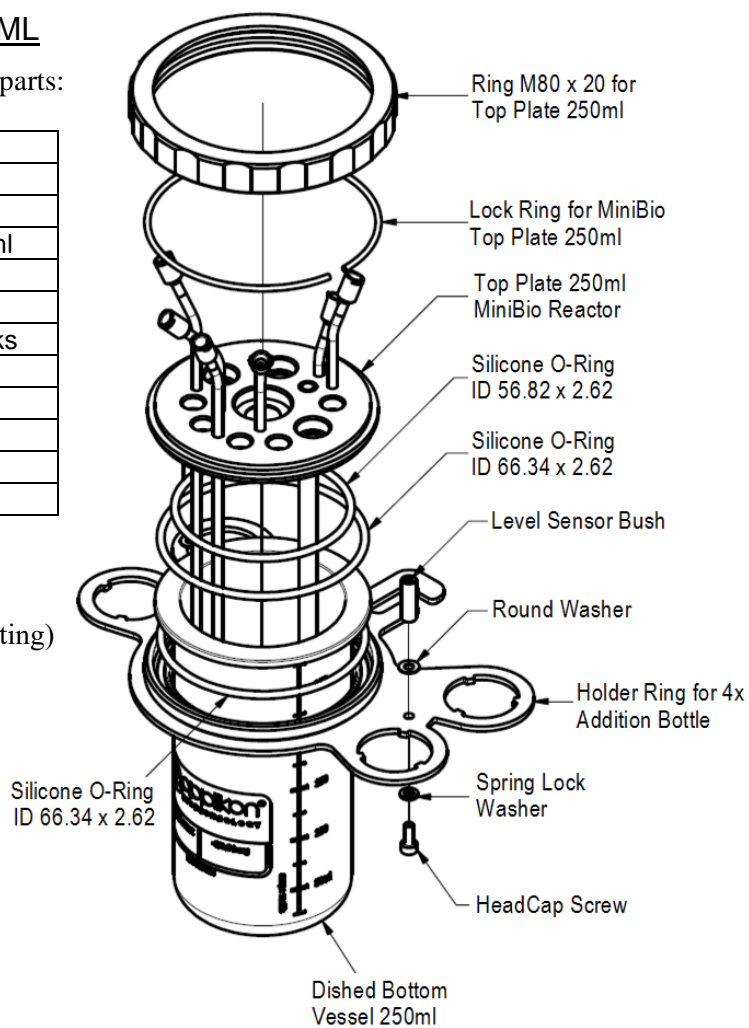
### 6.1.4 BIOREACTOR ASSEMBLY 250 ML

The 250 ml bioreactor consists of the following parts:

Part #	Description
V3MP072501	Vessel Dished Bottom 250ml
V3MP071851	Lock Ring for Top Plate 250ml
V3MP071811	Ring M80x2 for Top Plate 250ml
V3MP071031	Level Sensor Bush
V3KP070141	Holder Ring 4x Addition Bottle
V3KP070121	Top Plate 250ml with Luer Locks
V1S4ARP146	Silicone O-Ring ID 66.34x2.62
V1S4ARP140	Silicone O-Ring ID 82.34x2.62
V0N0310051	Spring Lock Washer
V0N0310001	Round Washer
V0N0305008	HeadCap Screw



The “top plate” is locked in the “(rotating) ring” by the “lock ring”.



## 6.2 MINIBIO REACTOR ASSEMBLY 500 ML

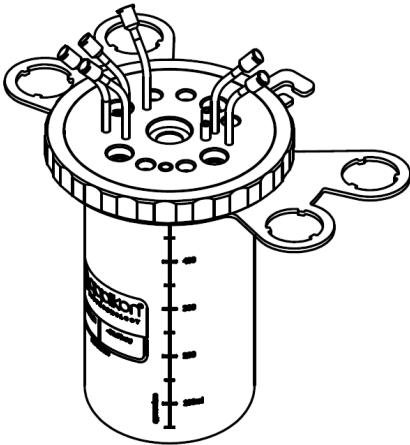
The 500 ml MiniBio Reactor consists of three major parts:

V3LP070551 Stand for 500ml MiniBio Reactor M2

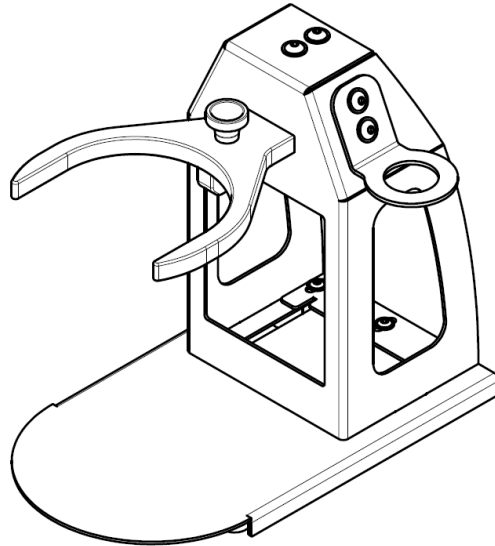
V3LP070721 Bioreactor Assembly 500ml MiniBio M2

V3MP078081 Autoclave Frame for 500ml MiniBio Reactor (frame for autoclaving the reactor)

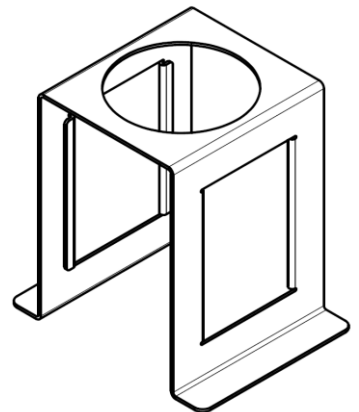
The three parts are presented in the images below:



MiniBio Reactor Assembly 500ml



Stand for 500ml Reactor

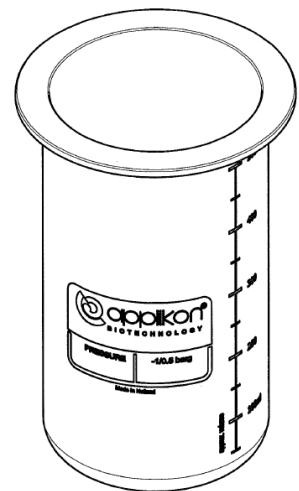


Autoclave Frame 500ml

### 6.2.1 GENERAL REACTOR SPECIFICATIONS

Reactor type: MiniBio 500 ml:

Total Volume Reactor*)	550 ml
Inside Total Height	145 mm
Inside Diameter	71 mm
H/D Ratio Total Volume	2.1
Working Volume Reactor*)	400 ml
Height Working Volume	107 mm
H/D Ratio Working Volume	1.5
Minimum Working Volume	100 ml
Material	Borosilicate glass
Minimum Reactor Safety Pressure	-1.0 barg
Maximum Reactor Safety Pressure	0.5 barg
Maximum Reactor Working Pressure **)	0.28 barg



\*) Reactor Volume without auxiliaries.

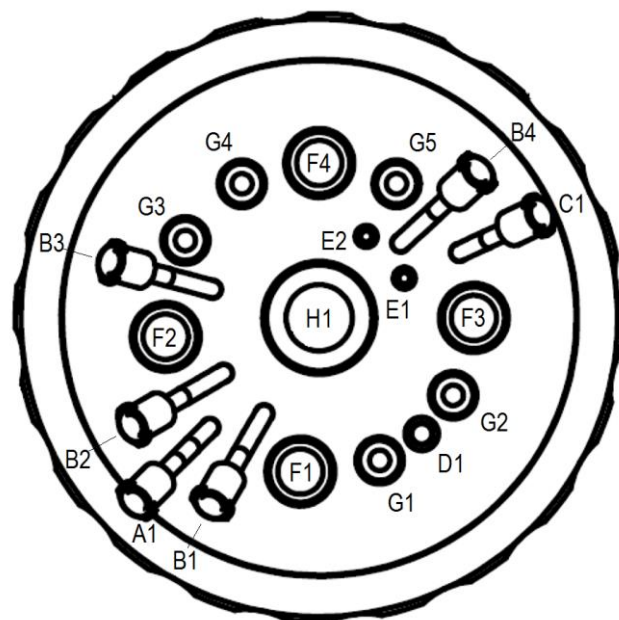
\*\*\*) \*\*) The maximum working pressure is the guaranteed pressure that can be reached with a standard configuration with a default O-ring (part number V1S4072X40). It is possible to go up to a maximum safety pressure (0.5 barg) by replacing the default O-ring with a gasket.

### 6.2.2 HEAD PLATE SPECIFICATIONS

The head plate comes with welded inserts for:

- Temperature measurement (thermometer pocket)
- Sparging and sampling
- Additions or overlay

Port #	Description
A1 (Luer Lock)	Sparger Pipe
B1 (Luer Lock)	Addition or Overlay Pipe
B2 (Luer Lock)	Addition or Overlay Pipe
B3 (Luer Lock)	Addition or Overlay Pipe
B4 (Luer Lock)	Addition or Overlay Pipe
C1 (Luer Lock)	Fixed Sample Pipe
D1	Temperature Pocket
E1	Contact Bus for Level Sensor
E2	Contact Bus for Level Sensor
F1	Sensor / Condenser Port M12 x 1
F2	Sensor / Condenser Port M12 x 1
F3	Sensor / Condenser Port M12 x 1
F4	Sensor / Condenser Port M12 x 1
G1	Universal Port M8x1
G2	Universal Port M8x1
G3	Universal Port M8x1
G4	Universal Port M8x1
G5	Universal Port M8x1
H1	Stirrer Port



One of the four addition ports may be used for gas overlay.

For Microbial applications, the lower end of the sparger pipe is left open or a jet sparger tip is used:

Z813180252 Jet Sparger Tip

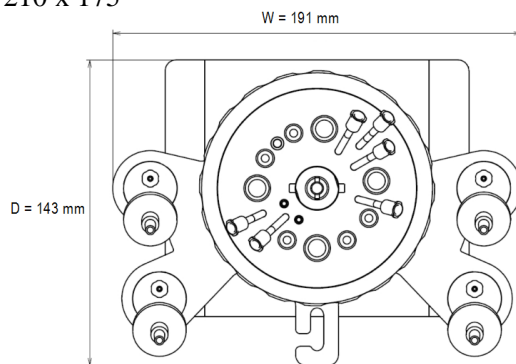
For Cell Culture applications, the lower end of the sparger pipe may be equipped with a porous sparger tip:

Z813180251 Porous Sparger Tip

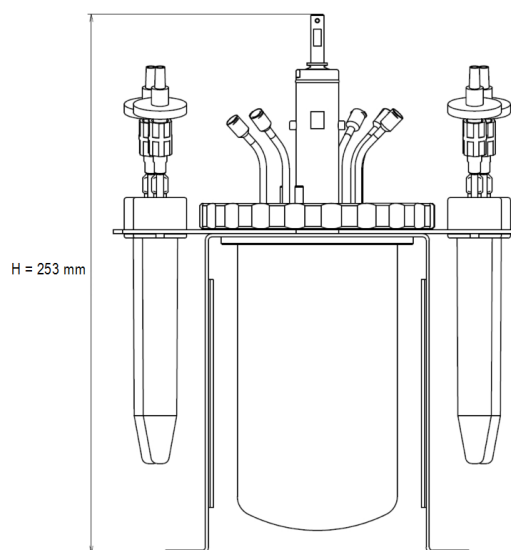
### 6.2.3 REQUIRED SPACE IN AUTOCLAVE

Required space in the autoclave (mm):

H x W x D = 280 x 210 x 175



Top View MiniBio Reactor Assembly 500 ml



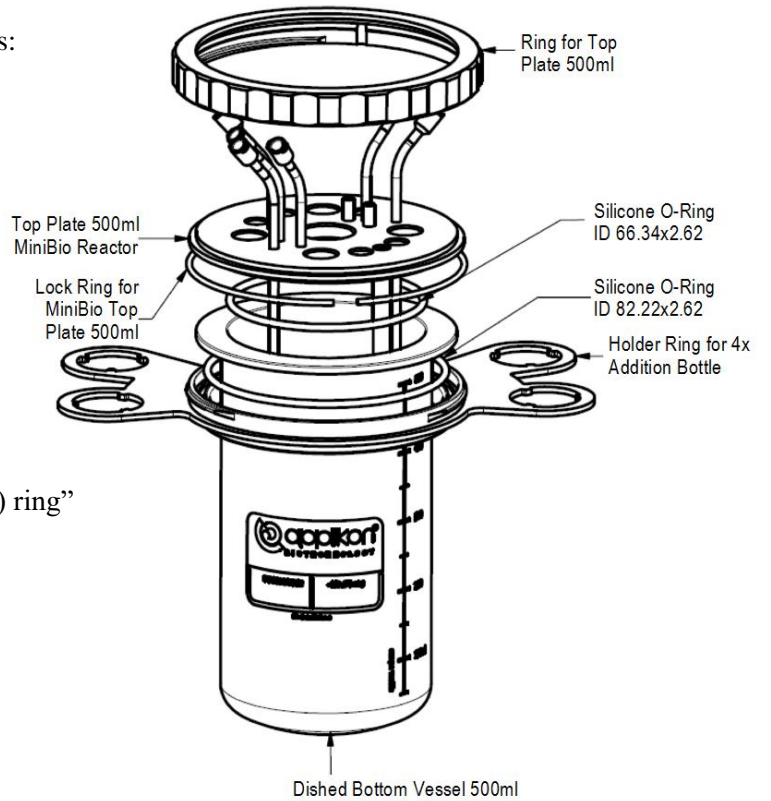
Side View MiniBio Reactor Assembly 500 ml



6.2.4 BIOREACTOR ASSEMBLY 500 ML

The 500 ml bioreactor consists of the following parts:

Part #	Description
V3MP075001	Vessel Dished Bottom 500 ml
V3KP070161	Holder Ring 4x Addition Bottle
V1S4ARP152	Silicone O-Ring ID 82.22x2.62
V1S4ARP146	Silicone O-Ring ID 66.34x2.62
V3MP071951	Ring for Top Plate 500ml
V3MP071981	Lock Ring for Top Plate 500ml
V3KP070131	Top Plate 500ml with Luer Locks



The “top plate” is locked in the “(rotating) ring” by the “lock ring”.

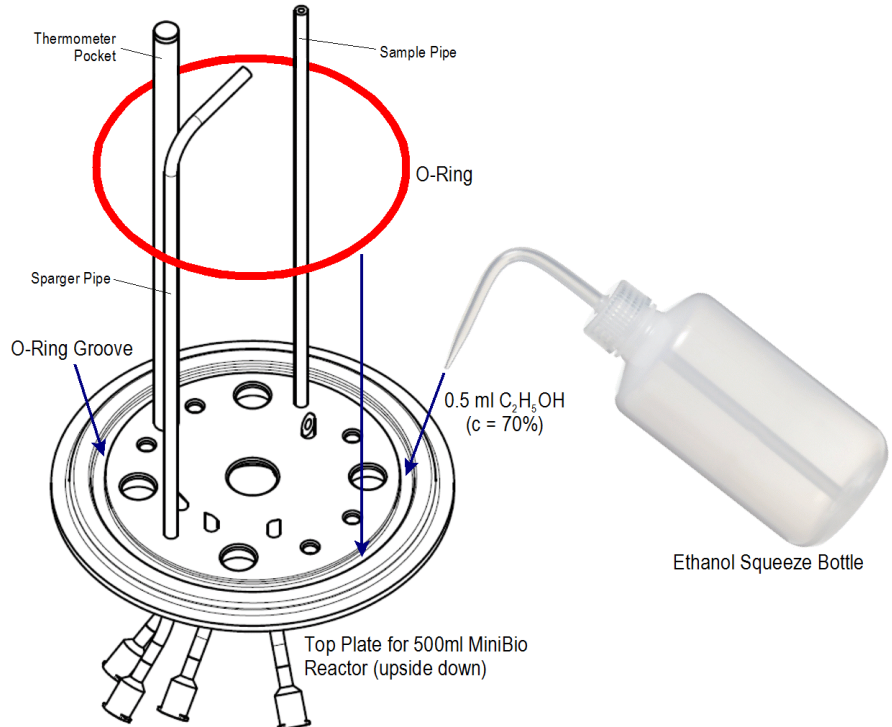
**Mounting the Silicone O-ring in the bottom of the top plate:**

If the O-ring in the bottom of the top plate has to be replaced, it requires a special trick to mount it without twisting.

Use an ethanol squeeze bottle to add approx. 0.5 ml ethanol (c = 70%) to the O-ring groove.

Insert the O-ring in the groove and use your thumbs to force the ring into the groove.

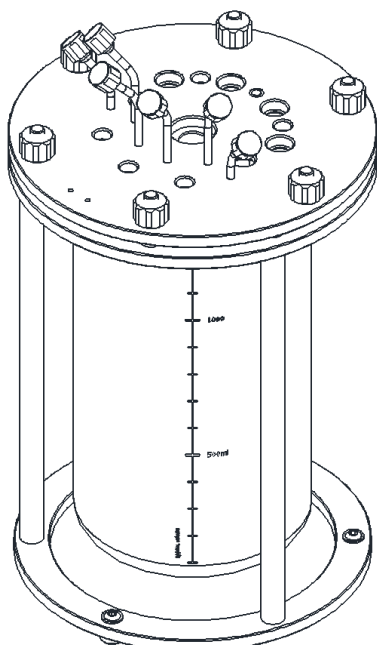
Since the O-ring is wetted by the ethanol, it will not pop out any longer.



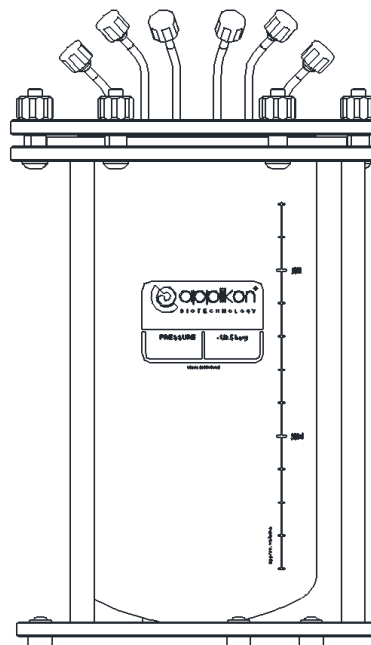
### 6.3 MINIBIO REACTOR ASSEMBLY 1000 ML

The 1000 ml MiniBio Reactor consists of one assembly:  
 Z611100020 MiniBio Reactor 1000 ml V2

See the images below:



MiniBio Reactor 1000 ml  
Isometric View



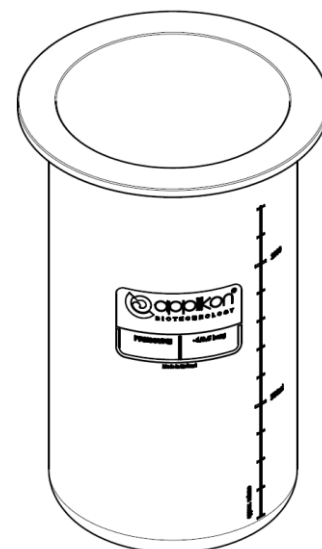
MiniBio Reactor 1000 ml  
Side View

#### 6.3.1 GENERAL REACTOR SPECIFICATIONS

Reactor type: MiniBio 1000 ml:

Total Volume Reactor*)	1250 ml
Inside Total Height	200 mm
Inside Diameter	94 mm
H/D Ratio Total Volume	2.1
Working Volume Reactor*)	1000 ml
Height Working Volume	145 mm
H/D Ratio Working Volume	1.5
Minimum Working Volume	200 ml
Material	Borosilicate glass
Minimum Reactor Safety Pressure	-1.0 barg
Maximum Reactor Safety Pressure	0.5 barg

\*) Reactor Volume without auxiliaries.



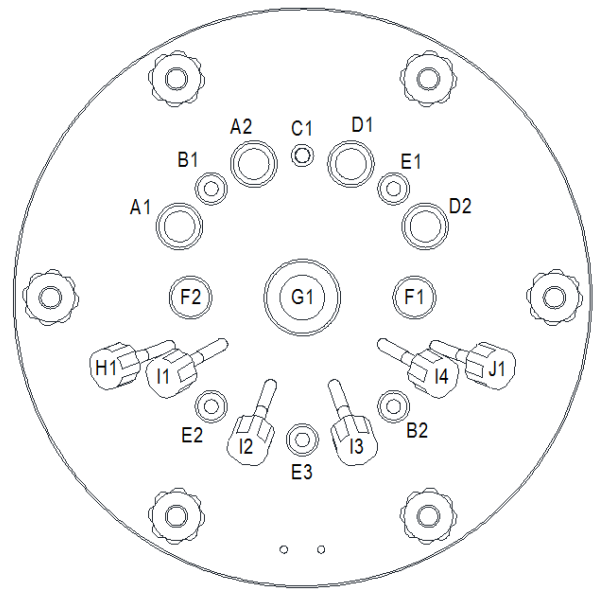
### 6.3.2 HEAD PLATE SPECIFICATIONS

The head plate comes with welded inserts for:

- Temperature measurement (thermometer pocket),
- Sparging,
- Sampling and
- Additions or overlay.

Layout and top view of the head plate:

Port #	Description
A1	Universal Port M12
A2	Universal Port M12
B1	Universal Port M8
B2	Universal Port M8
C1	Fixed Thermometer Pocket
D1	Universal Port M12
D2	Universal Port M12
E1	Universal Port M8
E2	Universal Port M8
E3	Universal Port M8
F1	Heat Exchanger Port
F2	Heat Exchanger Port
G1	Stirrer Port
H1 Luer Lock	Fixed Sample Port
I1 Luer Lock	Addition / Overlay Port
I2 Luer Lock	Addition / Overlay Port
I3 Luer Lock	Addition / Overlay Port
I4 Luer Lock	Addition / Overlay Port
J1 Luer Lock	Stirrer Port



One of the four addition ports may be used for gas overlay.

For Microbial applications, the lower end of the sparger pipe is left open or a jet sparger tip is used:

Z813180252 Jet Sparger Tip.

For Cell Culture applications, the lower end of the sparger pipe may be equipped with a porous sparger tip:

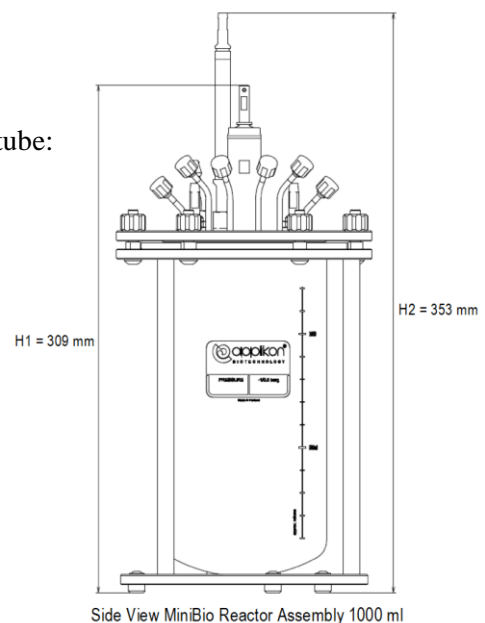
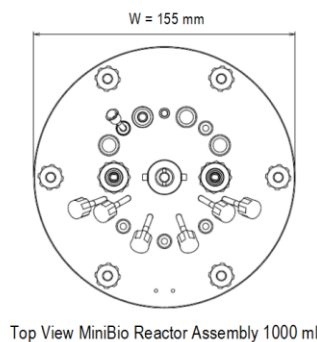
Z813180251 Porous Sparger Tip.

### 6.3.3 REQUIRED SPACE IN AUTOCLAVE

Required space in the autoclave (mm), with and without condenser tube:

H1 x W x D = 330 x 180 x 180

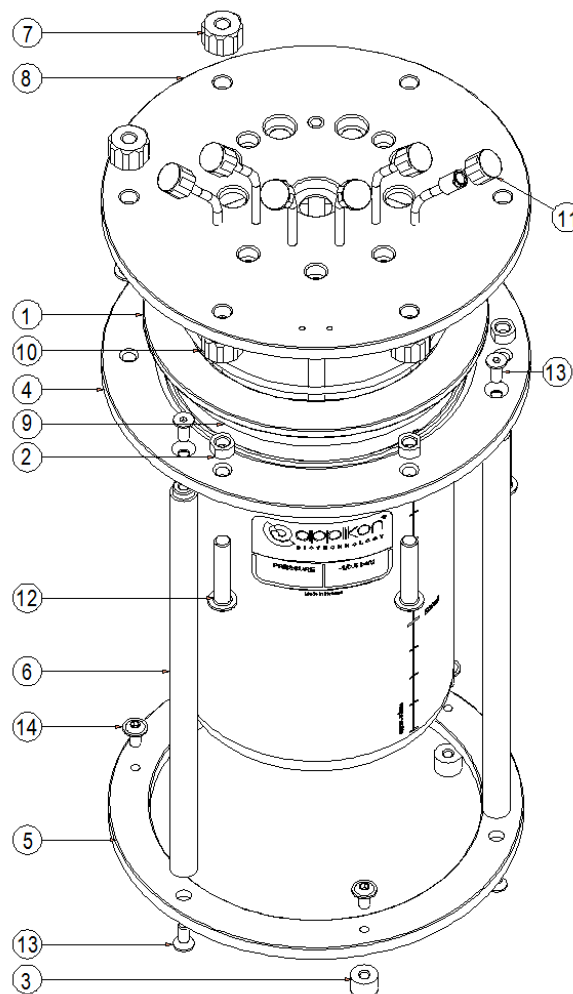
H2 x W x D = 380 x 180 x 180





### 6.3.4 BIOREACTOR ASSEMBLY 1000 ML

In this section, the MiniBio Reactor 1000 ml is presented in exploded view. The table lists the different parts:



Pos.	Part#	Description
1	V3MP075021	Vessel Dished Bottom 1000 ml WV
2	V3MP072201	Clamping Ring – Top Plate Spacer M6
3	V3MP072191	Foot OD10 for 3-Stand Bottom Ring
4	V3MP070991	Clamping Ring ID105 SS316
5	V3MP070981	Bottom Ring ID120 for 3-Stand AISI316
6	V3MP070971	Stand for 3-Stand OD10 L=195
7	V3MA010111	Ribbed Nut D15 H10 M6
8	V3KP070181	Top Plate 1000 ml Reactor with Luer Locks
9	V1S4104X30	O-ring ID104.20X3.00 Silicone
10	V1S4095X26	O-ring ID94.92 x 2.62 Silicone
11	V0W0030100	Male Cap for Female Luer Lock PC
12	V0N0625130	M6X30 Hex. Sock. Button HD Cap Screw
13	V0N0433010	M4X10 Hex Sock. Countersunk Head Screw
14	V0N0425008	M4X08 Hex. Sock. Button HD Cap Screw

## REACTORS AND AUXILIARIES

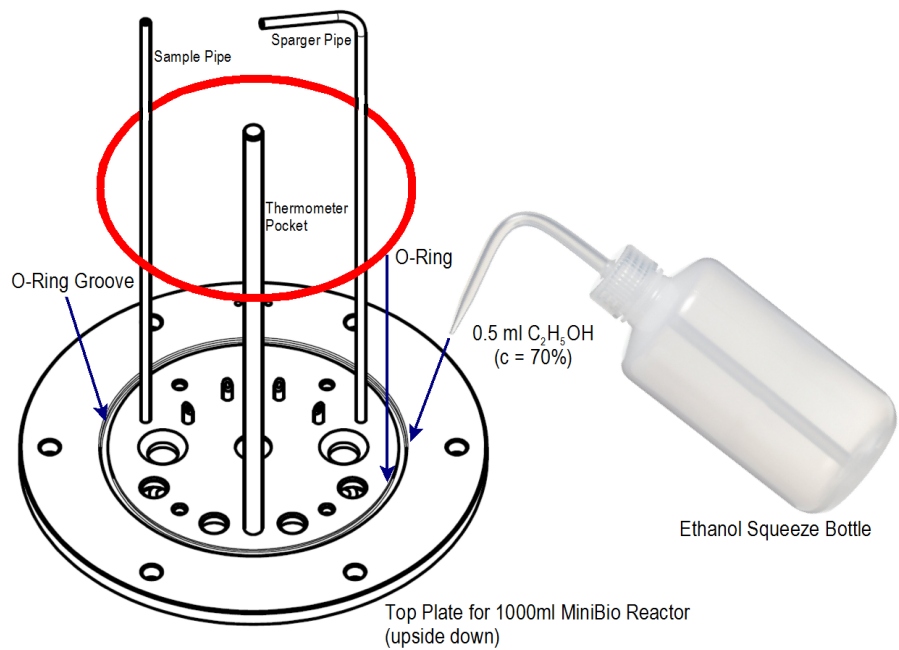
### Mounting the Silicone O-ring in the bottom of the top plate:

If the O-ring in the bottom of the top plate has to be replaced, it requires a special trick to mount it without twisting.

Use an ethanol squeeze bottle to add approx. 0.5 ml ethanol (c = 70%) to the O-ring groove.

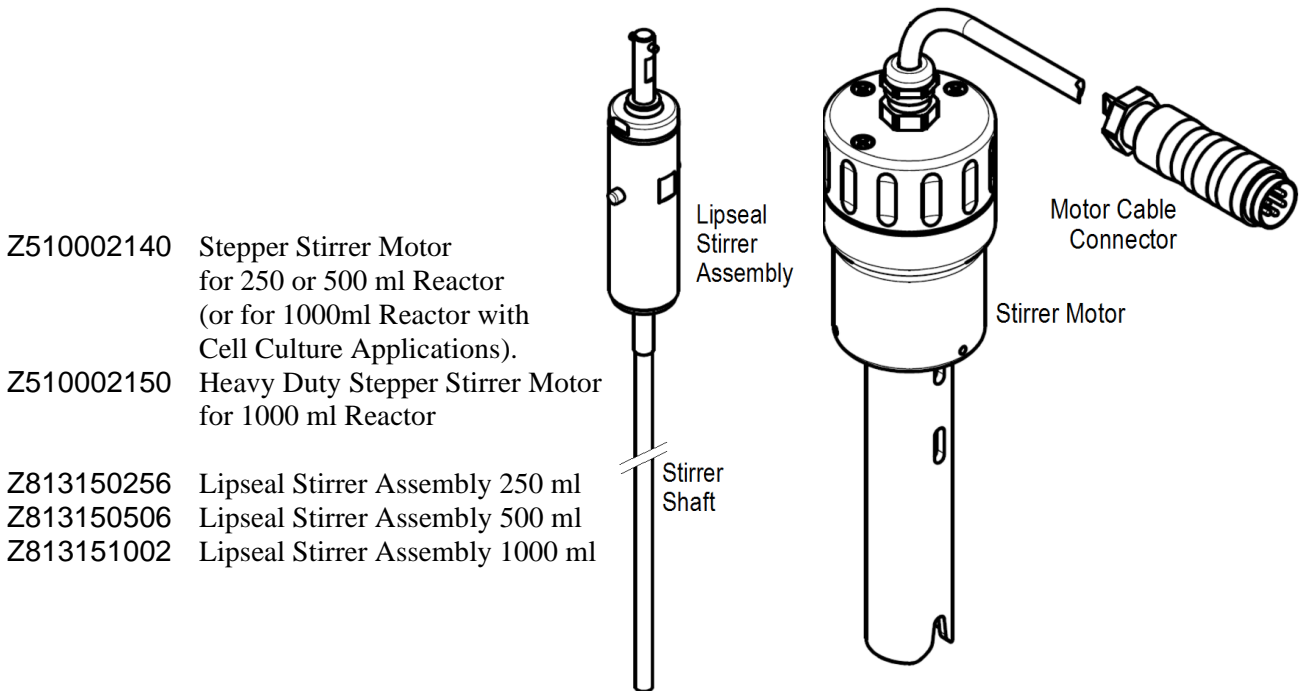
Insert the O-ring in the groove and use your thumbs to force the ring into the groove.

Since the O-ring is wetted by the ethanol, it will not pop out any longer.



## 6.4 STIRRER DRIVE AND STIRRER ASSEMBLY

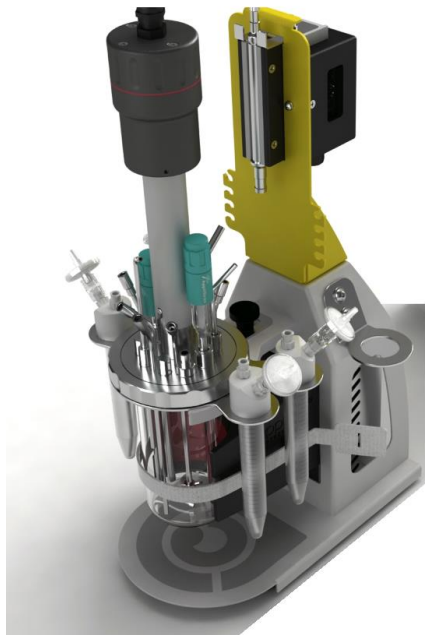
The Stepper Stirrer Motor Assembly for the MiniBio Reactors fits directly on top of the Stirrer Assembly.



The Stirrer Assembly is mounted in the central port of the reactor head plate.

The Stirrer Motor can be put on top of it. As soon as the motor starts turning, the fork coupling on the motor shaft will fit on the stirrer shaft.

The stands for the 250 and 500 ml MiniBio Reactors are equipped with a Motor Holder Ring at the right hand side of the stand. When the bioreactor is not in operation, the motor can be fitted in the holder:



Stirrer Motor on top of Stirrer Assembly

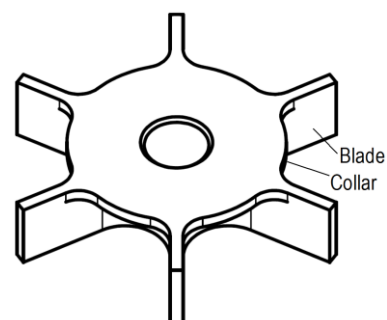


Stirrer Motor in Holder

### 6.4.1 IMPELLERS

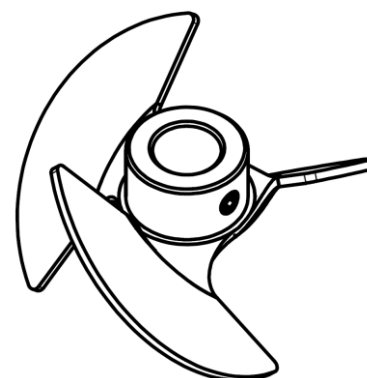
Impeller(s) can be mounted onto the stirrer shaft:

- Z813130261 Rushton Impeller ID5/OD22 – 6 (milled) blades for 250 ml Reactor
- Z813130511 Rushton Impeller ID5/OD28 – 6 (milled) blades for 500 ml Reactor
- Z813131011 Rushton Impeller ID5/OD38 – 6 (milled) blades for 1000 ml Reactor



It is advised to mount the Rushton Impeller with the collar facing upward. In this way, the residence time of gas bubbles is increased and the  $K_{LA}$ -value is improved.

- Z813140261 Marine Impeller ID5/OD22 – Vortex for 250 ml Reactor
- Z813140511 Marine Impeller ID5/OD28 – Vortex for 500 ml Reactor
- Z813141011 Marine Impeller ID5/OD38 – Vortex for 1000 ml Reactor



The impellers are mounted at the stirrer shaft by fixing the mounting screw. Part number of this screw:

Part #	Description
V0N0204002	M2X 2-S-A4 HX.Sock Setscrew Cup-PT

### 6.4.2 MAXIMUM STIRRER SPEED

The table below lists the maximum stirrer speed for the different MinBio reactors (in combination with the Rushton Impeller)

Max. Stirrer Speed	250 ml Reactor	500 ml Reactor	1000 ml Reactor
Z510002140 Stepper Stirrer Motor	2000 rpm	2000 rpm	1400 rpm
Z510002150 HD Stepper Stirrer Motor			2000 rpm*

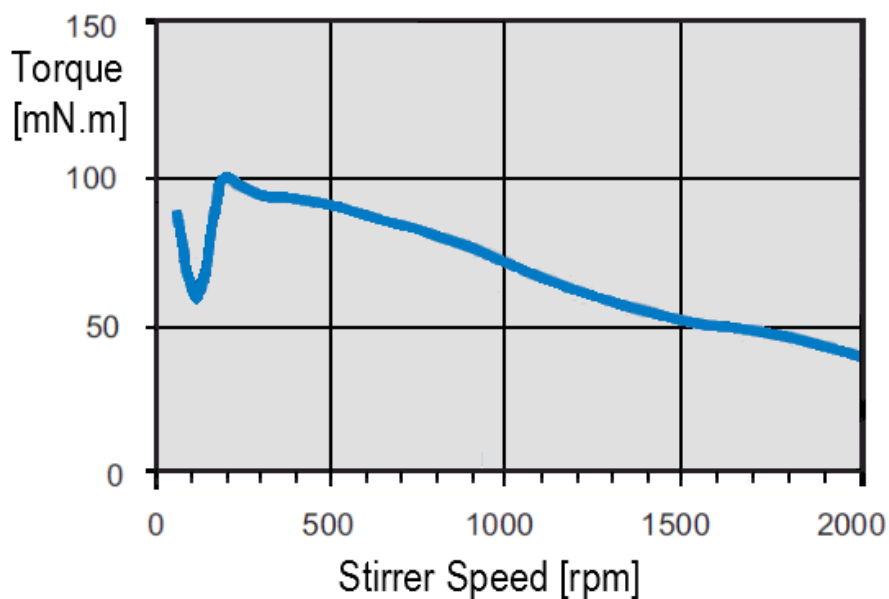
\*In a microbial reactor configuration with 2 Rushton impellers and baffles, the maximum stirrer speed of the HD Stepper Stirrer Motor will be reduced to approx. 1750 rpm. Increasing viscosity will also limit the maximum stirrer speed.

### 6.4.3 MAXIMUM TORQUE OF THE STEPPER STIRRER MOTORS

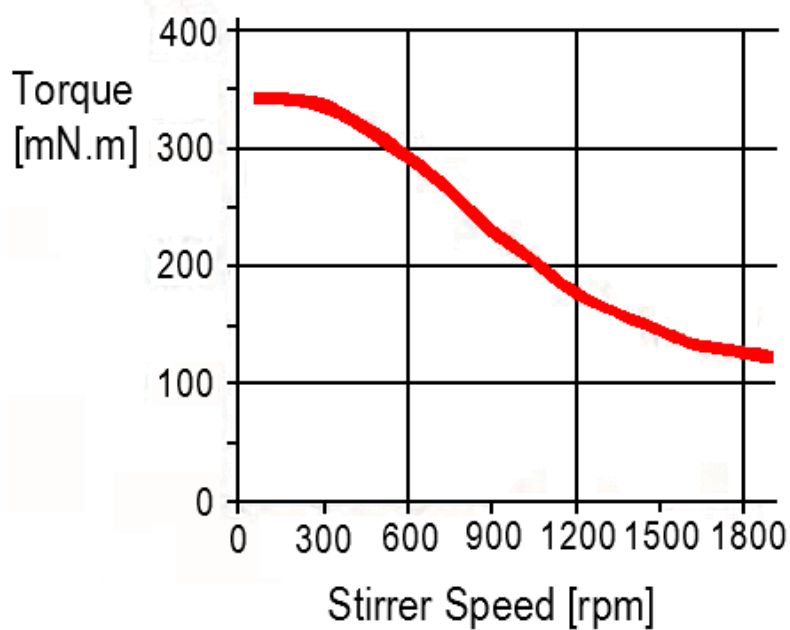
The torque that can be supplied by the Stepper Stirrer Motors depends on the Stirrer Speed. In general terms: the higher the stirrer speed, the lower the supplied torque.

The images below show the torque of both applicable Stepper Stirrer Motors as a function of the stirrer speed:

Torque for Stepper Stirrer Motor for 250 or 500 ml Reactor (Z510002140):

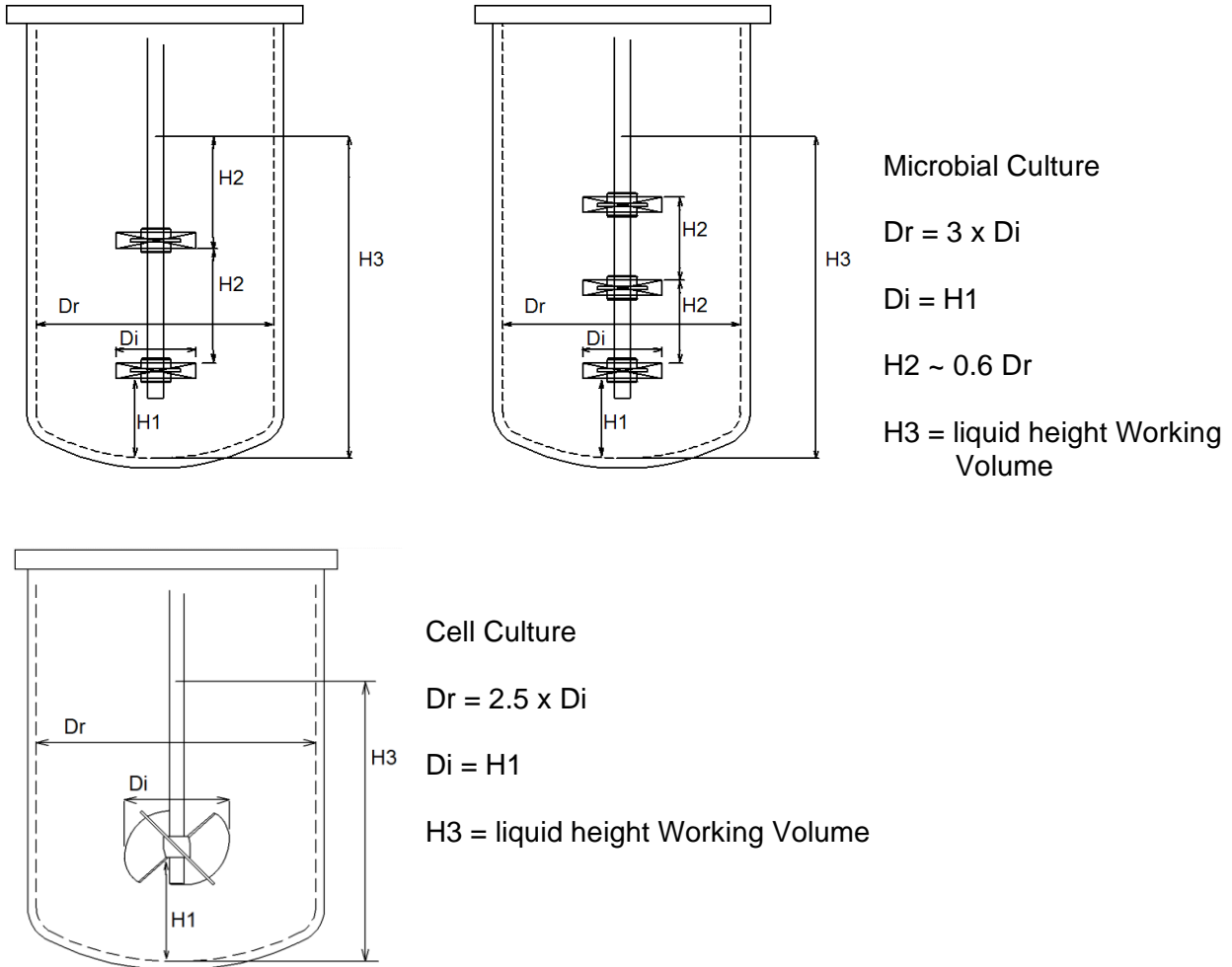


Torque for Heavy Duty Stepper Stirrer Motor for 1000 ml Reactor (Z510002150):



6.4.4 ADVISED IMPELLER CONFIGURATION

The following images show the advised impeller configuration (position and diameter) for the glass autoclavable bioreactors (microbial and cell culture):



### 6.4.5 STIRRER POWER CALCULATIONS AND EXAMPLES

The computations in this section are derived from the theory for **single impeller** configurations and are therefore the most accurate for those configurations. A subsequent version of this manual may include the calculations for multiple impeller configurations.

The power (Watt) of the stirrer motor that is required depends on the number, type and diameter of the impellers, density of the medium and the stirrer speed. The required power per impeller of a stirrer motor in **non-aerated** media is given by the equation:

$$P = \rho \times (N/60)^3 \times D^5 \times N_p$$

where:

P	Required Power of the Stirrer Motor (W)
$\rho$	Density of the Medium (kg/m <sup>3</sup> )
N	Stirrer Speed (rpm)
D	Diameter of the Impeller (m)
N <sub>p</sub>	Power Number of the Impeller*)

- \*) Rushton turbine impellers:            N<sub>p</sub> = 6
- Applikon marine impellers:        N<sub>p</sub> = 1.5

When mounted according to the given configuration, a second or third impeller on a shaft requires only 90 % of the power of the first impeller. This means that the equation above is multiplied with the factor 1.9 for two impellers and with a factor 2.8 for three impellers.

#### **Required Torque**

The required torque of the stirrer motor is related to its power according to the following equation:

$$M = P \times 60 / (2 \pi N)$$

where:

M	Required Torque of the Stirrer Motor (Nm)
P	Required Power of the Stirrer Motor (W)
N	Stirrer Speed (rpm)

#### **Impeller Tip Speed**

The Tip Speed (m/s) of an impeller at a certain stirrer speed is given by the equation:

$$\text{Tip speed} = (N / 60) \times \pi \times D$$

Where:

N	Stirrer Speed (rpm)
D	Diameter of the Impeller (m)

The examples section shows several calculations of required power, torque, and impeller tip speed.

## **EXAMPLES**

Required stirrer power, torque and corresponding tip speed for non-aerated media with a density of  $1100 \text{ kg/m}^3$  are calculated as follows:

2 or 3 liter reactor with two 6-bladed turbine impellers of 45 mm, at 1250 rpm:

$$\begin{aligned} \text{required power:} & \quad P = 1100 \cdot (1250 / 60)^3 \cdot (0.045)^5 \cdot 6 \cdot 1.9 \approx 21 \text{ W} \\ \text{required torque:} & \quad M = 21 \cdot 60 / (2 \cdot \pi \cdot 1250) \approx 0.16 \text{ Nm} \\ \text{tip speed:} & \quad T = (1250 / 60) \cdot \pi \cdot 0.045 \approx 2.9 \text{ m/s} \end{aligned}$$

5 or 7 liter reactor with two turbine impellers of 60 mm, at 800 rpm:

$$\begin{aligned} \text{required power:} & \quad P = 1100 \cdot (800 / 60)^3 \cdot (0.060)^5 \cdot 6 \cdot 1.9 \approx 23 \text{ W} \\ \text{required torque:} & \quad M = 23 \cdot 60 / (2 \cdot \pi \cdot 800) \approx 0.28 \text{ Nm} \\ \text{tip speed:} & \quad T = (800 / 60) \cdot \pi \cdot 0.060 \approx 2.5 \text{ m/s} \end{aligned}$$

15 liter reactor with two turbine impellers of 75 mm, at 800 rpm:

$$\begin{aligned} \text{required power:} & \quad P = 1100 \cdot (800 / 60)^3 \cdot (0.075)^5 \cdot 6 \cdot 1.9 \approx 70 \text{ W} \\ \text{required torque:} & \quad M = 70 \cdot 60 / (2 \cdot \pi \cdot 800) \approx 0.85 \text{ Nm} \\ \text{tip speed:} & \quad T = (800 / 60) \cdot \pi \cdot 0.075 \approx 3.1 \text{ m/s} \end{aligned}$$

20 liter reactor with three turbine impellers of 75 mm, at 800 rpm:

$$\begin{aligned} \text{required power:} & \quad P = 1100 \cdot (800 / 60)^3 \cdot (0.075)^5 \cdot 6 \cdot 2.8 \approx 105 \text{ W} \\ \text{required torque:} & \quad M = 105 \cdot 60 / (2 \cdot \pi \cdot 800) \approx 1.25 \text{ Nm} \\ \text{tip speed:} & \quad T = (800 / 60) \cdot \pi \cdot 0.075 \approx 3.1 \text{ m/s} \end{aligned}$$

15 liter reactor with one marine impeller of 74 mm, at 200 rpm:

$$\begin{aligned} \text{required power:} & \quad P = 1100 \cdot (200 / 60)^3 \cdot (0.15)^5 \cdot 1.5 \approx 0.14 \text{ W} \\ \text{required torque:} & \quad M = 0.14 \cdot 60 / (2 \cdot \pi \cdot 200) \approx 0.065 \text{ Nm} \\ \text{tip speed:} & \quad T = (200 / 60) \cdot \pi \cdot 0.074 \approx 0.8 \text{ m/s} \end{aligned}$$



In bacterial cultures with aeration of approximately 2 VVM (2 gas volumes per reactor (working) volume per minute), the required motor power and torque will show a substantial decrease in relation to the calculated value.

Friction in the (ball) bearings may cause power losses of 10 % to 20 %.



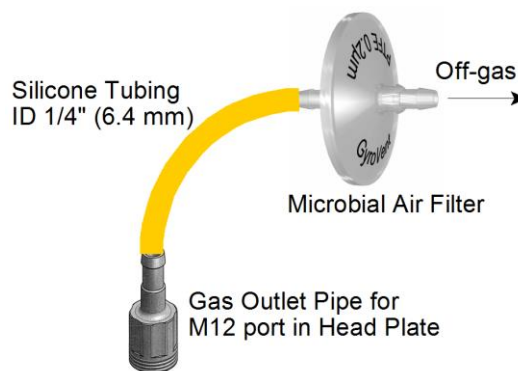
## 6.5 OFF-GAS LINE CONFIGURATION

The configuration of the Off-gas Line depends on the application.

- Since for cell cultures a low gas flow is used, no condenser is used in the Off-gas Line.
- For microbial applications a larger gas flow is used. Therefore, a Thermo Electric Condenser is connected to the Off-gas Line in order to prevent excessive evaporation of the medium.

### 6.5.1 CELL CULTURE APPLICATIONS

Cells are quite sensitive for shear by gas bubbles. Therefore, the gas flow through the broth is kept low. Therefore, there is no need for using a Condenser in the Off-gas line. The Gas Outlet Pipe is directly connected to the disposable air filter. Use silicone tubing with ID=1/4" (6.4 mm).



Z813080252 Gas Outlet Pipe for M12 Port  
 Z811302030 Autoclavable Gas Filter

### 6.5.2 MICROBIAL APPLICATIONS

For microbial applications, larger gas flows are allowed.

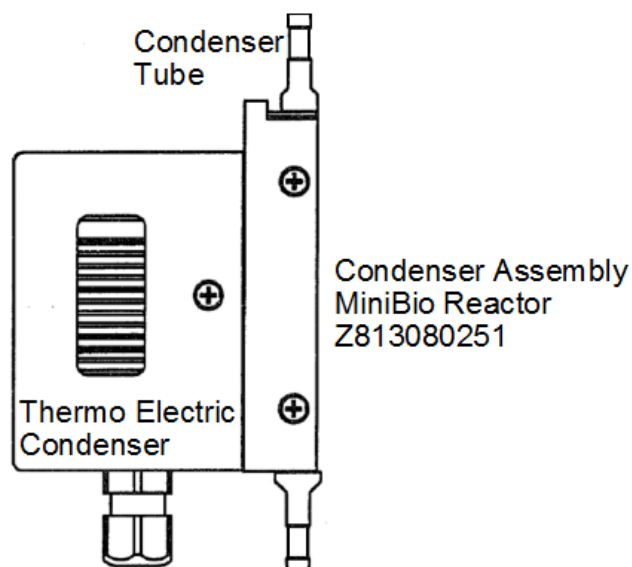
However, in order to prevent excessive evaporation, a Condenser Assembly can be used to cool down the off-gas and to decrease the amount of water vapor that leaves the reactor.

For the 250 and 500 ml reactors, the Thermo Electric Condenser assembly is used. See section on Condenser on the stand.

For the 1000 ml reactor, both the Thermo Electric Condenser assembly and the Water Cooled Condenser assembly can be used. See section on Condenser on the head plate.

The Thermo Electric Condenser, as presented in the adjacent image, cools down the steel Condenser Tube and emits the heat to the environment. The cooling energy is controlled by an analog output of the my-Control.

The formed drops of condensate can flow back to the reactor by gravity.

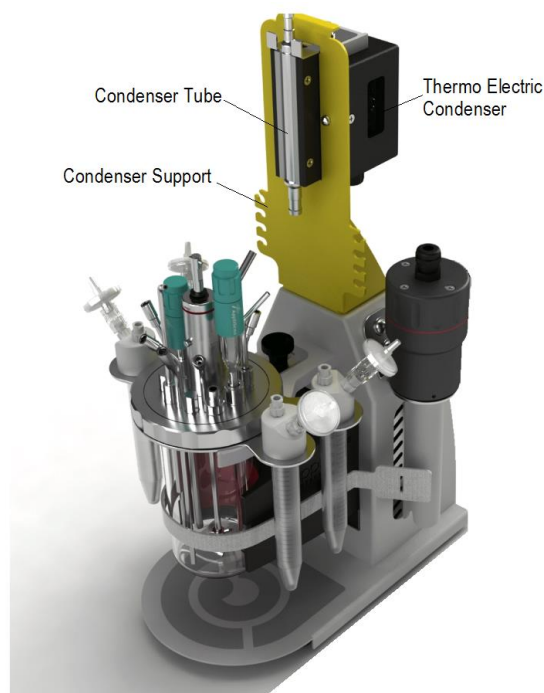


### 6.5.3 THE CONDENSER ON THE STAND OF THE 250 AND 500 ML REACTOR

The Thermo Electric Condenser can be mounted at the Condenser Support for the Stand of the 250 and 500 ml MiniBio Reactor.

The Condenser Support is available in the same colors as the Front Panel of the my-Control. See the table below:

Ordering #	Description
Z813080271	Condenser Support Yellow MiniBio V2
Z813080272	Condenser Support Orange MiniBio V2
Z813080273	Condenser Support Red MiniBio V2
Z813080274	Condenser Support Purple MiniBio V2
Z813080275	Condenser Support Light Blue MiniBio V2
Z813080276	Condenser Support Green MiniBio V2
Z813080277	Condenser Support Marine Blue MiniBio V2
Z813080278	Condenser Support Pink MiniBio V2
Z813080279	Condenser Support Silver MiniBio V2



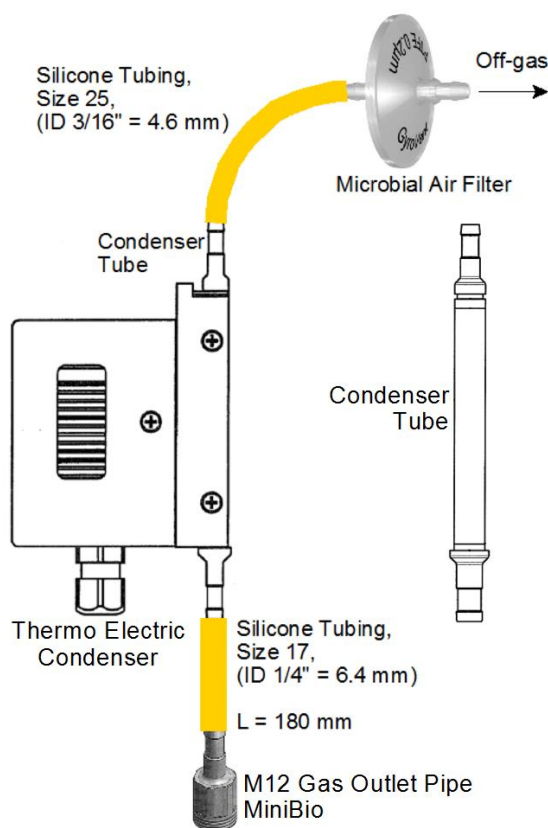
The connection between the reactor Off-gas port and the Condenser Tube is schematically described below:  
The M12 Hose Barb Insert, that is mounted in the Off-gas Port of the reactor head plate, is connected to the Condenser Tube by Silicone Tubing size 17 (ID 1/4" = 6.4 mm). The outlet side of the Condenser Tube is connected to an autoclavable gas filter by silicone Tubing size 25 (ID 3/16" = 4.6 mm).



The internal diameter of tubing between Gas Outlet and Condenser Tube must not be smaller than 1/4" / 6.4 mm (tube size 17). Otherwise the gas velocity will increase, preventing condensate droplets from flowing down the tube walls into the vessel!

The optimum length of the tubing between the Gas Outlet and the lower end of Condenser Tube = 180 mm!

- Z813080253 Condenser Tube 250-500 ml Reactor
- Z813080261 Thermo Electric Condenser
- Z811302030 Autoclavable Gas Filter
- Z813080252 Gas Outlet Pipe for M12 Port

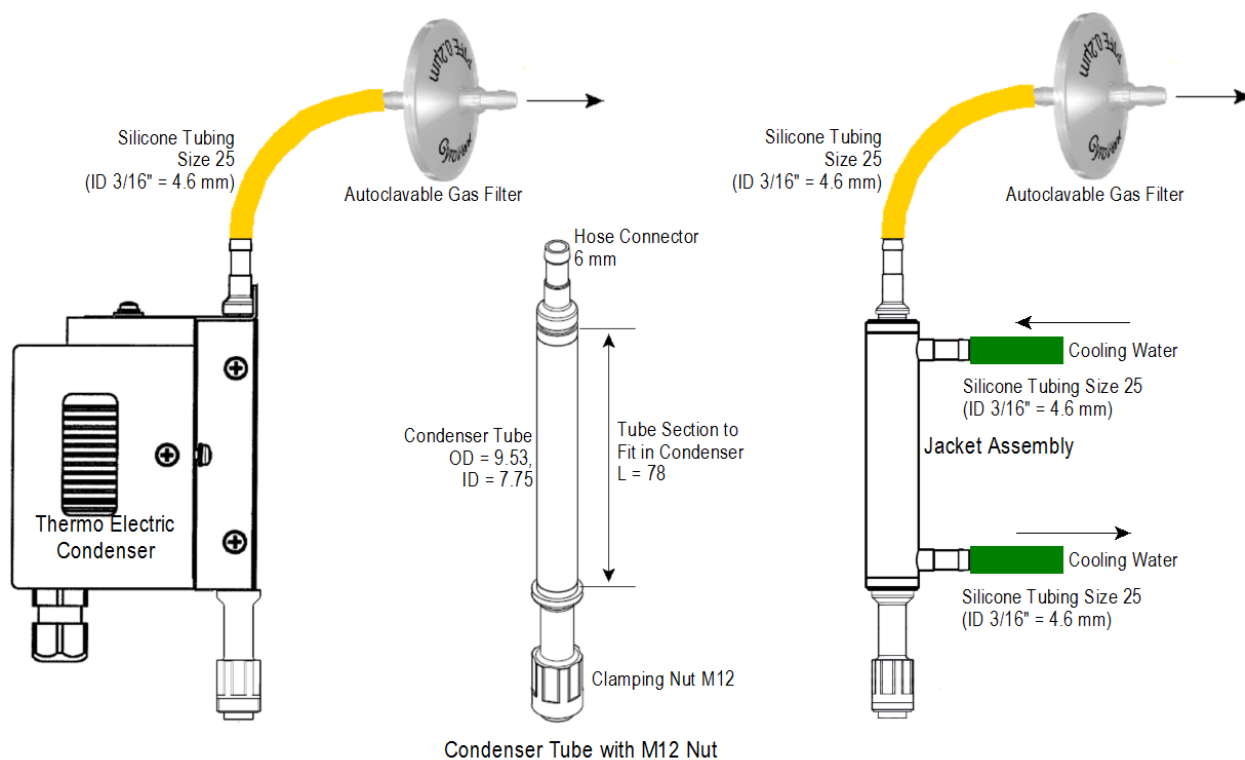


### 6.5.4 THE CONDENSER ON THE HEAD PLATE OF THE 1000 ML REACTOR

The 1000 ml MiniBio Reactor is not equipped with a reactor stand. Therefore, the Condenser Tube is equipped with a M12 clamping nut that can be mounted directly in the M12 Off-gas Port of the reactor.

The Condenser Tube can be cooled with either a Thermo Electric Condenser or with a Water Cooled Jacket.

The image below shows the Condenser Tube (center of the image) with the Thermo Electric Condenser at the left and the Water Cooled Jacket at the right.



The outlet side of the Condenser Tube is connected to an autoclavable gas filter by silicone Tubing size 25 (ID 3/16" = 4.6 mm).

- Z813080300 Condenser Tube 1000 ml Reactor
- Z813080261 Thermo Electric Condenser
- Z813080020 Water Cooled Jacket
- Z811302030 Autoclavable Gas Filter

### 6.5.5 GAS INLET / OUTLET FILTERS

A bacterial air filter is an economical filter for sterile gas delivery and venting applications. The hydrophobic PTFE filter membrane excludes the risk of contamination. The filter is autoclavable.

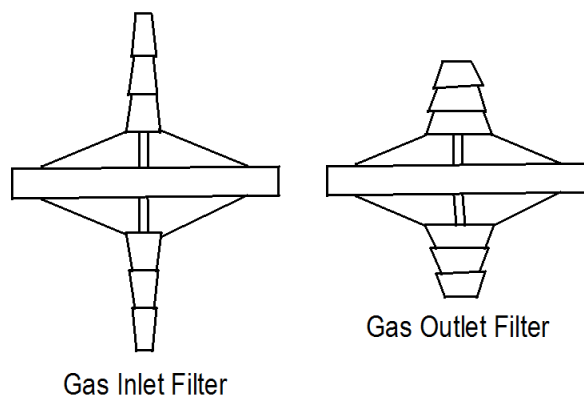
Housing material: polypropylene  
 Pore size: 0.22 µm  
 Maximum temperature: 132 °C

Filter for gas inlet (mini Hose Barb 3 mm):

Part #	Description
Z811300251	Autoclavable air filter 0 – 5 L/min

Filter for gas outlet (Hose Barb 7 – 9.5 mm):

Part #	Description
Z811302030	Autoclavable air filter 0 – 40 L/min



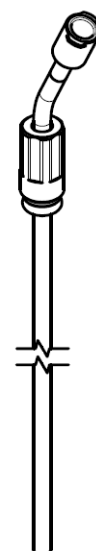
### 6.6 SAMPLE PIPE (ADJ. HEIGHT) WITH LUER LOCK CONNECTION

Although the head plate contains a fixed (OD3.18 x 0.89) sample pipe, the bioreactor may also be equipped with a height adjustable sample pipe of the same diameter. The sample pipe fits in a M8 x 1 port of the head plate of the bioreactor.

- Z813190252 Sample Pipe Height Adjustable MiniBio 250/500 Luer Lock  
Max. insertion length L=136 mm
- Z813191052 Sample Pipe Height Adjustable MiniBio 1000 Luer Lock  
Max. insertion length L=188 mm
- Z813190260 Sample Pipe Height Adjustable with Thread MiniBio 250/500 Luer Lock
- Z813191060 Sample Pipe Height Adjustable with Thread MiniBio 1000 Luer Lock

The sample pipe includes:

Part #	Description
V3MP100121	Clamping Nut Sample M8x1 ID3.1
V1S4ARP007	O-ring 3,68x1.78



### 6.7 SEPTUM ASSEMBLY

The Septum Assembly is used for additions. It fits in the M8x1 port of the head plate of the reactor.

- Z813020252 Septum Assembly MiniBio V2

The septum assembly consists of:

Part #	Description
V3MP070621	Septum OD=6, Height=3, Silicone
V3MP070612	Clamping Nut for Septum MiniBio
V3MP070602	Clamping Nut for Septum M8x1 MiniBio
V1S4ARP006	O-Ring ID 2.90 x 1.78 Silicone

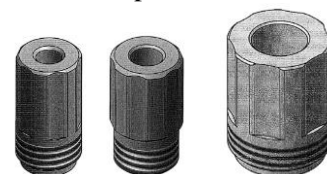


## 6.8 CLAMPING NUTS AND BLIND NUTS

The following clamping nuts and blind stoppers are available for the MiniBio Reactor head plate:

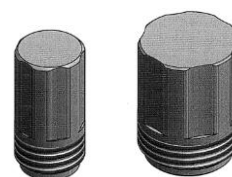
Clamping Nuts:

Part #	Description
V3MP100121	Clamping Nut Sample / Septum M8x1 ID3.2
V3MP070171	Clamping Nut Universal M8x1
Z813000251	Sensor Holder pH/DO MiniBio



Blind Nuts:

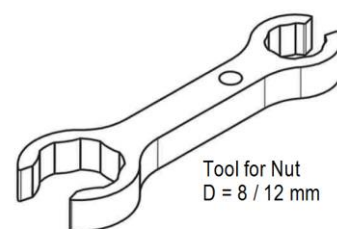
Part #	Description
Z813220251	Blind Nut M8x1
Z813220252	Blind Nut M12x1



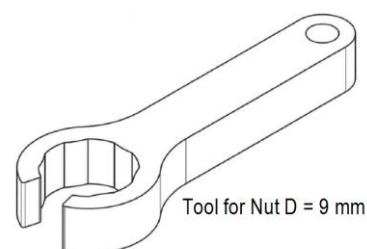
## 6.9 TOOLS FOR FASTENING THE NUTS

The following tools are available for fastening the nuts in the head plate of the MiniBio reactor.

V3MP079121 Tool for Clamping Nut D8 / D12 mm  
This tool is part of the Startup Kit



V3MP079131 Tool for Clamping Nut D9 mm  
This tool is part of the Micro Valve Assembly

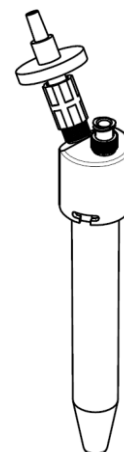
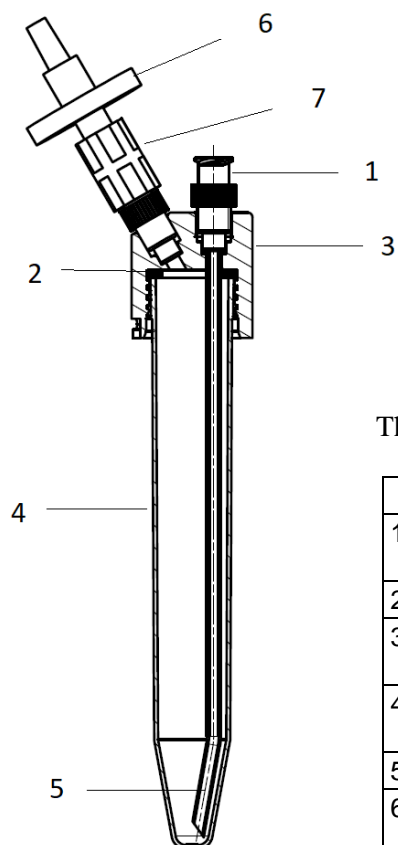


## 6.10 LIQUID ADDITION / SAMPLING ASSEMBLY (250 AND 500 ML MINIBIO REACTOR)

The Liquid Addition / Sample Vial Assembly fits in one of the four Vial Holders at the Head Plate ring of the 250 and 500 ml MiniBio Reactor.

It can be used for either liquid addition or for sampling.

Z812070253 Liquid Addition/Sample Bottle Cap 15 ml

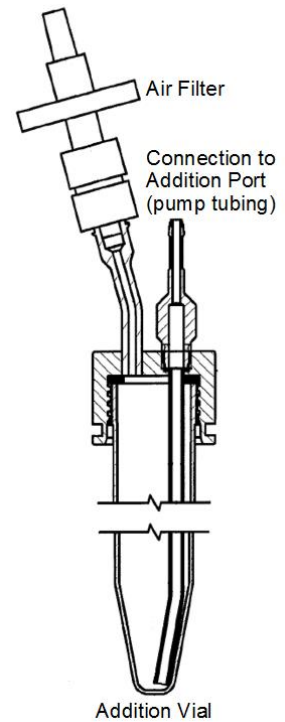


The following parts are included in the assembly:

	<b>Part #</b>	<b>Description</b>
1	V0W0030126	Threaded Female Luer Lock Connector M7x0.75 POM
2	V3MP070811	Seal for Cap 15 ml Tube
3	V3MP070461	Plastic Cap for 15ml Tube - Dual M7x0.75 port
4	V0W8003000	Conical Centrifuge Tube 15 ml PP (100 pcs)
5	V0W2130084	Tube for Cap Reagent Bottle L=419
6	V0W1040020	Air Filter 0.2µm PP/PTFE Luer L. M + Luer Slip
7	V0W0030116	Male Luer – Male Luer Connector PC

In case the assembly is used for **addition**, pump tubing can be used to connect the Addition Vial dip tube with the addition port of the MiniBio Reactor.

Before autoclaving, the vial is filled with addition liquid.  
 After autoclaving, the pump tubing can be inserted in the tubing pump at the my-Control and the addition assembly will be ready to be used.

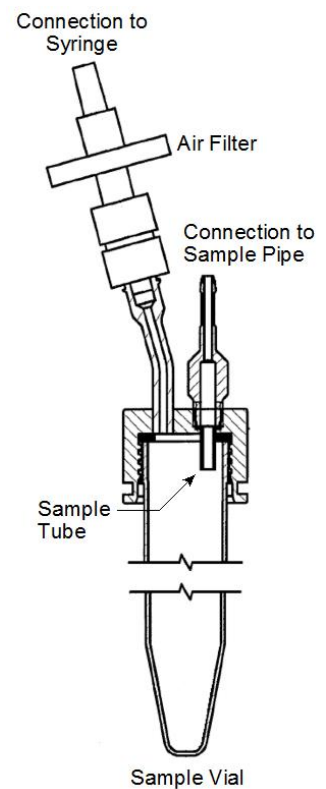


The assembly can also be used for **sampling**.  
 In this case, the dip tube in the vial has to be cut off (approx.. 1 cm below the bottom of the cap).  
 Connect a syringe to the air filter (using a piece of additional tubing).  
 Connect the sample tube side of the assembly with the sample pipe in the MiniBio Reactor.

Before autoclaving, the vial is empty.  
 During cultivation, the sampling system can be operated using the syringe:

- Air from the syringe can be forced through the filter to empty the sample tube
- Afterwards, sample can be drawn through the sample pipe and tubing into the sample vial.
- The sampling action must be completed by using the syringe to force the content of the sample tubing back into the reactor.

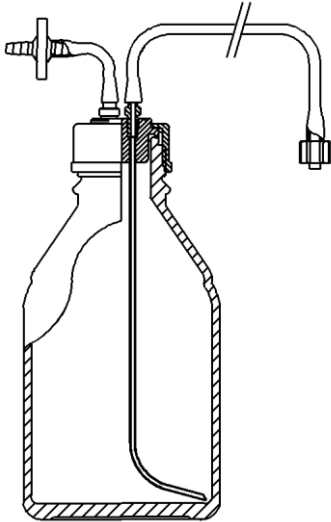
After sampling, the filled sample vial can be replaced by a (sterile) new one in a sanitary manner.



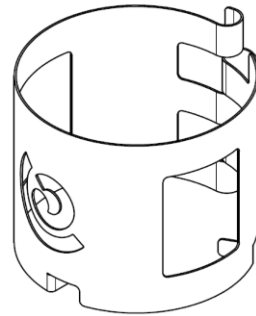


## 6.11 LIQUID ADDITION BOTTLE AND BOTTLE HOLDER FOR 1000ML MINIBIO REACTOR

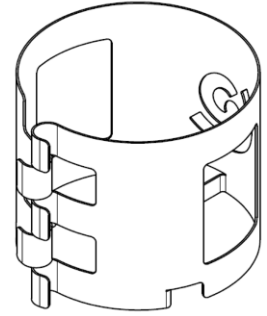
A 250ml Liquid Addition Bottle is available to fit in a Bottle Holder that can be fixed to one of the standing rods of the 1000ml MiniBio Reactor.



Liquid Addition Bottle 250 ml



Front View



Rear View

Bottle Holder for 250 ml Feed Bottle

Squeeze the Bottle Holder and fit it on one of the vertical standing rods.

Place the bottle in the holder.

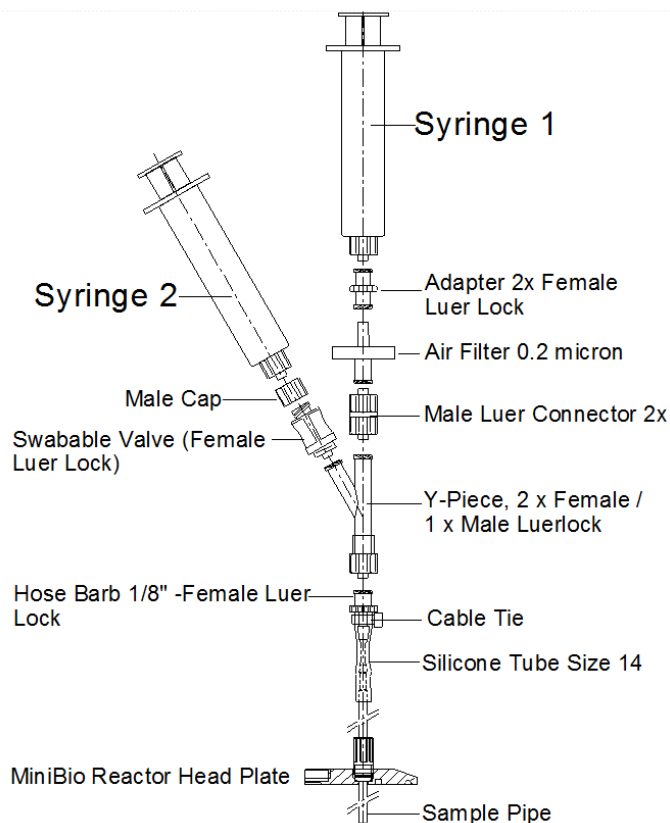
The Addition Bottle (including the connecting tubing) can be autoclaved together with the bioreactor.

Z811301918 Liquid Addition Bottle 250 ml, 1.5 barg

Z811301938 Autoclavable Bottle Holder for Tripod (0.25L bottle)

## 6.12 SINGLE USE SAMPLE SYSTEM

The Single Use Sample System is fixed on top of the Sample Pipe. Before sampling, a sterile Syringe 2 is mounted on top of the swabable valve. See image below.



Syringe 1 with (withdrawn plunger) is mounted on top of the air filter. Push the plunger of Syringe 1 to remove medium from the sample pipe.

Withdraw the plunger of Syringe 2 to take sample from the reactor.

Remove Syringe 2 from the Sample System and clean the Syringe and swabable valve with ethanol 70%.

The parts that are included in the assembly are listed in the table below:

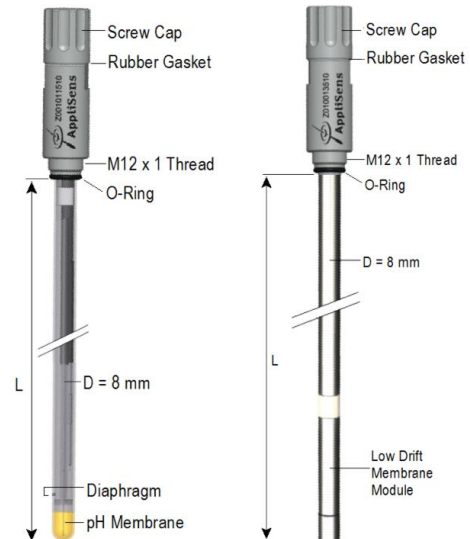
Part #	Description
V0W6500002	Syringe 10ml with Luer Lock
V0W0030121	Adapter 2x Female Luer Lock
V0W1040020	Air Filter 0.2µm
V0W0030116	Male Luer Connector 2x
V0W0030113	Male Cap
V0W0030103	Swabable Valve (Female Luer Lock)
V0W0030104	Y-Piece, 2xFemale Luer Lock, 1xMale
V0W0030109	Hose Barb 1/8" – Female Luer Lock
V0R1451030	Cable Tie Black
V0M5219030	Silicone Tubing Size 14

Z850000251 Sample System Single Use for MiniBio Reactors

## 6.13 SENSORS

### 6.13.1 pH AND DO SENSORS

The pH and DO sensors are available in a special version for application in the MiniBio Reactor.  
The diameter of the sensor = 8 mm.



pH Sensors	Description	DO Sensors	Description
Z001011510	pH Gel Sensor for MiniBio 250 ml	Z010011510	dO <sub>2</sub> Sensor for MiniBio 250 ml
Z001013510	pH Gel Sensor for MiniBio 500 ml	Z010013510	dO <sub>2</sub> Sensor for MiniBio 500 ml
Z001018510	pH Gel Sensor for MiniBio 1000 ml	Z010018510	dO <sub>2</sub> Sensor for MiniBio 1000 ml
Z100065013	Sensor Cable pH 65 cm Grey Cap	Z100065014	Sensor Cable DO 65 cm Grey Cap
V1S4ARP011	O-ring Silicone 7.65 x 1.78	V1S4ARP011	O-ring Silicone 7.65 x 1.78
V1S5ARP011	O-ring EPDM 7.65 x 1.78	V1S5ARP011	O-ring EPDM 7.65 x 1.78
V1S6ARP011	O-ring Viton 7.65 x 1.78	V1S6ARP011	O-ring Viton 7.65 x 1.78
		Z110000480	Low Drift Membrane Module Kit

### 6.13.2 LEVEL SENSORS

The bioreactor may be equipped with one or two levels sensors.  
The long version can be used for low level measurements.  
The short version may be used for high level measurements or foam.

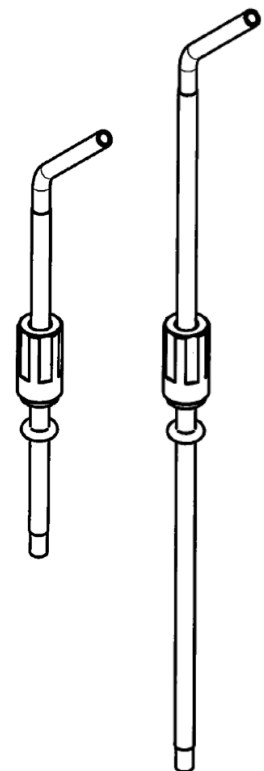
The level sensors fit in an M8 x 1 port of the bioreactor's head plate.  
Both level sensors are height adjustable.

At the sensor side, the Level sensor cable is equipped with two jacks. One jack needs to be inserted at the top side of the hollow sensor, the other jack fits in the 2 mm hole in the top plate of the bioreactor.

Z054015010 Level Sensor Assembly OD3 L150  
Z054008010 Level Sensor Assembly OD3 L80

The level sensors include:

Part #	Description
V3MP100171	Clamping nut Universal M8x1
V1S4ARP006	O-ring 2.90x1.78



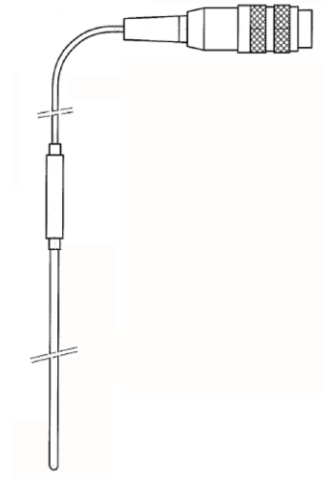
### 6.13.3 TEMPERATURE SENSOR

The temperature sensor contains a Pt-100 resistor for measuring the reactor temperature.

The sensor is placed in the thermometer pocket. The thermometer pocket must be filled with water or silicone oil in order to improve the heat transfer between medium and sensor.

Sensor diameter (insertion part) 3 mm  
 Sensor length (insertion part) 185 mm  
 Attached Sensor Cable L=650 mm

Measuring principle 3- wire Pt-100 (correction for cable length)  
 Measuring accuracy According to IEC 60751:2008 Class AA  
 (0 . . . 150 °C + 0.1 °C)



Z034018510 Temperature Sensor Pt-100 L=185, D=3 for 250, 500 and 1000ml MiniBio Reactors.

### 6.13.4 USB SENSORS

The available USB sensors (such as biomass and optical pH and dO<sub>2</sub> sensors) have their own dedicated description. Refer to the documentation folder named “USB Sensors”).

## 6.14 START-UP KITS

Three different types of Start-Up Kits are available for the range of autoclavable bioreactors:

- For the 250 ml reactor,
- For the 500 ml reactor and
- For the 1000 ml reactor.

See the sections below.

### 6.14.1 START-UP KIT 250 ML MINIBIO REACTOR

Z811000251 Start-up Kit MiniBio Reactor 250 ml.

The table below lists the content of the Start-Up Kit.

Part Number	Part Description	Quantity Per Assembly
V3MP079131	TOOL FOR CLAMPING NUT D9	1
V3MP079121	TOOL FOR CLAMPING NUT D8 & D12	1
V1S4ARP146	O-RING ID 66.34X2.62 SILICONE	4
V1S4ARP140	O-RING ID 56.82X2.62 SILICONE	2
V1S4ARP108	O-RING ID 6.02X2.62 SILICONE	4
V1S4ARP014	O-RING ID 12.42X1.78 SILICONE	2
V1S4ARP011	O-RING ID 7.65X1.78 SILICONE	10
V1S4ARP006	O-RING ID 2.90X1.78 SILICONE	10
V1S1302B06	LIPSEAL D5.5-6.5 FLAT BACK - BLACK FPM - FDA COMPLIANT	4
V3MP070621	SEPTUM OD6 HEIGHT=3 SILICONE	5
V0W0030100	MALE CAP FITS FEMALE LUER LOCK PC	12
V0W0530006	REDUCER MALE-MALE 1/16"-3/32"	10
V0W0530005	REDUCER MALE-MALE 1/16"-3/16"	10
V0W0530004	REDUCER MALE-MALE 1/8"-3/16"	4
V0W0030117	HOSE BARB 1/16"- MALE LUERLOCK PP	10
V0W0030111	HOSE BARB 1/16"- FEM LUERLOCK PC	10
V0W0030110	HOSE BARB 1/16"- MALE LUERLOCK PC	10
V0W0030107	DUCKBILL CHCK VLV F+M LUER 30MBAR	10
V0R9900108	ALLEN KEY 0.89 MM CHROMED/ZINC PLATED	1
V0R9900007	COMP. STORAGE BOX 312x238x51MM, 21 DIVIDERS	1
V0R1451010	CABLE TIE BLACK 92X2.3 MM	25

### 6.14.2 START-UP KIT 500 ML MINIBIO REACTOR

Z811000501 Start-up Kit MiniBio Reactor 500 ml.

The table below lists the content of the Start-Up Kit.

Part Number	Part Description	Quantity Per Assembly
V3MP079131	TOOL FOR CLAMPING NUT D9	1
V3MP079121	TOOL FOR CLAMPING NUT D8 & D12	1
V1S4ARP146	O-RING ID 66.34X2.62 SILICONE	2
V1S4ARP152	O-RING ID 82.22X2.62 SILICONE	2
V1S4ARP108	O-RING ID 6.02X2.62 SILICONE	4
V1S4ARP014	O-RING ID 12.42X1.78 SILICONE	2
V1S4ARP011	O-RING ID 7.65X1.78 SILICONE	10
V1S4ARP006	O-RING ID 2.90X1.78 SILICONE	10
V1S1302B06	LIPSEAL D5.5-6.5 FLAT BACK - BLACK FPM - FDA COMPLIANT	4
V3MP070621	SEPTUM OD6 HEIGHT=3 SILICONE	5
V0W0030100	MALE CAP FITS FEMALE LUER LOCK PC	12
V0W0530006	REDUCER MALE-MALE 1/16"-3/32"	10
V0W0530005	REDUCER MALE-MALE 1/16"-3/16"	10
V0W0530004	REDUCER MALE-MALE 1/8"-3/16"	4
V0W0030117	HOSE BARB 1/16"- MALE LUERLOCK PP	10
V0W0030111	HOSE BARB 1/16"- FEM LUERLOCK PC	10
V0W0030110	HOSE BARB 1/16"- MALE LUERLOCK PC	10
V0W0030107	DUCKBILL CHCK VLV F+M LUER 30MBAR	10
V0R9900108	ALLEN KEY 0.89 MM CHROMED/ZINC PLATED	1
V0R9900007	COMP. STORAGE BOX 312x238x51MM, 21 DIVIDERS	1
V0R1451010	CABLE TIE BLACK 92X2.3 MM	25

**6.14.3 START-UP KIT 1000 ML MINIBIO REACTOR**

Z811001001 Start-up Kit MiniBio Reactor 1000 ml.

The table below lists the content of the Start-Up Kit.

<b>Part Number</b>	<b>Part Description</b>	<b>Quantity Per Assembly</b>
V3MP079131	TOOL FOR CLAMPING NUT D9	1
V3MP079121	TOOL FOR CLAMPING NUT D8 & D12	2
V3MP070621	SEPTUM OD6 HEIGHT=3 SILICONE	3
V1S4ARP108	O-RING ID 6.02X2.62 SILICONE	4
V1S4ARP014	O-RING ID 12.42X1.78 SILICONE	5
V1S4ARP011	O-RING ID 7.65X1.78 SILICONE	6
V1S4ARP006	O-RING ID 2.90X1.78 SILICONE	7
V1S4104X30	O-RING ID104.20X3.00 SILICONE	8
V1S4095X26	O-RING ID94.92 x 2.62 SILICONE	9
V1S4001X07	O-RING ID 1.40X0.70 SILICONE	10
V1S1302B06	LIPSEAL D5.5-6.5 FLAT BACK - BLACK FPM - FDA COMPLIANT	11
V0W0530006	REDUCER MALE-MALE 1/16"-3/32"	12
V0W0530005	REDUCER MALE-MALE 1/16"-3/16"	13
V0W0530004	REDUCER MALE-MALE 1/8"-3/16"	14
V0W0030117	HOSE BARB 1/16"- MALE LUERLOCK PP	15
V0W0030111	HOSE BARB 1/16"- FEM LUERLOCK PC	16
V0W0030110	HOSE BARB 1/16"- MALE LUERLOCK PC	17
V0W0030107	DUCKBILL CHCK VLV F+M LUER 30MBAR	18
V0W0030100	MALE CAP FITS FEMALE LUER LOCK PC	19
V0R9900108	ALLEN KEY 0.89 MM CHROMED/ZINC PLATED	20
V0R9900007	COMP. STORAGE BOX 312x238x51MM, 21 DIVIDERS	21
V0R1451010	CABLE TIE BLACK 92X2.3 MM	22





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