

## KLF – At a glance

### Bioengineering KLF essentials

#### General

- In situ sterilizable small benchtop glass reactor – no need to move around for sterilization
- The standard bottom drive in the stainless steel bottom provides plenty of space on the lid for comfortable handling of numerous lid connections and allows easy lid removal for maintenance and cleaning
- Bottom drain valve available for easy and sterile sampling and harvest
- Wide variety of options available

#### Bioengineering KLF for microbial culture (KLFM)

- Provides best in class oxygen transfer rates due to powerful agitator
- Several gas lines available
- Optional pressure control
- Full sterilization in place with stirred media enables fast sterilization of media with minimal negative impact to media components

#### Bioengineering KLF for cell culture (KLFC)

- Gentle heating during cultivation by heating jacket
- Low shear force agitation system adapted for cell culture
- Rounded stainless steel bottom supports mixing even at low rotational speed
- Efficient and careful aeration system with several gas lines
- Individual drives for rotor filter (perfusion system) and agitator available

# Configurations and specifications

## Module Options

- Minimal equipment
  - Option
  - Not possible
- a Option is only possible if the free lid ports are not already occupied by other options - standard system of KLFM has 4, standard system of KLFC has 5 free lid ports.
- b Option is only possible together with option T-piece connection or option stainless steel vessel V1S or if ports of the standard system will be released by removing a probe, dosing line or sampling tube.
- c Option is only possible together with option T-piece connection or if 1 port of the standard system will be released by removing a probe, dosing line or sampling tube.

Vessel		Microbial			Cell		
		KLFM			KLFC		
		2.4 L	3.1 L	3.7 L	2.4 L	3.1 L	3.7 L
Glass vessel	In situ sterilizable glass pressure vessel, single jacket, with stainless steel lid and bottom. To be placed on top of a bench. Incl. stainless steel rupture protection jacket	•	•	•	•	•	•
Stainless steel vessel	In situ sterilizable stainless steel pressure vessel, single jacket, 3 side ports DN25 in the lower vessel wall, viewing glass. With stainless steel lid and bottom. To be placed on top of a bench. DN25 side ports provide 2 free DN12 ports in lid.	◦	◦	◦	-	-	-
Baffles	4x baffles stainless steel 316L	•	•	•	◦	◦	◦
Direct bottom drive with mechanical seal	Direct drive from bottom by brushless DC motor, with mechanical seal, 60-2300 rpm controlled speed	•	•	•	◦	◦	◦
Direct bottom drive with mechanical seal, short shaft	Direct drive from bottom by brushless DC motor, with mechanical seal, 60-2300 rpm controlled speed, short shaft	◦	◦	◦	•	•	•
Direct bottom drive, magnetically coupled	Direct drive from bottom by brushless DC motor, magnetically coupled, 60-2300 rpm controlled speed	◦	◦	◦	◦	◦	◦
Direct top drive with mechanical seal	Direct drive from top by brushless DC motor, with mechanical seal, 60-2300 rpm controlled speed	◦ <sup>b</sup>	◦ <sup>b</sup>	◦ <sup>a</sup>	◦ <sup>c</sup>	◦ <sup>c</sup>	◦ <sup>a</sup>
Direct top drive, magnetically coupled	Direct drive from top by brushless DC motor, magnetically coupled, 60-1500 rpm controlled speed	◦ <sup>b</sup>	◦ <sup>b</sup>	◦ <sup>a</sup>	◦ <sup>c</sup>	◦ <sup>c</sup>	◦ <sup>a</sup>
Flat-blade disc agitator	2 flat-blade disc agitator, 6-blades for radial mixing (diameter: see technical data)	•	•	•	-	-	-
Propeller agitator	Propeller agitator for axial mixing (diameter: see technical data)	-	-	-	•	•	•
Segment pitched blade agitator	Segment pitched blade agitator for axial mixing (diameter: see technical data)	◦	◦	◦	◦	◦	◦
Airlift draught tube	Stainless steel draught tube incl. agitator. For airlift or agitator driven vertical mixing	◦	◦	◦	◦	◦	◦

Temperature control		Microbial			Cell		
		KLFM			KLFC		
		2.4 L	3.1 L	3.7 L	2.4 L	3.1 L	3.7 L
Electrical heating finger 800 W and cooling finger	Electrical heating finger 800 W and cooling finger with solenoid valve to control temperature during sterilization and cultivation	•	•	•	-	-	-
Electrical heating finger 800 W and cooling finger, together with electrical heating pad	Electrical heating finger 800 W for in situ full sterilization and additional electrical heating jacket as well as cooling finger with solenoid valve to control temperature during cultivation	◦	◦	◦	•	•	•
Steam generator BioVap	Steam generator BioVap for sterilization of peripheric components, e. g. bottom drain valve	◦	◦	◦	◦	◦	◦

Aeration		Microbial			Cell		
		KLFM			KLFC		
		2.4 L	3.1 L	3.7 L	2.4 L	3.1 L	3.7 L
Aeration tube	Aeration tube for submerged aeration. The inlet gas is led to agitator blades for efficient dispersion of bubbles.	◦	◦	◦	-	-	-
Ring sparger	Aeration tube with ring sparger for efficient and careful submerged aeration	•	•	•	◦	◦	◦
Sinter sparger	Aeration tube with sintered metal microsparger for efficient submerged aeration also with low gas flow	-	-	-	•	•	•
Bubble free aeration	Stainless steel basket with coiled silicone hose for bubble free gas transfer. Inlet and outlet of gas connected by needles and diaphragm	-	-	-	◦	◦	◦
Inlet gas filter, ceramic, autoclavable with needle and check valve	Ceramic gas inlet filter in stainless steel housing, autoclavable, to be connected to in situ sterilized fermentor system by hypodermic needle. Incl. check valve for filter protection	◦	◦	◦	◦	◦	◦
Inlet gas filter, glass fibre, autoclavable with needle and check valve	Glass fibre gas inlet filter in stainless steel housing, autoclavable, to be connected to in situ sterilized fermentor system by hypodermic needle. Incl. check valve for filter protection. Cut off rate 99.9999% for particles and drops of size 0.1 µm	•	•	•	•	•	•
SteriCap for all inlet gas filters instead of needle	All autoclavable inlet gas filters selected will be connected by SteriCap instead of a hypodermic needle to the in situ sterilized fermentor system.	-	-	◦	-	-	◦
MO gas supply: 1 gas supply line (gas 1)	1-channel gas supply unit. Pressure control valve, pressure gauge, rotameter for gas flow indication up to 2 vvm Air, needle valve and pulsed solenoid valve	•	•	•	◦	◦	◦
CE gas supply: 3 gas supply lines (gases 1, 2 and 3)	3-channel gas supply and mixing unit. Each channel with pressure control valve, pressure gauge, rotameter for gas flow indication up to 0.1 / 0.1 / 0.05 vvm Air / O <sub>2</sub> / CO <sub>2</sub> , needle valve and pulsed solenoid valve	◦	◦	◦	•	•	•
Freely configurable gas lines	1-6 gas lines can be individually configured for submerged or surface aeration and the following gases: Air, O <sub>2</sub> , CO <sub>2</sub> , N <sub>2</sub>	◦	◦	◦	◦	◦	◦
MFC instead of pulsed valve for gas lines	Each gas line can be individually equipped with a thermal mass flow controller to measure and control the air flow	◦	◦	◦	◦	◦	◦
Non-standard flow rates for gas lines	For each gas line the flow rate can be freely configured. Selection is possible between the following maximum flow rates: 2, 5, 8, 16, 40, 100, 250 or 500 L/h	◦	◦	◦	◦	◦	◦
Exhaust filter ceramic, sterilized with vessel	Ceramic exhaust gas filter in stainless steel housing, in situ sterilized together with fermentor system. Incl. diaphragm valve to hold pressure during sterilization	◦	◦	◦	◦	◦	◦
Exhaust filter glass fibre sterilized with vessel	Glass fibre exhaust gas filter, in stainless steel housing, in situ sterilized together with fermentor system. Incl. diaphragm valve to hold pressure during sterilization. Cut off rate 99.9999% for particles and drops of size 0.1 µm	•	•	•	•	•	•
Exhaust gas condenser, stainless steel	Ventilation via water cooled stainless steel condenser. With connections for cooling water supply and return, incl. closing and adjustment valve for cooling water	•	•	•	◦	◦	◦

Addition/Transfer		Microbial			Cell		
		KLFM			KLFC		
		2.4 L	3.1 L	3.7 L	2.4 L	3.1 L	3.7 L
Immersion tube, height adjustable	Height adjustable immersion tube, stainless steel. DN06, with needle connection, incl. needle and silicone hose. For harvest and mechanical level control together with a harvest pump (not included)	°b	°b	°a	°c	°c	°a
Rotor filter package 20 µm Agitator bottom drive	Open rotor filter with stainless steel sieve 20 µm pore size, mounted on bottom driven agitator shaft. To be used with level probe and controller, incl. immersion tube with needle connection and needle for cell free harvest	-	-	-	°c	°c	°a
Rotor filter package 20 µm Agitator top drive	Open rotor filter with stainless steel sieve 20 µm pore size, mounted on top driven agitator shaft. To be used with level probe and controller, incl. immersion tube with needle connection and needle for cell free harvest	-	-	-	-	-	°a
Fixed bed package	Stainless steel insert basket for carriers to immobilise cells. With central tube for radial media supply minimising substrate and oxygen gradients. Incl. bypass loop (without pump) and connections for addition of fresh media and for harvest. For perfusion culture of immobilised organisms	°b	°b	°a	-	-	°a
Primary pump module 2x fixed speed	Pump module with 2 fixed speed peristaltic pumps, max. 130 rpm. 2 sets of hoses, 2 hose clamps	°	°	°	°	°	°
Primary pump module 2x fixed, 1x variable speed	Pump module with 2 fixed speed and 1 variable speed peristaltic pumps, max. 130 rpm, reversible. 3 sets of hoses, 3 hose clamps	•	•	•	•	•	•
Secondary pump module 2x fixed speed	Additional pump module with 2 fixed speed peristaltic pumps, max. 130 rpm. 2 sets of hoses, 2 hose clamps	°	°	°	°	°	°
Secondary pump module 2x fixed, 1x variable speed	Additional pump module with 2 fixed speed and 1 variable speed peristaltic pumps, max. 130 rpm, reversible. 3 sets of hoses, 3 hose clamps	°	°	°	°	°	°
Peristaltic pump, variable speed, connected by Profibus	Additional stand-alone peristaltic pump with local and remote speed display and control, 0.1 -10rpm or 0.03 - 3rpm. Connected by profibus with the BioSCADA system	°	°	°	°	°	°

		KLFM			KLFC		
		2.4 L	3.1 L	3.7 L	2.4 L	3.1 L	3.7 L
Bottle incl. lid and filter, with hose and needle	2x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. hypodermic needle with cup. Cannot be combined with other bottle options	-	-	°	-	-	•
	2x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. double hypodermic needle with cup. Cannot be combined with other bottle options	°	°	-	•	•	-
	3x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. hypodermic needle with cup. Cannot be combined with other bottle options	-	-	•	-	-	°a
	3x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. 1 single and 1 double hypodermic needle with cup. Cannot be combined with other bottle options	•	•	-	°c	°c	-
	4x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. hypodermic needle with cup. Cannot be combined with other bottle options	-	-	°a	-	-	°a
	4x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. 2 single and 1 double hypodermic needles with cup. Cannot be combined with other bottle options	°b	°b	-	-	-	-
	5x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. hypodermic needle with cup. Cannot be combined with other bottle options	-	-	°a	-	-	°a
	5x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. 3 single and 1 double hypodermic needles with cup. Cannot be combined with other bottle options	°b	°b	-	-	-	-
	6x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. hypodermic needle with cup. Cannot be combined with other bottle options	-	-	°a	-	-	°a
	7x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. hypodermic needle with cup. Cannot be combined with other bottle options	-	-	°a	-	-	°a
Double hypodermic needle incl. hoses, 1 piece	2x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. SteriCap sterile connection system. Cannot be combined with other bottle options	-	-	°	-	-	°
	3x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. SteriCap sterile connection system. Cannot be combined with other bottle options	-	-	°	-	-	°a
	4x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. SteriCap sterile connection system. Cannot be combined with other bottle options	-	-	°a	-	-	°a
	5x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. SteriCap sterile connection system. Cannot be combined with other bottle options	-	-	°a	-	-	°a
	6x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. SteriCap sterile connection system. Cannot be combined with other bottle options	-	-	°a	-	-	°a
	7x autoclavable glass bottles 250 mL, incl. GL45 screw cap with sterile filter and immersion tube, incl. SteriCap sterile connection system. Cannot be combined with other bottle options	-	-	°a	-	-	°a
	Double hypodermic stainless steel needle for sterile connection of 2 hoses to 1 lid port of fermentor vessel. Incl. hoses. Provides 1 free lid port	-	-	°	-	-	°
Sterile case	3x Stainless steel sterile case with built-in sterile filter and steam trap. For steam sterilization and subsequent save and sterile storage of hypodermic needles	°	°	°	°	°	°
	6x Stainless steel sterile case with built-in sterile filter and steam trap. For steam sterilization and subsequent save and sterile storage of hypodermic needles	°	°	°	°	°	°

		KLFM			KLFC		
		2.4 L	3.1 L	3.7 L	2.4 L	3.1 L	3.7 L
Sampling system with needle incl. glass tube	Sampling system with GL32 glass tube for hygienic sampling. Incl. needle and sampling tube stainless steel Di 3.5 mm	-	-	•	-	-	-
Sampling system with needle incl. glass tube. With inoculation port	Sampling system with GL32 glass tube for hygienic sampling. Incl. needle and sampling tube stainless steel Di 3.5 mm. T-piece and stainless steel connection piece with DN12 diaphragm interface for inoculation, incl. cup	•	•	-	-	-	-
Sampling system with needle incl. glass tube. With harvest bottle connection	Sampling system with GL32 glass tube for hygienic sampling. Incl. needle and sampling tube stainless steel Di 3.5 mm. T-piece and GL45 bottle screw cap autoclavable incl. sterile filter and immersion tube, for harvest	-	-	-	•	•	•
Sampling system with SteriCap incl. glass tube	Sampling system with GL32 glass tube for hygienic sampling. Incl. SteriCap and sampling tube stainless steel Di 3.5 mm. Alternative to other sampling systems	-	-	°	-	-	-
Sampling system with SteriCap incl. glass tube. With harvest bottle connection	Sampling system with GL32 glass tube for hygienic sampling. Incl. SteriCap and sampling tube stainless steel Di 3.5 mm. T-piece and GL45 bottle screw cap autoclavable incl. sterile filter and immersion tube, for harvest. Alternative to other sampling systems	-	-	-	-	-	°
T-piece and connection piece with DN12 diaphragm	T-piece and stainless steel connection piece with DN12 diaphragm interface to connect an additional dosing line by needle-diaphragm technique. incl. cup. Provides 1 free lid port	-	-	°	°	°	°
DN19 port instead of DN12 port	1 large DN19 lid port instead of 1 standard DN12 lid port	-	-	°a	-	-	°a
Bottom drain valve	Bottom drain valve, steamable. Incl. steam supply diaphragm valve	°	°	°	°	°	°
Bottom drain valve with sterile case	Bottom drain valve, steamable. Incl. steam supply diaphragm valve and sterile case for steam sterilization and subsequent keeping sterile of bottom drain valve	°	°	°	°	°	°
Bottom drain valve with steamable coupling and bottle	Bottom drain valve, steam sterilizable. Incl. diaphragm valve assembly with steam trap, sampling bottle 250mL, hose and sterilizable connection valve for fully closed sampling or harvest	°	°	°	°	°	°

Control unit		Microbial			Cell		
		KLFM			KLFC		
		2.4 L	3.1 L	3.7 L	2.4 L	3.1 L	3.7 L
Agitation Speed Control	Agitation speed measurement and control. Display of speed and controller operation by BioSCADA system	•	•	•	•	•	•
Temperature Control	Sterilizable Pt100 temperature probe and temperature controller, activating actuators of heating/cooling system. Display of temperature and controller operation by BioSCADA system	•	•	•	•	•	•
pH Control	Sterilizable pH probe and pH controller, activating actuators (base and acid pump, CO2 valves). Display of pH and controller operation by BioSCADA system	•	•	•	•	•	•
pO2 Control	Sterilizable DO (pO2) probe with DO controller, activating actuators and secondary controllers by configurable cascade control. Display of pO2 and controller operation by BioSCADA system	•	•	•	•	•	•
Foam / Level Control	Sterilizable conductive level and foam probe with controller, activating dosing or harvest pumps. Controller operation by BioSCADA system	•	•	•	•	•	•
I/O package with additional interfaces and controllers	Package consisting of: - 1x RS232 input, connected to universal PID controller - 1x 4-20 mA input, connected to universal PID controller - 2x 4-20 mA input without controller - 4x 4-20 mA outputs (from each universal controller, positive and negative) - 2x digital outputs 24 V, freely configurable All inputs and outputs are available on sockets at the control cabinet housing. Handling of input and output values as well as controller operation by BioSCADA system	•	•	•	•	•	•

		KLFM			KLFC		
		2.4 L	3.1 L	3.7 L	2.4 L	3.1 L	3.7 L
Redox probe with transmitter, without display	Sterilizable redox (ORP) probe and controller activating actuators (pumps or valves). Display of redox potential and controller operation by BioSCADA system	°b	°b	°a	°c	°c	°a
Optical Density probe	Sterilizable turbidity (optical density) probe and controller activating actuators (pumps or valves). Display of turbidity and controller operation by BioSCADA system	°b	°b	°a	°c	°c	°a
Balance, 10–35,000 g	Platform scale with display for weight measurement of liquid in bottles or in fermentor vessel. E.g. for consumption measurement of acid, base antifoam, media. Can be used also for gravimetric level control in fermentor vessel. With cable for connection to universal controller via RS232	°	°	°	°	°	°
Balance, 1–16,100 g	Platform scale with display for weight measurement of liquid in bottles. E.g. for consumption measurement of acid, base antifoam, media. With cable for connection to universal controller via RS232	°	°	°	°	°	°
Balance, 1–6,500 g	Platform scale with display for weight measurement of liquid in bottles. E.g. for consumption measurement of acid, base antifoam, media. With cable for connection to universal controller via RS232	°	°	°	°	°	°
Exhaust gas analyzer, O2 and CO2 concentration	Gas analyzer type Exhalyzer to measure concentration of O2 (0–25%) and CO2 (0–10%). Incl. bypass valve in the exhaust gas line, connecting tubes and cables for connection to an universal controller or an I/O module	°	°	°	°	°	°
BioSCADA software package	1 system for up to 6 fermentor units. Runs with windows system software. Installed, ready to use if ordered together with Laptop. Customized main operation screen for system visualization and control. Input of set points, process values, PID parameters for controllers. Trends and historic process data visualization with scalable timeframe. Display of calculated consumption rates of actuators. Programming of cascades and profiles. Calibration of inputs and outputs. Alarm management, event list. Batch processing. Programming of recipes; step sequence program	•	•	•	•	•	•
Laptop	Laptop to run BioSCADA or BioLogg software (installed)	°	°	°	°	°	°
Power supply: Europe, Asia	1x 230 V, 50–60 Hz	•	•	•	•	•	•
Power supply: parts of America	1x 110 V, 50–60 Hz	°	°	°	°	°	°













## Technical data

General	2.4 L	3.1 L	3.7 L
Ambient temperature		5–40 °C	
Relative humidity (non-condensing)		85%	
Operating temperature (cultivation)		Max. 80 °C	
Operating temperature (sterilization)		Max. 130 °C	
Operating pressure		Max. 1.5 barg   21 psig	
Net weight [kg   lbs], 1 unit	75   165.4	76   167.5	76   167.5
Gross weight [kg   lbs], 1 unit wrapped	98   216.1	99   218.3	99   218.5

### Utility requirements

Power supply	CEE 7/7, 1x 230 V, 50/60 Hz, 10 A fused   NEMA 5–12, 1x 110 V, 50/60 Hz, 16 A fused		
Max. power consumption (230 V)   (110 V) [W]	1400   800 or 1400 (depending on heater type)		
Cooling water supply: connection   flow   pressure	Hose nipples 6/1 mm   2–4 L/min   0.6–2 bar (8.7–29.0 psig)		
Cooling water return: connection   flow   pressure	Hose nipples 6/1 mm   2–4 L/min   pressureless		
Peak water consumption during cooling at 2 bar, with exhaust cooler	Max. 250 L/h		
Average water consumption during cultivation mode	Approx. 60 L/h		
Gas (dry, particle- and oil-free): connection   flow   pressure	Pneumatic plug connection 8/1 or 6/1 mm   5–500 L/h   2.5–10 barg (36.3–145.0 psig)		
Gas consumption	Depending on process parameters		

Vessel	2.4 L	3.1 L	3.7 L
Recommended working volume [L], max.	1.6	2.0	2.5
Recommended working volume [L], min. microbial	1.06	1.4	1.66
Recommended working volume [L], min. cell (with heating blanket)	0.4	0.52	0.61

### Process connections

12 mm lid ports	9	9	15
12 mm bottom ports	4	4	4
Bottom port for agitator	1	1	1

### Motor type

Motor type	BLDC
Motor torque [Nm]	0.8
Motor power [W]	250

### Agitator diameter, standard [mm]

Flat-blade disc agitator (2x)	40	48	48
Propeller agitator (1x)	48	66	66
Segment pitched blade agitator (1x)	48	66	66

Material glass vessel (product contacted)	Borosilicate
Material steel parts (product contacted)	316L
Steel parts surface roughness (product contacted)	Ra ≤ 0.8 μm
Material polymer (product contacted)	EPDM, PTFE, silicone

Temperature control	2.4 L	3.1 L	3.7 L
Temp. control range with cooling water (chilled) [°C]		4-125	
KLFM: electrical heater in vessel, bottom port [W]		800*	
KLFC: heating blanket (cultivation)   heater in vessel (sterilisation [W])	300   800*	400   800*	400   800*
Heating-up time (full sterilization)	Approx. 2.4 min/°C		
Cooling-down time	Depending on cooling water temperature		

\* only with 208V-230V power supply

#### Requirements for external chiller

Cooling water supply: connection   pressure	Hose to nipples 6/1 mm   0.6-2 bar (8.7-29.0 psig)
Cooling water return: connection   pressure	Hose to nipples 6/1 mm   pressureless
Cooling capacity up to 3 units   6 units	400 W, 30 L water tank capacity   600 W, 50 L water tank capacity

Aeration	2.4 L	3.1 L	3.7 L
Rotameter Air for KLFM	0-250 Ln / h	0-250 Ln / h	0-500 Ln / h
Rotameter Air   O <sub>2</sub>   CO <sub>2</sub> for KLFC	0-8   8   5 Ln / h	0-16   16   8 Ln / h	0-16   16   8 Ln / h
Flow meter Air for KLFM	0-250 Ln / h [±1.0%, 1:50]		0-500 Ln / h [±1.0%, 1:50]
Flow meter Air   O <sub>2</sub>   CO <sub>2</sub> for KLFC	0-8   8 Ln / h [±1.0%, 1:50]	0-16   16 Ln / h [±1.0%, 1:50]	0-16   16 Ln / h [±1.0%, 1:50]
In- and outlet filter	Stainless steel housing. Cut off rate 99.9999% for particles and drops of size 0.1 µm		

Addition/Transfer	2 L	3.7 L	5 L
<b>Peristaltic pumps</b>			
Pump head	BioE/Oina		
Fix rpm   flow rate hose Di 2.0 mm   3.5 mm	130   35 mL/min   60 mL/min		
Variable rpm   flow rate hose Di 2.0 mm   3.5 mm	0-130   0-35 mL/min   0-60 mL/min		

Storage bottles, volume [mL]	250
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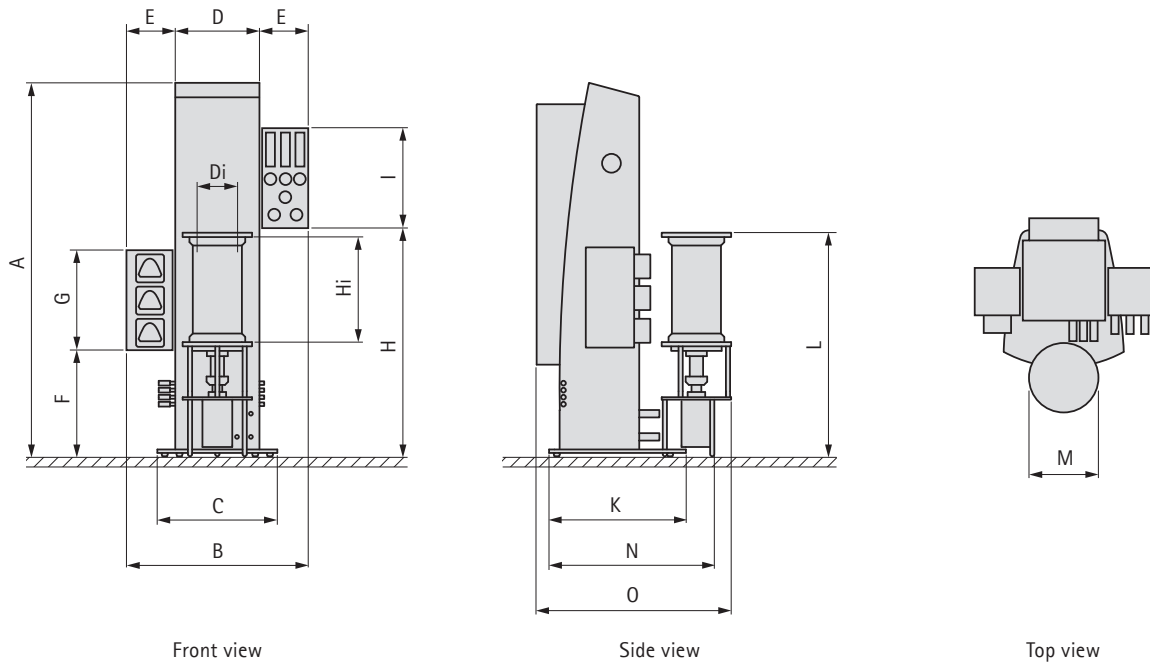
Control unit	2 L	3.7 L	5 L
Communication to Laptop	USB		
Temperature, Pt100 , bottom port	0-150 °C ± 0.1 °C		
Agitator speed controlled	60-2800 rpm ± 2 rpm		
pH, gel electrode	2-12 ± 0		
pO <sub>2</sub> , optical	4 ppb to saturation ± [1% + 4 ppb]		
Foam and level, conductive on / off	On/off, reaction time		
Free I/Os: RS232 in   4-20 mA in   4-20 mA out   24 V out	1   3   4   2		

#### Minimum requirements for external PC

Processor   RAM   HD   optical drive   ports   OS	PIII, 1.2 GHz   512 MB   20 GB   CD   USB 2.0   Windows 7
Screen	Min. 15"   color

Material control tower	Stainless steel AISI 304 + steel 37, varnished
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## Dimensions



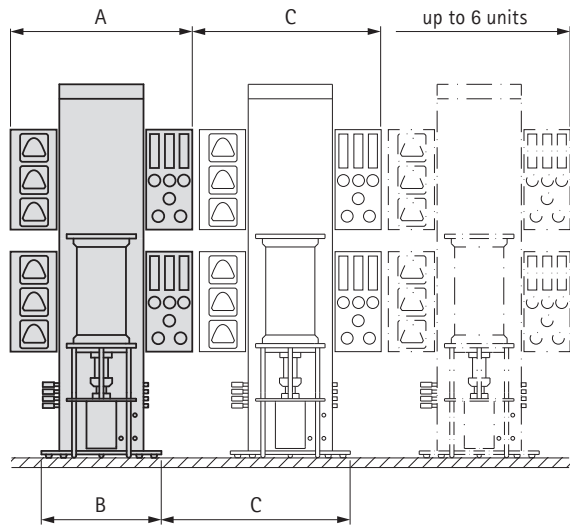
A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	K [mm]	L [mm]	M [mm]	N [mm]	O [mm]
1065	510	342	240	135	307	285	652	285	390	638	198	471	555

	Di [mm]	Hi [mm]
KLF 2.4 L	96	300
KLF 3.1 L	115	300
KLF 3.7 L	125	300

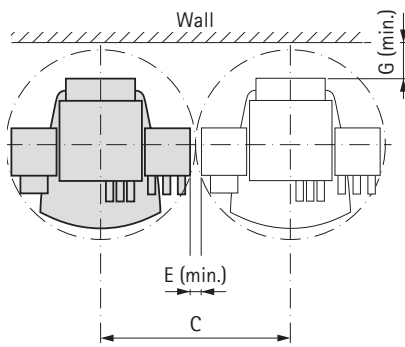
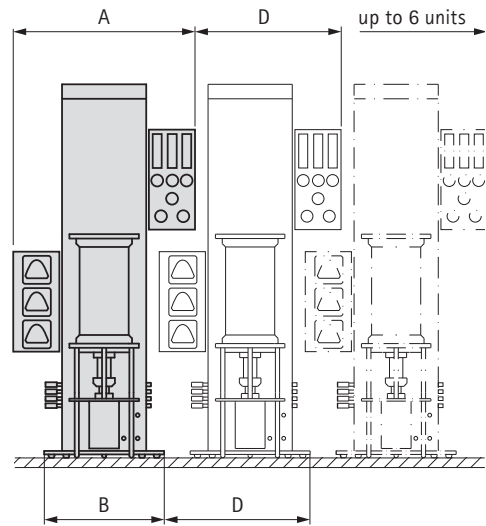
A [inch]	B [inch]	C [inch]	D [inch]	E [inch]	F [inch]	G [inch]	H [inch]	I [inch]	K [inch]	L [inch]	L [inch]	L [inch]	L [inch]
41.93	20.16	13.46	9.45	5.35	12.17	11.22	25.67	11.22	15.35	25.12	7.80	18.54	21.85

	Di [inch]	Hi [inch]
KLF 2.4 L	3.78	11.81
KLF 3.1 L	4.53	11.81
KLF 3.7 L	4.92	11.81

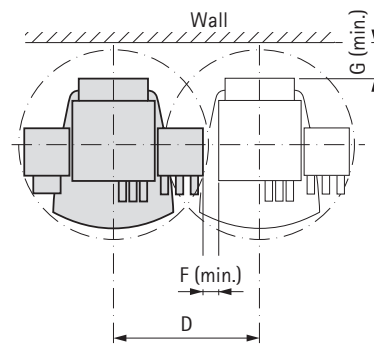
Installation type 1



Installation type 2



Top view (installation type 1)



Top view (installation type 2)

A [mm]	B [mm]	C [mm]	D [mm]	E* [mm]	F* [mm]	G* [mm]
512	342	550	426	35	50	130

A [inch]	B [inch]	C [inch]	D [inch]	E* [inch]	F* [inch]	G* [inch]
20.157	13.464	21.653	16.771	1.378	1.968	5.118

\* Minimum dimension for maintenance