Labfors 5

Universal applicability for single or parallel bioprocesses with no compromises



QUALITY
MADE IN SWITZERLAND

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Images examples only.

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We bring life to your laboratory.

INFORS HT



Two worlds, one philosophy!
INFORS HT supports the Masoala rain forest project in Zurich zoo. You can find detailed information at www.infors-ht.com.

Cultivating customer visions

INFORS HT is a company of international reputation in the field of biotechnology

Innovative thinking, quality and an understanding of the needs of our partners has secured INFORS HT an unrivalled place amongst manufacturers of bioreactor and shaker equipment. An enthusiasm for experiment and a creative mind has guided the company from its establishment in 1965 through its development to become firmly established as an important player in the field of biotechnology engineering. Independence, a distinctive character and a strong team spirit will continue to serve us well in the future. **www.infors-ht.com**

About our Quality Label

The Quality Label is INFORS HT's acknowledgment of Switzerland as a centre for research, development and manufacturing. Certified specialists stand for the first-class, tested quality of our shakers and bioreactors in terms of their materials, workmanship, safety and reliability. "Quality – Made in Switzerland" is also our customers' guarantee of straightforward, swift order processing, short delivery periods, and flexible, efficient service in administrative matters too. INFORS HT attaches great importance to fulfilling individual customer needs, as well as to long-term, close and trustful partnerships with purchasers and suppliers alike.

Quality Standards
- **ISO 9001**

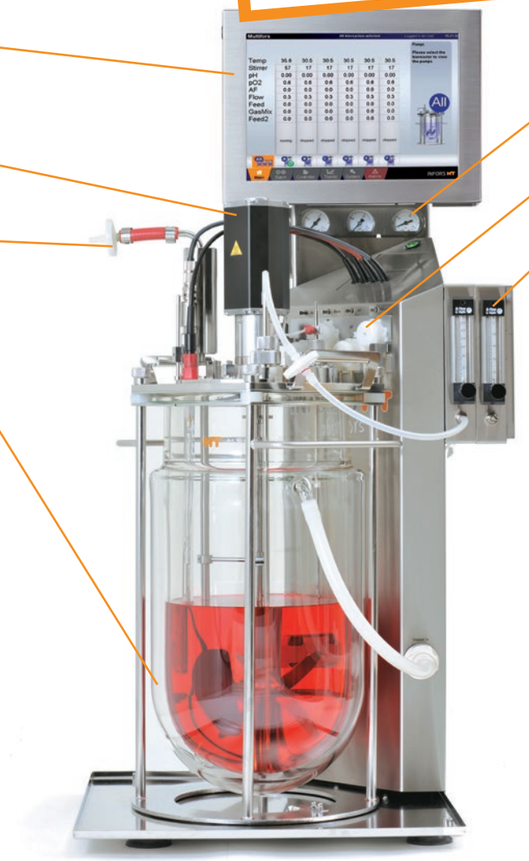
For process validation to cGMP
- **Documentation**
- **IQ**
- **OQ**
- **FAT & SAT**

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Labfors 5 at a glance

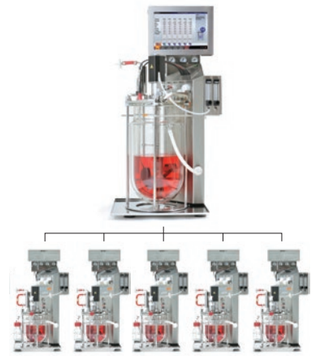
KEY BENEFITS

- Flexible and application-optimised configurations
- Splashproof touch screen with OPC server
- Parallel bioreactor option
- Faster results with optimised handling
- 100 % aseptic operation and sampling
- Space-saving, compact design



Parallel Bioreactor Option

The Labfors 5 features a new parallel bioreactor option which allows up to 6 vessels to be independently controlled from a single touch screen. Special features optimise the system for parallel bioreactor operation.



Key technical data

Minimum dimensions (W x D x H): 464 x 462 x 996 mm
Vessels: 2; 3.6; 7.5; 10; 13 L total volume
Maximum expansion: Up to 6 base units per touch screen controller
Speed range: 10–1500 min^{-1} direct drive, 20–300 min^{-1} magnetic drive (depending on vessel and motor options)
Temperature range: 5 °C above coolant to 70 °C (water jacket) or 95 °C (heating pad)
Pump flow rate: 0.0034 to 3.46 mL/min (standard tubing), 0.017 to 17.16 mL/min (large-size tubing), 0.0012 bis 1.24 mL/min (small-size tubing)
Standard parameters: Stirrer speed, temperature, pH, pO_2, antifoam, feed

Applications

- High-density cultures for protein production
- Photosensitive cultivations
- Biofuels
- Process Analytical Technology (PAT)
- Process development
- Process optimization
- Scale-up
- Scale-down
- Statistical studies
- Growth studies
- Anaerobic cultures
- Halophile strains
- Brewing research

May be subject to technical amendments.

What you get with Labfors 5

Universal applicability with no compromises: Labfors 5 is a leading bench-top bioreactor, providing the user with an easy-to-handle, flexible and upgradable system for culture volumes from 0.5 L up to 10 L. The Labfors 5 is always application optimized for your microbial or cell culture bioprocesses. A special LED lighting option even enables the Labfors 5 to cultivate photosynthetic active organisms. A nonmetal vessels option for growth of organisms in corrosive media and a single-use vessel option for cell culture adds further flexibility. Different cultivation strategies such as culture in batch, fed-batch and continuous modes are possible. The integrated OPC server makes the connection with additional sensors as simple as possible. A parallel bioreactor option allows to control up to 6 bioreactors with a single controller. Special configurations or modifications of Labfors 5 are available on request, providing ultimate flexibility for the user. Applications include high-density cultures for protein production, biofuel and process analytical technology (PAT).



KEY FEATURES LABFORS 5

Compact base unit

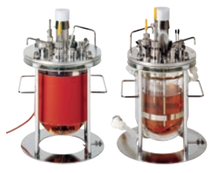
With a footprint as low as 464 x 462 mm for a fully equipped 10 L bioreactor, the Labfors 5 saves valuable bench space. This reduces the overall cost and allows greater research capacity in the same space. With the parallel bioreactor option, up to six bioreactors can be connected to one controller.

Flexible top-drive stirring system

The aseptic Labfors 5 top-drive stirring system features both a direct high-power version for microbial applications and a sensitive low-speed motor with magnetic coupling for long-time aseptic cell cultures. For details see pages 6/7.



Choose your temperature control system



A single-wall vessel with electric heating pad and cold finger allows gentle heating and cooling with a maximum temperature of 95 °C. A double-wall glass vessel with water circulation provides a perfect view to your culture and maximum heat transfer for rapid temperature changes (heating and cooling) to 70 °C.

More reproducible and accurate results thanks to the innovative thermodynamic exit gas cooler



Excessive loss of liquid from a bioreactor vessel as water vapour can be critical. The internal structure of the INFORS HT exit gas cooler condenses moisture leaving in the exit gas stream with maximum efficiency.

Fully equipped vessels

Labfors 5 has fully equipped, interchangeable vessels with working volumes from 0.5 up to 10 litres. The 316L stainless steel top plate includes many industry standard Pg13.5 ports, enabling a wide array of sensors to be fitted (antifoam, optical density, pH, pO_2, redox, capacitance, etc.). Different vessel sizes are available.

The vessel interior can be configured in a number of different ways with choices of impellers, spargers and special accessories, such as a draft tube or spin filter. A range of optional fittings are available to cover almost any possible application.

Services requirements

Electrical: 230 V 6.3 A (option 120 V 10 A) 50/60 Hz
Air: Clean, dry, oil-free air at 2 ± 0.5 bar (reduced internally)
Water: Cold water, 2 ± 1 bar, <50 ppm solids
Drain: Lower than base unit, no back pressure

Labfors 5 can be integrated into a house water supply, or a chiller unit.

May be subject to technical amendments.

The construction and design of the vessels (with no welded parts) make Labfors 5 ideal for applications where GMP conditions have to be faithfully observed.

Open-frame gas supply with up to 5 mass flow controllers

The open frame gas supply is highly flexible and allows a free choice of mass flow controllers, rotameters and gas mixing for up to 4 gases (air, N_2, O_2 and CO_2, each with integrated pressure control) in virtually any combination between the sparger and the headspace. Optimised configurations are available for microbials and cell cultures. For details see pages 6/7.

Time-saving, high-precision pumps

Four high-precision pumps per vessel are included for feed, acid, base and antifoam/level/harvest as standard. This makes the Labfors 5 ready for applications such as fed-batch or continuous culture out of the box.

The pump heads can be removed on a single plate in groups of 4 and autoclaved with the vessel. This reduces handling time considerably as tubing does not need to be threaded around the pump heads and adjusted before use. Handling errors due to misplaced pumps and tubing are completely eliminated with this unique construction. Set-up simply involves relocating the plate back into position. Automatic emptying, filling of tubing and calibration of the pumps makes the task even easier.

Super Safe Sampler – 100 % aseptic and absolutely hygienic sampling



The INFORS HT Super Safe Sampler allows you to take smallest samples without wasting any culture. This helps to get more precise results especially in small-scale bioprocesses due to minimum loss of culture volume. The truly aseptic design makes contamination during sampling impossible.

Top-plate specification: Number of ports (direct drive)

Vessel size	19 mm	12 mm	10 mm	Total
2 L	2	6	2	14
3.6 L (wide)	3	6	2	15
7.5 L	3	6	2	15
13.0 L	6	5	2	16

Vessel external dimensions

Height x Diameter (incl. vessel holder, gas cooler and without bottle cage):
2.0 L: 453 x 250 mm
3.6 L: 618 x 250 mm (150 mm vessel)
7.5 L: 717 x 250 mm
10 L: 608 x 290 mm
13 L: 700 x 290 mm

May be subject to technical amendments.

HIGHLIGHT

Get faster results with optimised parallel handling

The Labfors 5 has been designed to make handling as easy as possible. The integrated reagent bottle and pump holder fits onto the vessel holder. This simplifies handling, so only a single unit is taken to the autoclave.

4 easy steps and you're ready to go

1) Replace vessel holder on base unit



2) Fit plates with pump heads



3) Prime pumps automatically in groups

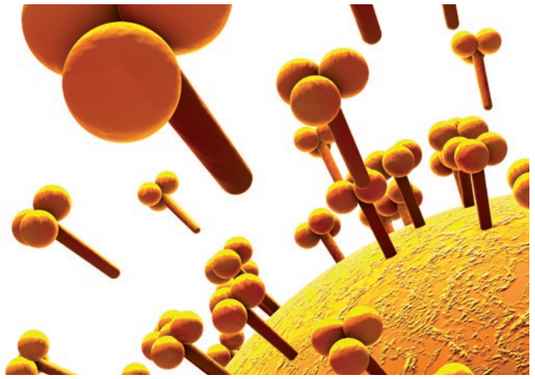


4) Synchronised start of all bioreactors



Individual configuration for your application

Labfors 5 Cell



For culture of suspended mammalian cells (CHO, HEK, etc.) and insect cells (Sf9, High Five, etc.), as well as adherent cells on microcarriers. The Labfors 5 Cell is fully optimised for sterile and reproducible bioprocesses, which allows advanced cell cultivation to your wishes.

SPECIAL FEATURES

100 % aseptically designed low-speed stirring system

The open axial magnetically coupled stirring system uses a slow-speed motor (20 up to 300 min^{-1}) for gentle and reliable mixing. A pitched blade stirrer is included as standard, which allows a shear-stress-free movement and mixing of the cells. The magnetic coupling is easy to clean and 100 % aseptic design without compromises.

Customised gas strategy

The INFORS HT open-frame gassing system offers very precise gas mixing and gas flow control for highly accurate pO_2 and pH control. This is especially important for optimal cultivation of sensitive cell cultures. Any combination of air, O_2, N_2 or CO_2 as single gas or gas mix can be directed into the sparger or head space.

As standard for cell culture we recommend:
- pO_2 control: Air, O_2 and N_2 to sparger via mass flow controller
- pH control: CO_2 to sparger via mass flow controller
- Antifoam: Headspace aeration with air as mechanical antifoam device

Perfusion

A spin filter is often used for both immobilised cell cultures and those in suspension because of its easiness to scale-up. A rotating filter keeps cells outside, creating a pool of cell-free medium inside the filter cup. Cell-free medium can be removed and replenished with fresh medium, continuously or in batches. Labfors 5 Cell can also be set up with other perfusion systems, e.g., hollow-fibre module for tangential flow filtration (TFF), alternating tangential filtration (ATF) or ultrasonic resonance system.

Labfors 5 Fermentation



INFORS HT has over 45 years experience in designing bioreactors to provide powerful mixing, good temperature control plus flexible oxygenation and feeding strategies. All this know-how has been transferred into the Labfors 5.

SPECIAL FEATURES

Designed for more process understanding

The very strong and reliable Labfors 5 controller allows a very easy and almost unlimited integration of sensors and analytical equipment. Together with bioprocess platform software eve® there are no limits for your cultivation strategy and more process understanding. Application-specific fed-batch strategies and continuous cultures are possible out of the box.

Customised gas strategy

The INFORS HT open-frame gassing system offers very precise gas mixing and gas flow control for highly accurate pO_2 control. The whole system offers a very high k_La that is comparable to larger system to make scale-up as easy as possible. Any combination of air, O_2, N_2 or any other single gas can be directed into the sparger or head space.

As standard for microbial cultivation we recommend:
- pO_2 control: Air, O_2 to sparger via mass flow controller

Options for halophile and metal-sensitive organisms

Halophile strains are able to grow in habitats with the presence of sodium chloride from 2 % to 30 %. As the sodium chloride concentration gets higher, the more difficult it is to cultivate halophiles due to the corrosivity issues of the processing equipment.

In a Labfors PEEK reactor, all parts are made of corrosion-resistant parts like borosilicate glass and PEEK polymer. This makes the Labfors 5 PEEK long living even though the corrosivity of the used media.

May be subject to technical amendments.

Labfors 5 Bioethanol Options

A specialised innovative agitation system allows homogenous mixing of solid-phase enzymatic reaction. The Labfors 5 high-precision temperature and pH control system let the enzymes develop their full potential even at high temperatures. The anaerobic ethanol production phase can automatically follow in the same vessel with an aerobic precultivation if needed. Precise control and measurement of yeast activity, e.g., exhaust gas analyses or integration of external devices such as HPLC, MS, glucose analyser, etc., can be made very easy over the integrated OPC server.

Labfors 5 Lux

LED Flat Panel Option – perfect for biofuel research

A Labfors 5 controller with flat panel vessel and LED light that is dimmable from 0–100 % Caribbean sunlight noon intensity (3000 µmol/m^2s [µEinstein]). The main advantages of the flat panel compared to the stirred tank are scalability to pilot and production size as well as even light distribution throughout the culture.

LED Stirred Tank Option – classic photosynthetic applications

A Labfors 5 controller with stirred tank reactor and LED light stripes in different colours, e.g., white, red, blue, etc., to optimise spectra for specific organisms. The light intensity is dimmable from 0–100 % up to 700 µmol/m^2s (µEinstein).

Packages Labfors 5

The Labfors 5 packages are especially configured to meet the requirements of cell cultures, microbials, halophile strains or photosynthetic active organisms. For specifications of the Labfors 5 Lux options please ask your local INFORS HT representative.

	Microbial Package	Cell Culture Package
Compact base unit	x	
Fully equipped vessels	x	
– Total volume per vessel	2 L | 3.6 L | 7.5 L | 13 L	2 L | 3.6 L | 7.5 L | 10 L | 13 L
– Working volume per vessel	1 L | 2.3 L | 5 L | 10 L	1 L | 2.3 L | 5 L | 7 L | 10 L
– Vessel type	Round bottom	
– Stirrer type	2 Rushton impellers	1 Pitched blade impeller
– Sparger type	Arch sparger for microbials	Ring sparger for cell culture
Temperature control module	x	
Top-drive stirring system	Direct drive	Magnetic drive
– Stirrer speed	10–1500 min^{-1} (depending on vessel and motor options)	20–300 min^{-1}
Open-frame gas supply	x	
– Gas mix	Air/O_2 for pO_2 control Options for other gas mix	Air/O_2/N_2 gas mix for pO_2 control CO_2 for pH control Options for other gas mix
– Submerse gassing	Gas mix to sparger (approx. 0.02–2 vvm)	Gas mix to sparger (approx. 0.001–0.1 vvm)
– Headspace gassing	Optional	Air to headspace (approx. 1 vvm)
– Gas flow control	Mass flow control or rotameter	
Thermodynamic exit gas cooler	x	
4 High-precision pumps (1 analog + 3 digital)	0.0034 to 3.46 mL/min (standard) 0.017 to 17.16 mL/min (option) 0.0012 to 1.24 mL/min (option)	
Super Safe Sampler	x	
Touch screen with OPC server	x	

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Touch screen with OPC server

Bioprocess control begins with the quality and flexibility of the local controller. The Labfors 5 touch screen controller provides accurate and reliable measurement, control and communication with supervisory software. The touch screen controller is able to provide individual control for up to 6 bioreactors. Key parameters for all six vessels are shown in an overview main screen but control of each unit is fully independent.

Unlimited connection with external devices

As a standard the Labfors 5 has an integrated OPC server. Connecting external devices such as HPLC, MS, glucose analyser, etc., is possible via analogue in/out signals, Modbus or OPC XML DA. The integrated OPC server also provides a link to SCADA software via a network.

Very flexible cascade control

All measured parameters can be cascaded to another parameter to provide control without any limitation. Parameter configurations can be saved and reused.

Faster setup with the INFORS HT ALL functions

The ALL functions make emptying and priming of pumps easy even if a full system with 24 pumps is used. Each set of pumps can be defined separately, e.g., all the acid pumps for duration of the filling or emptying operation.

- Calibration of pH and pO_2 probes with one push of a button
- Start ALL/Stop ALL capability for ease of handling with multiple vessels

Easy to use

The user interface has been optimised after detailed testing by users, psychologists and usability experts and features simple and intuitive operation. A tabbed menu system makes it easy to find associated items together and move between options. Password protection and different user levels allows personnel with varying degrees of knowledge and experience to safely use the bioreactor.

Simple connection of peripheral equipment

A connector is provided as standard for additional analogue inputs and outputs (from sensors and pumps typically). Additional parameters can be added quickly and without the additional expense of extensive reprogramming.

Up to 24 parameters per vessel

- Temperature
- Stirrer speed
- pH
- pO_2
- Antifoam/Level
- Feed
- Gas mix
- Gas flow
- + 16 free channels







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Accessories

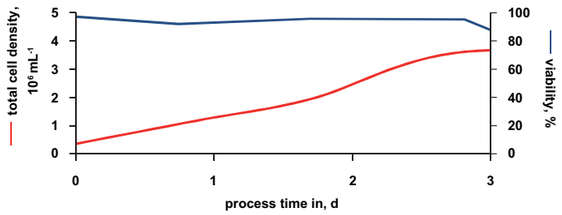
Integration of external sensors or analysers

With several freely programmable channels and the integrated OPC XML DA server as standard, the integration of sensors and external analysers is very easy.

External sensors or analysers such as HPLC, MS, glucose measurement devices, etc., can be integrated via analogue signals, Modbus or OPC XML DA. With bioprocess platform software eve®, all parameters can be combined and cascaded individually.

Online cell density and biomass

INFORS HT provides solutions for the online detection of cell densities and biomass. You'll get a better understanding of your processes without manually taking a sample, which reduces your process time significantly.



As a standard, we provide the Optek ASD12-N sensors for automated detection of both total cell density and biomass during the cultivation of cells or microorganisms. The ideal sensors will be chosen for your application.

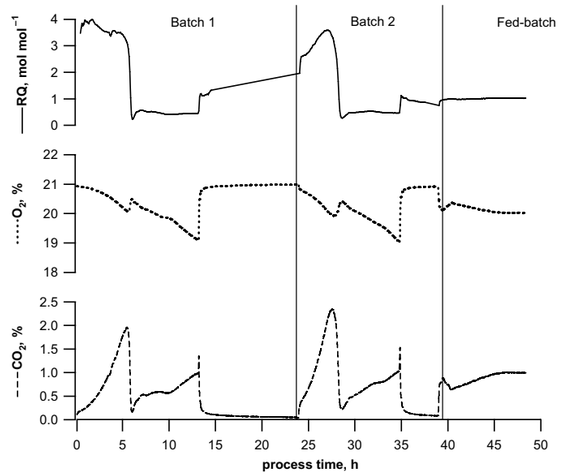
For determining the viable cell density, sensors from ABER Instruments can also easily be operated with the INFORS HT Labfors 5.

RQ measurement and control

INFORS HT offers you professional solutions for O_2 and CO_2 analysis for metabolic studies and bioprocess control: the INFORS HT Gas Analyser or BlueSens gas sensors.

The O_2 or CO_2 analysis can be seamlessly integrated into your bioreactor, thus enabling you to make direct estimations as to the condition of the culture during the actual bioprocess. The bioprocess platform software eve® allows the calculation of parameters such as the CO_2 evolution rate (CER), the O_2 uptake rate (OUR) and the resulting respiratory quotient (RQ).

This in turn makes it possible to adopt a systematic approach to bioprocess control, to maintain specific metabolic states and to prevent O_2 limitations or substrate limitations.





May be subject to technical amendments.

Qualification

Compliance with regulatory requirements is becoming a critical issue for more users each year. INFORS HT provides a full qualification service with standard or customised packages to meet this need, e.g., cGMP compliance.

What is available?

The process starts with the Design Qualification and then planning of the production for qualification. Testing occurs at many points in the process and usually ends with a Factory Acceptance Test (FAT).



A package of comprehensive documentation is prepared and shipped with the bioreactor. Tests for IQ (Installation Qualification) and OQ (Operational Qualification) can then be made using this information. Site Acceptance Test (SAT) is typically carried out to show the equipment meets all necessary requirements.



An important point to note is that ALL our bioreactors are manufactured to exactly the same high standards, it is only the amount of testing and documentation which varies.

Service and support



At INFORS HT, we are committed to providing the very highest level of customer support and service, based on our principles of customer proximity, expertise and efficiency.

- **Close and direct contact with our specialists**
- **Technical and scientific experts**
- **Fast responses when you need it**

Our high-quality service sets INFORS HT ahead and makes a real difference for our customers. Key services enable our users to get the most from their equipment, quickly and easily.

- **Customer support (email, phone, on site)**
- **Technical solutions for special requests**
- **Installation and commissioning**
- **Equipment and application training**
- **Preventative maintenance**

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As unique as your bioprocess!



Multitron Cell



Labfors 5



Techfors

INFORS HT equipment is individually adapted to meet the needs of your bioprocess. Our designers and application experts take the time to configure an optimised solution to your needs in partnership with you. Combined with the bioprocess platform software eve®, the full potential productivity of your cell culture or microbial fermentation can be successfully unlocked.

From laboratory-scale shaker to pilot-scale bioreactor

As different as these devices are, you will find they have a lot in common:

- Individual configuration for your application
- Simplified handling
- Common operation and control
- Turnkey equipment which is usable "out of the box"
- Exceptional Swiss quality
- Outstanding service and support

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