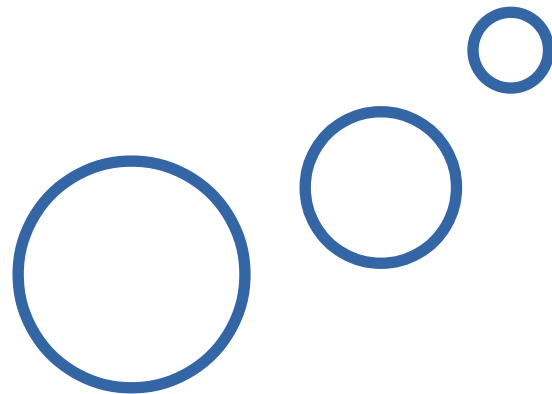




Technical Data Sheet CITSens Bio CITSens MeMo and in-situ sensors for SUB's



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CITSens Bio



CITSens Bio is an electrochemical, enzyme based sensor with the capacity to be used in defined cell culture media as well as in complex matrices, e.g. blood.

The continuous online/insitu measurement of glucose and / or lactate adds value to cell line, media and process development projects within the biopharma community. The affordable sensor system is unique and delivers real-time

information on a culture’s growth behavior and metabolic state at any given time. Data is being generated at a 20 second frequency and continuously sent to a database via wireless communication out of a closed incubator. Using a smartphone, a round the clock observation of your cell culture is here. Through straightforward OPC server connectivity, process control based on the online measured kinetics of glucose consumption and/or lactate generation has become reality.

The benefits are evident: Easy and fast process development at lowest investment and running cost, no risk of contamination, intime information and automation, better science.

The single-use sensor part of the system comes as a standard product (as a reactor probe containing a PG13.5 thread or as a flow cell sensor) or can be custom-manufactured as a cap sensor fitting any of the mostly used brands of cell culture vessels. The sensors are delivered double packed and gamma-sterilized and stored at 4 C.

To be used with our Screen Printed Glucose or Lactate Sensor, Smart disposable Bioreactors, CapSensors, PG 13.5 Plug or flow-cell.

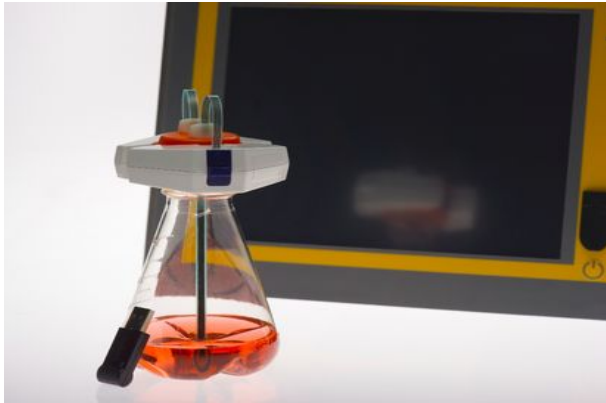
In-situ Glucose or Lactate Sensor

Delivery	Gamma irradiated (25 kGy), double packed		
Dimension (SPE)	Length:	230 mm or 330 mm	
	Tip diameter:	8 mm	
	Thickness:	0.15 mm	
Analytes	Glucose		
	Measuring range	0 - 48 mmol/L	0 – 6.0 g/L linear 6 – 8.0 g/L non linear
	Precision	+/- 0.5 mmol/L	
	Resolution	0.1 mmol/L	
	Lactate		
	Measuring range	0 - 15 mmol/L	0 – 1.35 g/L
	Precision	+/- 0.5 mmol/L	
	Resolution	0.1 mmol/L	

Product Number	Description	Pcs / Unit
3002-101	CITSens Bio Starter Kit & License	1



CITSens MeMo



CITSens *MeMo* is an electrochemical, enzyme-based sensor system with the capacity to be used in defined cell culture media as well as in complex matrices, e.g. blood.

The continuous online/in-situ measurement of glucose and lactate on one sensor as offered by CITSens *MeMo* adds value to cell line, media and process development projects within the biopharma community. The affordable sensor

system is unique and delivers real-time information on a culture's growth behavior and metabolic state at any given time. Data is being generated at a 20 second frequency and continuously sent to a database via wireless communication out of a closed incubator. Using a smartphone, a round the clock observation of your cell culture is here. Through straightforward OPC server connectivity, process control based on the online measured kinetics of glucose consumption and lactate generation has become reality.

The benefits are evident: Easy and fast process development at lowest investment and running cost, no risk of contamination, in-time information and automation, better science.

The single-use sensor part of the system comes as a standard product (as a reactor probe containing a PG13.5 thread or as a flow cell sensor) or can be custom-manufactured as a cap sensor fitting any of the mostly used brands of cell culture vessels. The sensors are delivered double packed and gamma-sterilized and stored at 4 C.

To be used with our Screen Printed Glucose or Lactate Sensor, Smart disposable Bioreactors, CapSensors, PG 13.5 Plug or flow-cell.

In-situ bi-parametric Glucose & Lactate Sensor

Delivery	Gamma irradiated (25 kGy), double packed		
Dimension (SPE)	Length:	230 mm or 330 mm	
	Tip Diameter:	8 mm	
	Thickness:	0.15 mm	
Analytes	Glucose / Lactate combined		
	Glucose		
	Measuring range	0 - 48 mmol/L 0 - 6.0 g/L 6 - 8.0 g/L	linear non linear
	Precision	+/- 0.5 mmol/L	
	Resolution	0.1 mmol/L	
	Lactate		
	Measuring range	0 - 15 mmol/L 0 - 1.35 g/L	
	Precision	+/- 0.5 mmol/L	
	Resolution	0.1 mmol/L	

Product Number	Description	Pcs / Unit
3002-1030	CITSens MeMo Starter Kit & License	1

CITSens Bio / MeMo APC



CITSens Bio/MeMo APC is a software update available for either the CITSens Bio or CITSens MeMo system which offers standalone feedback control capabilities at lowest investment. The APC upgrade brings completely new process control options in order to reduce cell stress by hyper- / hypo-glycemia or high lactate levels. In addition the system allows to increase product yield as well as product quality due to lowered glucose levels and its positive effect on protein expression.

If not used as a process optimization tool, both APC systems enable remote cell culture monitoring / control for bridging weekends without the need of visiting the lab.

The APC systems are capable of communicating with RS232 driven pumps as well as with our Micropump using bluetooth connectivity.

For larger bioreactors or cultivation dishes the RS232 peristaltic pump (Ismatec Reglo Digital) is recommended. The micropump offers the same possibility for small bioreactors (e.g. ShakeFlasks) and can be placed inside the incubator next to the cell culture vessel. The CITSens Bio system can handle up to 24 Ismatec Reglo Digital or 12 micropumps whereas the CITSens MeMo is capable of handling 12 Ismatec Reglo Digital or 12 micropumps in parallel.

Like the standard systems the APC systems generate data on a 20 second measuring interval. Connecting the system to a 3rd party system via OPC is possible to have full data traceability on your process control system.

To be used with our Screen Printed Glucose or combined Sensor, Smart disposable Bioreactors, CapSensors, PG 13.5 Plug or flow-cell.

Recommended control range:
(Control is enabled on Glucose parameter)

Bio:	High Glucose:	0.5 – 5.0 g/L
	Low Glucose:	0.3 – 2.5 g/L
MeMo:	High Glucose:	0.5 – 5.0 g/L
	Low Glucose:	0.3 – 2.5 g/L
	Combined (Glu/Lac):	0.5 – 5.0 g/L

Pump flow rates:

Ismatec Reglo Digital:	0.002 – 45 mL/min
Micro Pump:	0.7 – 7.0 mL/min

Third party connectivities:

- OPC
- API for EVE® Infors HT:
- ODBC

Product Number	Description	Pcs / Unit
3002-2030	CITSens APC (automated process control)	1
3002-2030-MP	Micropump	4
3002-2030-MPCM	Micropump control module quad	1
3002-ISM833	Ismatec REGLO Digital MS-4/6	1



USB wired Board



Lactate simultaneously and is compatible with all the sensors in the portfolio. The board comes with a USB and sensor cable that allows easy connection of our sensor to the board.

Measuring takes place at a 5 seconds interval,



USB wired Board is a standalone measuring module specially designed for direct integration purposes. The USB wired Board can be connected to any computer supporting virtual COM Port connected by USB or RS232. Due to its modular design the USB wired Board supports amperometric as well as potentiometric measurements which allows to read out our Glucose & Lactate sensors as well as pH & NH₄⁺ sensors. The USB wired Board supports 2 channel read out that allows measuring e.g. Glucose &

allowing not only monitoring but also control of Glucose in a narrow concentration range.

There are 3 data readout options available:

1. Free software for Windows or Linux supporting direct raw value readout (raw signal, no g/L signal)
2. Integration into 3rd Party systems
3. Integration into self developed process control systems (OEM)

To be used with our Screen Printed Glucose and / or Lactate Sensors, Smart disposable Bioreactors, CapSensors, Process Probes or Flow-cells.

Communication:	USB / RS232 Device will be recognized as COM port	
Data type:	Text string, nA_Value_1;na_Value_2\r\n (e.g. 1234;4521\r\n)	
Number of readout channels:	2 separate channels	
Available electronics:	- amperometric board for	Glucose/Lactate
	- potentiometric board for	pH/Ammonia
Measuring interval:	5 seconds	
Sensor connector cable length:	30 cm	
USB cable length:	1.5 meter (included)	
Housing:	available with or without housing (for direct integration)	

Product Number	Description	Pcs / Unit
3002-1030-A	CITSens USB Board & Licence	1

Disposable glucose and lactate sensors for SUB's



CITSens *Bio* sensors are based on screen printed electrodes which are coated with an immobilized enzyme. The sensor is built into the respective original cap or finished as a PEEK PG13.5 sensor, double packed and subsequently sterilized by gamma-irradiation.

For implementation of the system, the CITSens *Bio* sensor is connected to the radio transmitter and put into the cell culture. Data measured are transmitted to a receiver and transferred to the PC by means of LAN / Bluetooth

Information on a culture's growth behavior and metabolic state at any given time. Data is being generated at a 20 second frequency and continuously sent to a database via wireless

communication out of a closed incubator. Using a smartphone, a round the the clock observation of your cell culture is here.

Continuous and disturbance-free measuring of key metabolic parameters is critical for cell biologists. Cell growth and metabolic activity can be measured instantaneously and such derived data can be used to trigger bioprocess control actions.

It is not only the sophisticated labs of biopharmaceutical companies who benefit from the features offered by CITSens *Bio* but also the many investigators in the different fields of basic cell biology research. Frequent manual interventions for sample taking or optical examination harm cell cultures and disturb their growth. Negative aspects of disturbing growing cell cultures are:

- lower cell density resulting in lower product yield
- metabolic stress and gene expression due to environmental change (carbon dioxide, temperature, pH Shift, seize of agitation)
- no information on their actual metabolic state by optical inspection
- risk of contamination

To be used with CITSens *Bio* or CITSens *MeMo*

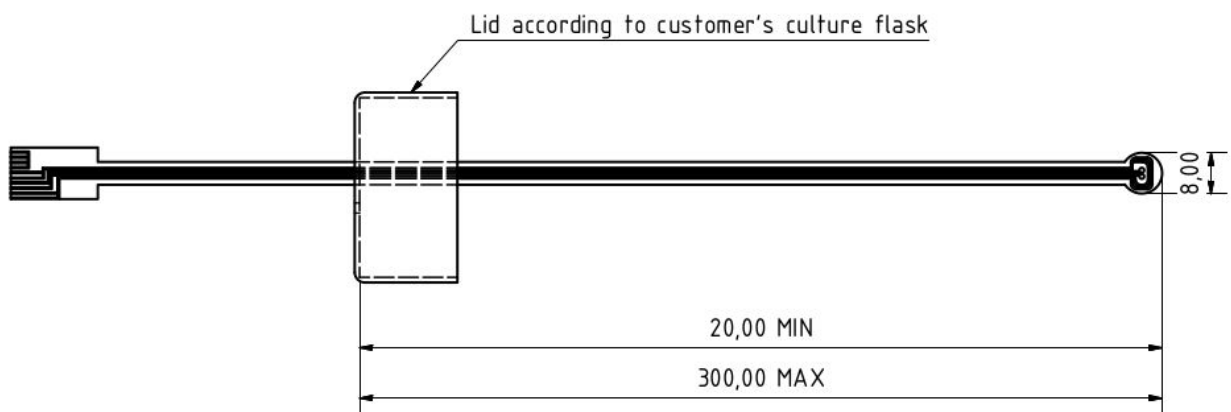
Cap Sensor



Upon request, C-CIT Sensors manufactures Cap Sensors for applications where cells are cultivated in T-, Shake, Roller and Spinner-Flasks.

Sensor specifications:

Length:	40 – 300 mm
Material:	Polymer (USP Class VI) coated screen printed electrode



Product Number	Description	Pcs / Unit
3002-501-HG	CITSens Bio Glucose sensor with cap for high glucose media	24 pieces
3002-501-LG	CITSens Bio Glucose sensor with cap for low glucose media	24 pieces
3002-501-L	CITSens Bio Lactate sensor with cap	24 pieces
3002-501-c-HG/L	CITSens MeMo high Glucose / Lactate combi sensor with cap	24 pieces

Process Probe for SUB



The Process Probe is the best choice for any stirred bioreactors.

Through its shape which is based on a standard pH-probe, the Process Probe easily fits into any stirred bioreactor via PG13.5 threaded lid or side ports.

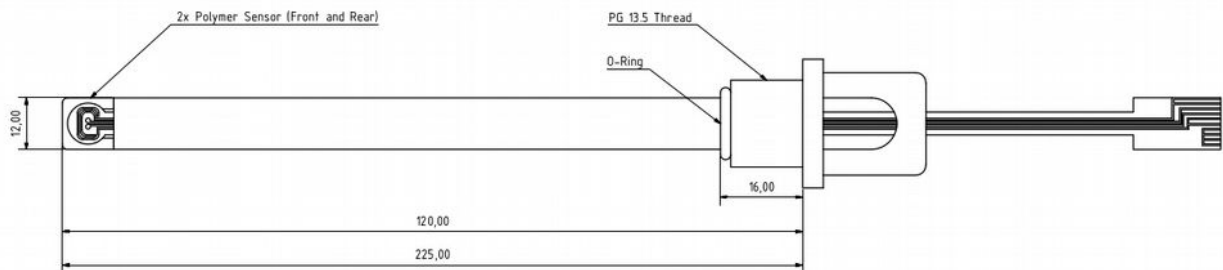
Using PEEK or PP as main in-process material, the Process Probe complies with USP VI criteria relevant for cell culture applications.

For larger single use bioreactors the Process Probe can be integrated into standard KLEENPAK connectors to allow aseptic integration.

Sensor specifications:

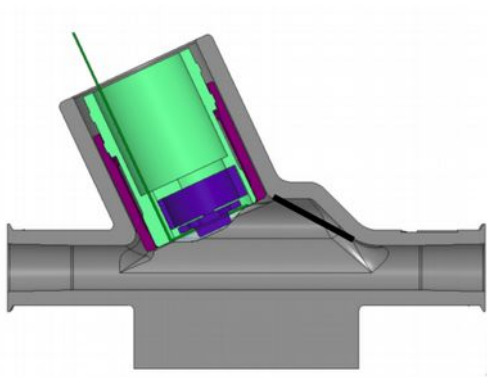
Length: 120 & 225 mm
other lengths on request

Material: PEEK (USP Class VI)
PP (USP Class VI)



Product Number	Description	Pcs / Unit
3002-511-HG	CITSens Bio Glucose reactor probe for high glucose media	12 pieces
3002-511-LG	CITSens Bio Glucose reactor probe for low glucose media	12 pieces
3002-511-L	CITSens Bio Lactate reactor probe	12 pieces
3002-511-c-HG/L	CITSens MeMo high Glucose / Lactate combi reactor probe	12 pieces

Flow Cell Sensor



The Flow Through Cell is the best choice for long term monitoring in tube based reactor systems or any perfusion based bioprocesses. Designed with a flat bottom without dead volumes, it allows the culture medium to pass through the cell and avoids any cell aggregation in or around the sensor.

Available with and without micropump

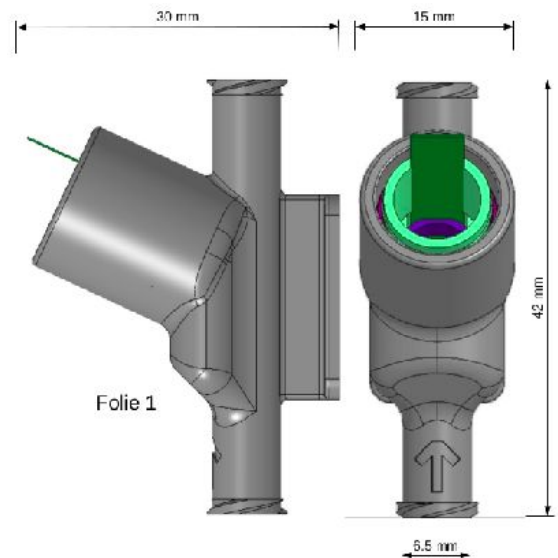
Sensor specifications:

Length:	Given by Flow Through Cell
Material:	Resin Polymer (USP Class VI)
Flow-rate:	8 μ L to 300 mL/min

Connection to Reactor:

LuerLock	Inlet	Female
	Outlet	Female

C-Flex Tubing



Product Number	Description	Pcs / Unit
3002-502-LG	CITSens Bio Glucose flow cell sensor for low glucose media	12 pieces
3002-502-HG	CITSens Bio Glucose flow cell sensor for high glucose media	12 pieces
3002-502-L	CITSens Bio Lactate flow cell sensor	12 pieces
3002-502-c-G/L	CITSens MeMo high Glucose / Lactate combi flow cell sensors	12 pieces
3002-502-LG-MP	CITSens Bio Glucose flow cell sensor for low glucose media with micropump	12 pieces
3002-502-HG-MP	CITSens Bio Glucose flow cell sensor for high glucose media with micropump	12 pieces
3002-502-LG-MP	CITSens Bio Lactate flow cell sensor with micropump	12 pieces
3002-502-c-G/L-MP	CITSens MeMo high Glucose / Lactate combi flow cell sensor with micropump	12 pieces
3002-2030-MP502	Micropump Controller for flowcell	1 piece



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