Xcellerex™ XDR-50 to XDR-2000

CELL CULTURE BIOREACTOR SYSTEMS

The Xcellerex™ XDR bioreactor product line offers you single-use technology and stirred-tank design in a modular, turnkey, bioreactor platform (Fig 1). Designed for scalability and robustness, Xcellerex XDR bioreactor systems provide the performance and flexibility needed from process development to large-scale biopharmaceutical manufacturing. These provide solutions for your batch, fed-batch, and perfusion processes.

Benefits:

- Proven for use in multiple applications including mAbs, viral vector and vaccines.
- Cytiva Bioreactor Scaler tool provides predictable stirred-tank performance parameters from micro bioreactor scale up to 2000 L.
- Single-use technology reduces costly and time-consuming cleaning and cleaning validation.
- Flexible automation with a modular system design supports your specific operational needs.
- Seamless connectivity to Xcellerex Automated Perfusion System (APS) for intensified cell culture operations.

Fig 1. Xcellerex XDR bioreactor system components: X-Station mobile control console and vessel.

System overview

The full line of Xcellerex XDR bioreactor systems (Fig 2) is designed and characterized to deliver scalable process equivalence from 25 L to 2000 L working volume, in both GMP and non-GMP environments. Additionally, the Xcellerex XDR-10 bioreactor has a working range from 4.5 L to 10 L (see data file Xcellerex XDR-10 cell culture bioreactor system). Traditional scaling methodology, based on measures such as shear, tip speed, power per unit volume, k_La, and specific process sensitivities, can be used during scale-up. Technology transfer using the Xcellerex XDR systems is straightforward, minimizing the need for costly and time-consuming process redesign. For enhanced utility across the bioreactor platform, the minimum working volume is as low as 20% of the maximum working volume.

The biocontainer assembly is prepackaged with a low profile impeller, a variety of sparge components, filters, and tubing, for quick installation. The flexibility of single-use technology enables quick changeover between production runs, for efficient equipment utilization.

Fig 2. Xcellerex XDR-10, XDR-50, XDR-200, and XDR-2000 (XDR-500 and XDR-1000 are not shown). The complete range of systems is available with maximum working volumes 10 L, 50 L, 200 L, 500 L, 1000 L, and 2000 L.

The modularity of the Xcellerex XDR product line stems from three main subsystem components: bioreactor vessel with frame, Input/Output (I/O) cabinet, and X-Station mobile control console. The system components can be used together for a complete turnkey system with true plug-and-play performance. Alternatively, the components can be used separately and integrated into existing infrastructure, such as DeltaV™, for enhanced flexibility.

System components

Bioreactor vessel

Constructed of 304 grade stainless steel (304/304L), the jacketed vessel enables efficient heat transfer and, together with an external temperature control unit (TCU), offers highly accurate temperature control of the cell culture. The bioreactor vessel features load cells for weight measurement and locking casters with leveling feet. Other features include a tubing manager for convenient positioning and routing of the biocontainer tubing and a high-performance, bottom-mounted, magnetically coupled drive system. Due to the biocontainer design and bottom drive, there are no shafts to install from the top of the bioreactor vessel, minimizing ceiling height requirements. To aid in coupling and decoupling the motor drive and the biocontainer, each Xcellerex XDR bioreactor includes a mechanical assist device.

The systems are equipped with inlet and exhaust filter holders and vessel sidewall viewing ports. A lower sidewall port opening makes room for a sampling port as well as probes for pH, dissolved oxygen (DO), and temperature. An optional perfusion-specific biocontainer loading door is available to accommodate cell retention devices on 1000 and 2000 L systems. The 1000 and 2000 L systems feature a semi-automatic hoist that simplifies biocontainer installation. An efficient exhaust gas filter heater is also included to reduce condensate.

Versatile I/O cabinet

Two 304 SS I/O cabinets functionally separate devices for gas management, AC power, pumps and transmitters for pH and DO measurement. Standard Xcellerex XDR bioreactor gas and liquid management configurations cover the majority of cell culture applications. Probes on the bioreactor system provide real-time data, monitored throughout the process run using The Figurate™ automation solution powered by AVEVA™ (formerly Wonderware®) software.

Profibus™ communication standard is used for device communication and communication to the X-Station. For custom installations, direct Profibus communication between the I/O cabinet and other automation systems (e.g., Rockwell Automation®, DeltaV, Siemens™) can be accomplished.

Liquid management

The I/O cabinet can be configured with up to four pumps including on-off and variable speed peristaltic pumps. The on-off pumps utilize a Watson-Marlow™ 114 pump head, while the variable speed pumps utilize Watson-Marlow 313 or 520 pump heads depending on configuration. The pumps have flow rate ranges to support liquid addition or removal. They can also be programmed for fed-batch and perfusion culturing and are easily calibrated using AVEVA software in conjunction with the Allen-Bradley PLC.

Gas management

Up to six mass flow controllers offer multiple sparging regimes, CO_2 abatement at large-scale, and overlay gas addition. The Xcellerex XDR systems include a gas manifold to distribute the various gases to the available bioreactor biocontainer destinations depending on configuration: sparger, sparge tee or headspace. The dual-panel design uses a gas management cabinet separate from the main I/O cabinet.

Measurements of DO and pH

DO and pH can be measured using conventional polarographic and optical sensors and glass electrodes, respectively. These sensors can be autoclaved prior to using the Click-In probe sheath. Aseptic insertion into the biocontainer is conveniently done using single-use connector technology. Optionally, single-use, weld-in DO (optical) and pH sensors are available; ready for use to minimize start-up time. The flexibility of the system allows the sensor technology to be mixed for use of conventional and single-use technologies simultaneously. All sensors are connected to the I/O cabinet transmitters. The dual-panel Xcellerex XDR bioreactor includes options for Rosemount 56, Rosemount 1056, and Mettler-Toledo MT-800 transmitters.

Measurement of dissolved carbon dioxide

Reusable, insertion-type probe technology is used for monitoring of dissolved carbon dioxide. A dedicated transmitter is available optionally for integration into the I/O cabinet.

Plug-and-play X-Station mobile control console

X-Station is a stand-alone, mobile control console featuring intuitive process control, data historian, and industrial-quality automation hardware and software (Fig 3). The control system provides real-time data acquisition, enables accurate process control, and offers convenient, real-time trending. X-Station is capable of measuring and controlling up to four bioreactor systems simultaneously.

Inside the 304 SS housing is a scalable programmable logic controller (PLC)/programmable automation controller (PAC) and a server-class computer running user interface and data historian software. X-Station comes with a 19 inch touchscreen, industrial, wash down-resistant mouse and QWERTY keyboard, and a built-in uninterruptible power supply (UPS). Profibus and Ethernet communication standards are included for equipment and local area network connectivity.

Fig 3. The X-Station mobile control console.

Single-use consumables

The biocontainers are constructed with a contact layer of USP 88 class VI-compliant ultra low-density polyethylene (ULDPE). The biocontainer incorporates a seal-less, bottom-mounted impeller/sparger assembly: Xcellerex XDR-50, center-mounted; Xcellerex XDR 200-2000, 15° offset. Installed in the bioreactor vessel, the impeller/sparger assembly couples with the magnetic drive head, creating a robust agitation system. Up to eight sparge elements are included in the impeller/sparge assembly depending on configuration (Fig 4A and 4B).

(A) (B)

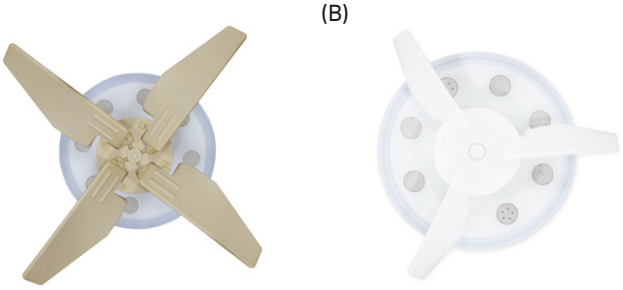


Fig 4. (A) Impeller/sparger for Xcellerex XDR-2000 with four pitched blades. (B) Example of an impeller/sparger assembly for Xcellerex XDR bioreactors smaller than 1000 L with three pitch blades. Both shown with eight sparge elements.

The Xcellerex XDR biocontainers are available in Pro, Development, and Custom formats (Fig 5) all meeting USP 85 LAL requirements on bacterial endotoxins. Pro-type are available for all bioreactor systems and have verified sparge configurations. Development-type are available for Xcellerex XDR-50 and XDR-200 bioreactor systems and differ from the Pro-type primarily in the configuration of the sparge elements. Development versions can be used in a broad array of process development activities where various micro- or macrosparging regimes are evaluated. Custom biocontainers can be modified with tubing type and length, connection type, filter element size, or sparger configuration. Each sparge element can be configured with defined porosities, drilled holes, or a combination of both to support both macro and micro-sparging. Xcellerex XDR biocontainers can also incorporate a CO_2 removal sparge tee to address processes sensitive to metabolic CO_2 accumulation.

Impeller configurations for microcarrier as well as microbial applications are also available in the 50 and 200 L versions.

Additional components include tubing with a combination of weldable sections and aseptic connectors for liquid addition/removal, a disposable pressure sensor, and filters for exhaust, sparge, and overlay/headspace gas.

Xcellerex XDR biocontainer accessories include seal-and-store sample manifolds, foam traps, and exhaust filter tubing sets.

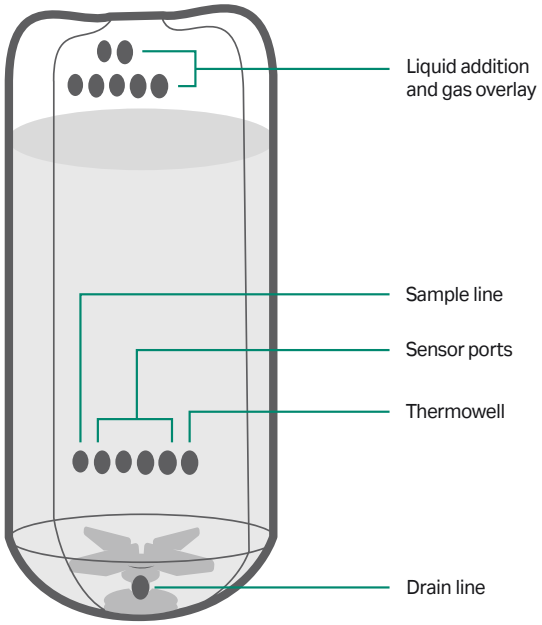


Fig 5. Xcellerex XDR-2000 Pro biocontainer assembly.

Applications

Xcellerex XDR cell culture bioreactor systems have successfully been used to cultivate a wide range of cell types and organisms including CHO cells, Vero cells, HEK293, and MDCK cells.

In addition, fermentor systems are available for microbial applications including *E. coli*, *Pseudomonas spp.*, and yeast (see data file Xcellerex XDR-50 MO fermentor system). Xcellerex XDR bioreactor systems can be operated in batch, fed-batch, and perfusion modes.

Perfusion with Xcellerex Automated Perfusion System (APS)

Designed to address your needs for flexibility, reliability, and simplicity in upstream perfusion applications, Xcellerex APS is a single-use system for both process development and production. Xcellerex APS integrates with three bioreactors in the Xcellerex XDR product line (50, 200, and 500 L) to perform a variety of upstream applications including classic steady state and N-1 perfusion, as well as techniques using ultrafilters.

Bioreactor scaler

With Cytiva's Bioreactor Scaler tool, you can now achieve seamless scaling from process development to biomanufacturing scale. This digital tool predicts operating parameters based on scaling parameters as well as bioreactor and cell line characteristics. The result is a more efficiently established and verified bioreactor scaling process for your Xcellerex XDR bioreactor.

FlexFactory™

The FlexFactory process train gives you the necessary integrated process equipment end to end – from cell culture expansion systems through your seed and production bioreactors to bulk drug substance formulation and into aseptic filling of drug product. From pilot- to commercial-scale production, you can run multiple Xcellerex XDR bioreactors with a single downstream processing train.

Xcellerex XDR bioreactor automation

Xcellerex XDR bioreactors utilize Figurate powered by AVEVA software platform to create the bioreactor applications for HMI/data historian and Allen-Bradley PLC/PAC, respectively. Combined with Microsoft Windows Server™ operating system, the AVEVA software creates a robust, contained, and stable bioreactor system. Alternatively, with Figurate automation for DeltaV DCS your Xcellerex XDR bioreactor can combine the equipment expertise of Cytiva with Emerson's DeltaV distributed control system (DCS) platform.

Exploring the menu items

- **Reactor display** (Fig 6) The HMI presents a main bioreactor overview screen graphically depicts the vessel/biocontainer assembly along with the peristaltic pumps and mass flow controllers. Process relevant data such as process values, setpoints and totalizers are also present. For X-Stations configured for multiple Xcellerex XDR bioreactors, a higher-level screen (Fig 7) is provided, showing reduced information for each. Selecting a specific bioreactor takes the user to the more detailed overview screen.

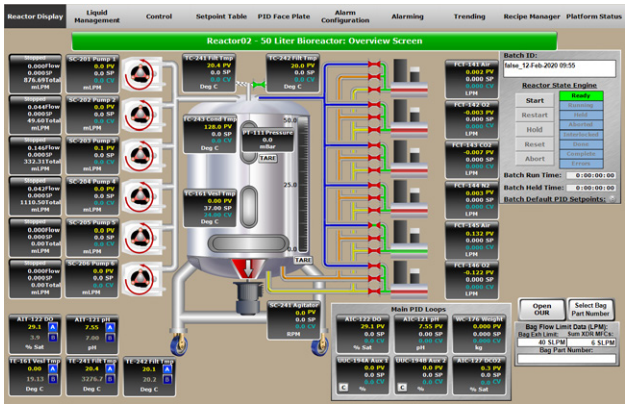


Fig 6. Main bioreactor overview screen.

Fig 7. Multi-vessel high level screen.

- **Liquid management** (Fig 8) is used to configure weight-based liquid flow controllers associated with up to three pumps and optionally available weigh scales. Liquid management offers individually, or in combination, up to two liquid feed and one removal pump/flow controller/weigh scale configurations. Two weight-based liquid feeds may operate independently or sequentially. Sequential operation allows for two liquid reservoirs such that as one empties, the system switches to the other; you may refill and re-use the empty reservoir, as needed.

Fig 8. Liquid management overview screen.

Additional menu items

- **Mapping control** provides a high-level approach to mapping control loops (e.g., dissolved oxygen, pH, agitation, etc.) to field actuators (e.g., pumps, MFCs, etc.) and their working mode (e.g., split-range, look-up table, etc.).
- **Setpoint table** allows creation of time-based tables with up to twenty steps for process setpoints.
- **PID face plate** collects each individual PID control loop face plate onto one screen. Like with the individual face plates, process variable (PV), set point (SP), control variable (CV), PID constants, high and low limits and the remaining controller parameters are visible and accessible.
- **Alarm configuration** consolidates each measurement's associated alarm parameters. Parameters include: HiHi, Hi, Lo and LoLo alarm limits; Deadband values; Major and Minor deviation.
- **Alarming** draws from the Alarm/Event database and provides an overview of bioreactor alarms and events. Besides a common view of both alarms and events, alarms or events may be shown individually with a push of button.
- **Trending** is used to create and display process parameters against time on a dynamic X-Y graph. One or more Xcellerex XDR bioreactor tags may be picked from the list. Among the set-up options are line types and colors, parameter ranges (Y-axis) and time frame (X-axis). Set-ups can be stored for re-use.

- **Recipe manager** is an integral function for defining, saving and re-using defined sets of process parameters (i.e., setpoints, alarms values), making it possible to replicate runs, or batches consistently without the need to re-enter parameters individually.
- **Platform status** provides a comprehensive status overview of the bioreactor computing environment, including server, memory and onboard network connections
- **Perfusion** shows a detailed graphic display of the bioreactor and the Xcellerex Automated Perfusion System and allows the user to monitor and control the process.

Reports

Xcellerex XDR bioreactors include a macro-enabled Microsoft Excel workbook for basic reporting. Reports can be generated with process data, alarm/event data or both sets of data. Reports have tabular and graphical data presentation capabilities. SQL reporting tools are delivered on the X-Station server and may be used to query the databases further.

Access, privacy and security

Xcellerex XDR bioreactors utilize a three-persona access control structure through the HMI. Defined personas are: Operator, Supervisor and Engineer. Each user within the personas have unique usernames and passwords. Additionally, Xcellerex XDR systems are designed around a contemporary cyber-security threat model to protect against unintended access or malicious activity. Xcellerex XDR bioreactors are deployed with application execution control software which allows only registered, approved programs to run, blocking all others. This approach avoids the need for anti-virus software with its constant updating. Physical locks are installed on unused USB and Ethernet ports. The built-in Xcellerex XDR bioreactor access security is complementary to customer-provided physical and network access controls at the installation site.

Customization

The Xcellerex XDR bioreactor offers standard configurations capable of addressing a broad set of cell culture applications. The product platform offers a variety of customizable options, which broaden its application. Contact your local Cytiva representative to match your process to the Xcellerex XDR configuration that is right for your application.

Qualification support

The Xcellerex XDR bioreactor systems are designed for use in environments that require 21 CFR Part 11 and GAMP 5. The systems are delivered with an operating manual, system specification, drawings to support qualification, and major component documentation. Industry standard installation and operation qualification (IQ/OQ) packages are available as an option.

Vessel specifications

Standard cell culture specifications are listed in Table 1.

Table 1. Specifications of standard configuration Xcellerex XDR cell culture bioreactor systems

Specifications	XDR-50*	XDR-200	XDR-500	XDR-1000	XDR-2000
Maximum working volume (L)	50	200	500	1000	2000
Minimum working volume (L)	25	40	100	200	400
Head-space volume at maximum working volume (L)	17.16	95.47	175.90	369.17	970.33
Volume turn-down ratio	2:1	5:1	5:1	5:1	5:1
Aspect ratio (H/D)	2.25:1	1.5:1	1.5:1	1.5:1	1.5:1
Vessel	Jacketed 304 SS				
Filter heat assembly	1				
Additional filter heater assemblies (optional)	1				
Biocontainer hoist	NA	NA	NA	Semi-automatic	Semi-automatic
Impeller, M40e pitched-blade type	3 blades at 40° pitch	3 blades at 40° pitch	3 blades at 40° pitch	3 blades at 40° pitch	4 blades at 40° pitch
Dimensions (W × H × D)	149 × 211 × 123 cm (58½" × 82¾" × 42⅛")	148 × 233 × 107 cm (58⅛" × 91⅜" × 41¾")	170 × 224 × 116 cm (66⅝" × 88" × 45½")	181 × 297 × 132 cm (70⅞" × 116⅝" × 51¾")	197 × 347 × 149 cm (77½" × 136¼" × 58½")
Weight (empty)	466 kg (1028 lb)	570 kg (1257 lb)	669 kg (1475 lb)	874 kg (1927 lb)	1135 kg (2502 lb)
Process instrumentation					
pH probes†	1 (2 optional)	2	2	2	2
DO probes†	1 (2 optional)	2	2	2	2
CO_2 probes (optional)	1 internal or 1 external				
MFC§ (standard)	4				
Additional MFC‡ (optional)	2				
Internal pumps (standard)	4 (from among 114, 313 or 520)				
External pumps (optional)§	2				
Temperature control unit¶ (heating, kW/cooling, HP)	3/1	9/1.5	9/1.5	9/1.5	9/1.5
Load cells	3	4	4	4	4

X-Station mobile control console	
Interfaces	52.4 mm/19" touchscreen, wash-down compatible keyboard and mouse; includes built-in UPS
Hardware	Rockwell/Allen Bradley
Operator interface	AVEVA HMI**
HMI/data historian	AVEVA
Compliance	21 CFR Part 11 compliant††
Dimensions (W × H × D)	601 × 1466 × 798 mm (23⅝" × 57¾" × 31½")
Weight (empty)	146 kg (321 lb)

*For specifications of Xcellerex XDR-50 MO fermentation system, see data file Xcellerex XDR-50 MO fermentor system.

† Single-use or reusable probes.

‡ Thermal mass flow controllers.

§ External pumps are available from among Profibus-based Watson-Marlow 530, 630 and 730, depending on required flow rate.

¶ Optional standalone heating/cooling TCU listed. Other TCU configurations available, including units that use facility chilled water/glycol.

**Human-machine interface.

†† Customer will need to implement appropriate operating procedures to be fully 21 CFR Part 11 compliant. The Xcellerex XDR is built to support this two-part compliance.

Note: For specifications of Xcellerex XDR-10 bioreactor system, see data file Xcellerex XDR-10 cell culture bioreactor system.

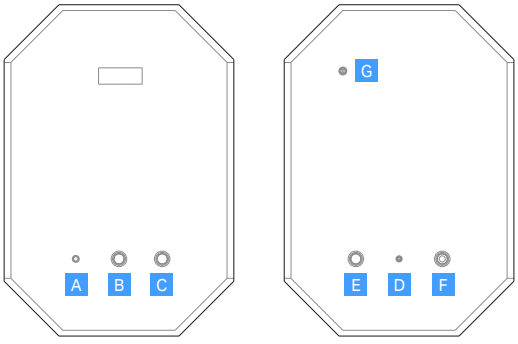
Biocontainer specifications

Biocontainer for Xcellerex XDR-10 bioreactor*

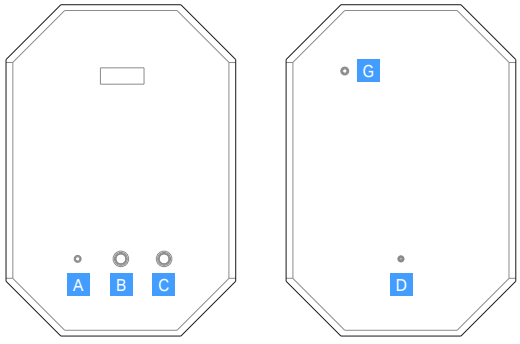
Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-10L ReadyKleer Plus Bag (29713147)	XDR-10L ReadyKleer Pro Bag (29713144)
A	Sample	1/8 × 1/4	60 (1524) 12 (305)	Luer needleless valve	•	•
B	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
C	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
D	Temperature	1/4 × 7/16	2.5 (64)	Thermowell	•	•
E	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	N/A
F	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	N/A
G	Overlay with pressure sensor	1/4 × 7/16 1/8 × 1/4	6.3 (160) 6.1 (155)	Filter, 0.2 µm	•	•
H	Exhaust	3/8 × 5/8 1/4 × 7/16	18.1 (460) 7 (180)	ReadyMate, 3/8" Filter, 0.2 µm	•	•
I	Liquid additions	1/8 × 1/4 1/8 × 1/4	39.25 (997) 39.25 (997)	Plug	•	•
J	Liquid additions	1/4 × 7/16 1/8 × 1/4	18 (460) 18 (460)	Plug	•	N/A
K	Liquid additions	1/8 × 1/4	84 (2135)	Plug	•	•
L	Liquid additions	1/8 × 1/4	84 (2135)	Plug	•	•
M	Harvest	1/2 × 3/4	6.1 (155)	ReadyMate, 1/2"	•	N/A

*For specifications of Xcellerex XDR-10 bioreactor system, see data file Xcellerex XDR-10 cell culture bioreactor system.

XDR-10L ReadyKleer Plus Bag (29713147)



XDR-10L ReadyKleer Pro Bag (29713144)

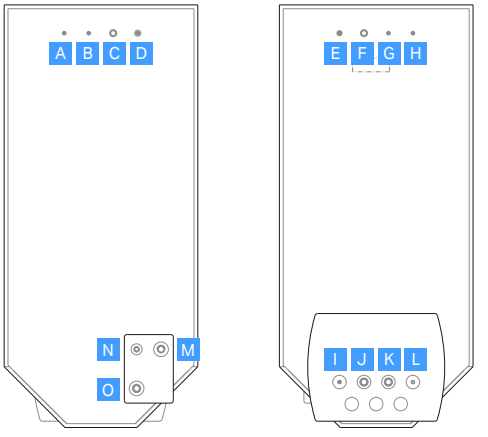


Slot	Details
1	2 µm sparge disc
2	20 µm sparge disc
3	Hose barb
4	2 µm sparge disk with 5 × 0.5 mm drilled holes
5	2 µm sparge disk with 5 × 1 mm drilled holes
6	Hose barb

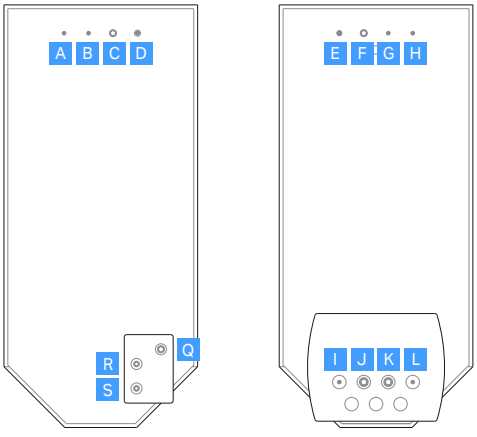
Biocontainer for Xcellerex XDR-50 bioreactor

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-50L ReadyKleer Dev Bag (29713149)	XDR-50L ReadyKleer Microcarrier Bag (29713157)
A	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	•	•
B	Liquid additions	1/4 × 7/16	48 (1219)	Plug	•	•
C	Exhaust	1/2 × 3/4 1/4 × 7/16	8 (204) 3 (76)	Filter, 0.2 µm	•	•
D	Liquid additions	1/4 × 7/16	48 (1219)	Plug	•	•
E	Liquid additions	3/8 × 5/8	78 (1981)	ReadyMate™, 3/8″	•	•
F	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	18 (457) 6 (152)	Air connector	•	•
G	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	•	•
H	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	•	•
I	Temperature	1/4 × 7/16	2.5 (64)	Thermowell	•	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik®, 1/2″	•	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2″	•	•
L	Sample	1/8 × 1/4	60 (1524) 12 (305)	Luer needleless valve	•	•
M	Liquid transfer	3/4 × 1	10 (254)	ReadyMate, 3/4″	•	N/A
N	Liquid transfer	3/8 × 5/8 1/4 × 7/16	18 (457) 18 (457)	Plug	•	N/A
O	Liquid transfer	3/4 × 1	10 (254)	ReadyMate, 3/4″	•	N/A
Q	Liquid transfer	1/2 × 3/4	3 (152)	ReadyMate, 1/2″	N/A	•
R	Liquid transfer	3/8 × 5/8 1/4 × 7/16	18 (457) 18 (457)	Plug	N/A	•
S	Liquid transfer	3/8 × 5/8	18 (457)	ReadyMate, 3/8″	N/A	•

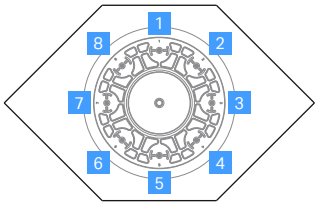
XDR-50L ReadyKleer Dev Bag (29713149)



XDR-50L ReadyKleer Microcarrier Bag (29713157)



Sparger



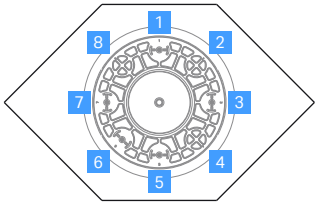
Slot	Details
1	Hose barb
2	2 µm sparge disk
3	Hose barb
4	2 µm sparge disk with 5 × 0.5 mm drilled holes
5	20 µm sparge disk
6	2 µm sparge disk with 5 × 0.5 mm drilled holes
7	Hose barb
8	2 µm sparge disk with 5 × 1 mm drilled holes

Biocontainer for Xcellerex XDR-50 bioreactor

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-50L ReadyKleer Pro Bag with AseptiQuik (29713153)	XDR-50L ReadyKleer Pro Bag with ReadyMate (29713151)
A	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	•	•
B	Liquid additions	1/4 × 7/16	48 (1219)	Aseptic connection	AseptiQuik, 1/4"	ReadyMate, 1/4"
C	Exhaust	1/2 × 3/4 1/4 × 7/16	8 (204) 3 (76)	Filter, 0.2 µm	•	•
D	Liquid additions	1/4 × 7/16	48 (1219)	Aseptic connection	AseptiQuik, 1/4"	ReadyMate, 1/4"
E	Liquid additions	3/8 × 5/8	78 (1981)	Aseptic connection	AseptiQuik, 3/8"	ReadyMate, 3/8"
F	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	18 (457) 6 (152)	Air connector	•	•
G	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	•	•
H	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	•	•
I	Temperature	1/4 × 7/16	2.5 (64)	Thermowell	•	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
L	Sample	1/8 × 1/4	60 (1524) 12 (305)	Luer needleless valve	•	•

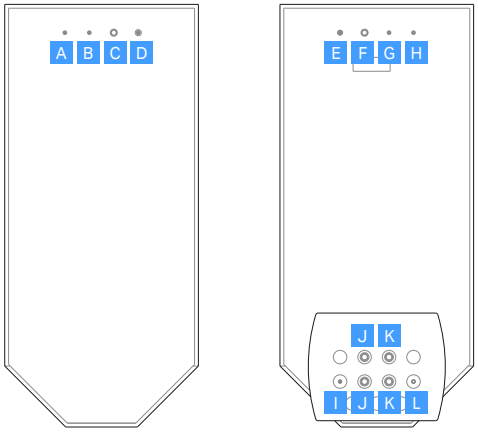
Slot	Details
1	Hose barb
2	Blank
3	Hose barb
4	Blank
5	20 µm sparge disk
6	2 µm sparge disk with 5 × 1 mm drilled holes
7	Hose barb
8	Blank

Sparger



Bottom

XDR-50L ReadyKleer Pro Bag with AseptiQuik (29713153)
XDR-50L ReadyKleer Pro Bag with ReadyMate (29713151)



Back Front

Biocontainer for Xcellerex XDR-200 bioreactor

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-200L ReadyKleer Dev Bag (29712046)	XDR-200L ReadyKleer Microcarrier bag (29712057)
A	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 120 (3048)	Plug	•	•
B	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 120 (3048)	Plug	•	•
C	Liquid additions	1/2 × 3/4	18 (457)	Kleenpak™ HT, 1/2"	•	•
D	Liquid additions	1/2 × 3/4	18 (457)	Kleenpak HT, 1/2"	•	•
E	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	30 (762) 6 (152)	Air connector	•	•
F	Liquid additions	1/2 × 3/4	18 (457)	Kleenpak HT, 1/2"	•	•
G	Liquid additions	1/2 × 3/4	120 (3048)	Plug	•	•
H	Sample	1/8 × 1/4	60 (1524) 12 (306)	Luer needleless valve	•	•
I	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
L	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
M	Temperature	1/4 × 7/16	6.5 (165)	Thermowell	•	•
N	Harvest	1/2 × 3/4	36 (914)	Kleenpak HT, 1/2"	•	•
O	Exhaust	3/4 × 1 1/2 × 3/4	9 (229) 6 (152)	Filter, 0.2 µm Kleenpak HT, 1/2"	•	•
S	Liquid transfer	1/2 × 3/4	6 (152)	ReadyMate, 1/2"	N/A	•
T	Liquid transfer	1/2 × 3/4	6 (152)	ReadyMate, 1/2"	N/A	•
U	Liquid transfer	3/8 × 5/8	6 (152)	ReadyMate, 3/8"	N/A	•
V	Liquid transfer	3/8 × 5/8	6 (152)	ReadyMate, 3/8"	N/A	•

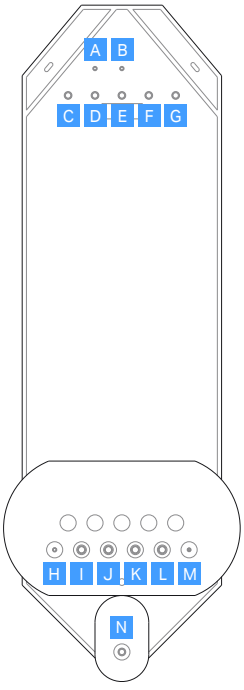
XDR-200L ReadyKleer Dev Bag (29712046)

Slot	Details
1	20 µm sparge disk
2	2 µm sparge disk
3	2 µm sparge disk with 5 × 1 mm drilled holes
4	2 µm sparge disk with 5 × 0.5 mm drilled holes
5	20 µm sparge disk
6	2 µm sparge disk
7	2 µm sparge disk with 5 × 1 mm drilled holes
8	2 µm sparge disk with 5 × 0.5 mm drilled holes

XDR-200L ReadyKleer Microcarrier bag (29712057)

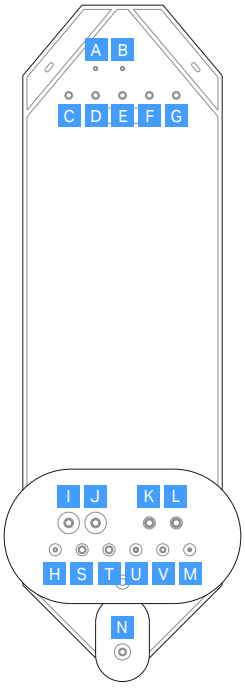
Slot	Details
1	2 µm sparge disk
2	2 µm sparge disk with 5 × 0.5 mm drilled holes
3	2 µm sparge disk with 5 × 1 mm drilled holes
4	20 µm sparge disk
5	2 µm sparge disk
6	2 µm sparge disk with 5 × 0.5 mm drilled holes
7	2 µm sparge disk with 5 × 1 mm drilled holes
8	20 µm sparge disk

XDR-200L ReadyKleer Dev Bag (29712046)

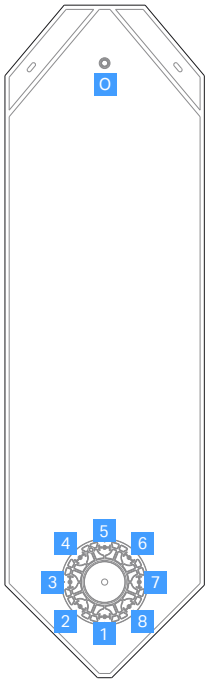


Front

XDR-200L ReadyKleer Microcarrier bag (29712057)



Front

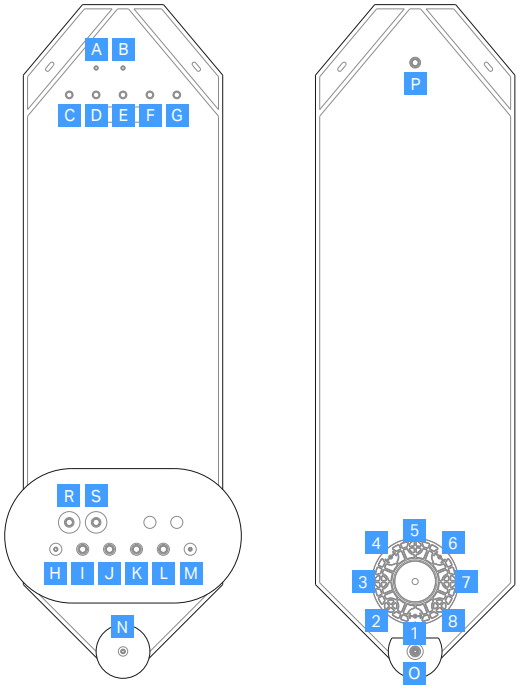


Back

Biocontainer for Xcellerex XDR-200 bioreactor

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-200L ReadyKleer Pro Bag with AseptiQuik (29712054)	XDR-200L ReadyKleer Pro Bag with ReadyMate (29712048)
A	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
B	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
C	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
D	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
E	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	30 (762) 6 (152)	Air connector	•	•
F	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
G	Liquid additions	1/2 × 3/4	120 (3048)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
H	Sample	1/8 × 1/4	60 (1524) 12 (306)	Luer needleless valve	•	•
I	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
L	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
M	Temperature	1/4 × 7/16	6.5 (165)	Thermowell	•	•
N	Secondary sparger (tee)	3/8 × 5/8 1/4 × 7/16	3 (76) 99 (2516)	Air connector	•	•
O	Harvest	3/4 × 1	36 (914)	ReadyMate	•	•
P	Exhaust	3/4 × 1 1/2 × 3/4	12 (304) 6 (152)	Filter, 0.2 µm AseptiQuik	•	•
R	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
S	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•

Slot	Details
1	20 µm sparge disk
2	Blank
3	Blank
4	20 µm sparge disk
5	Blank
6	20 µm sparge disk
7	Blank
8	Blank

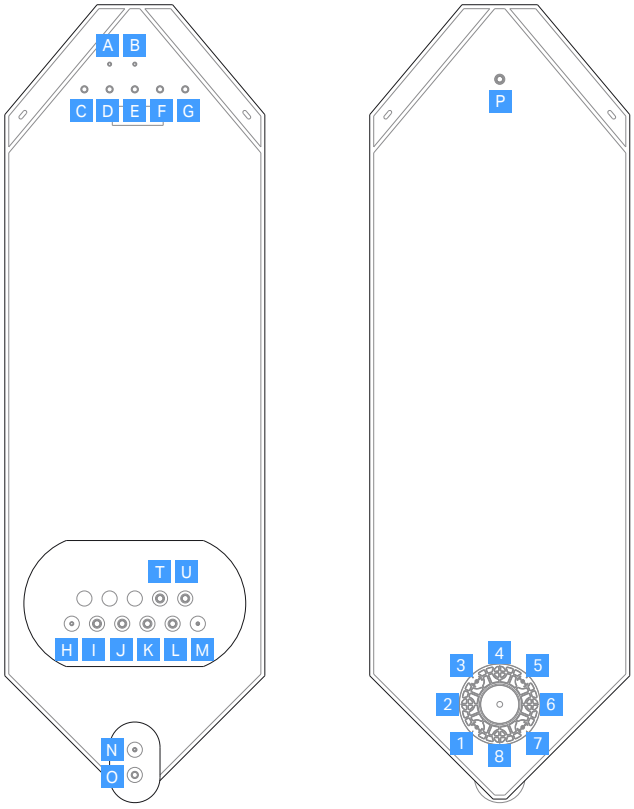


Front Back

Biocontainer for Xcellerex XDR-500 bioreactor

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-500L ReadyKleer Pro Bag with AseptiQuik (29713201)	XDR-500L ReadyKleer Pro Bag with ReadyMate (29712669)
A	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
B	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
C	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
D	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
E	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	30 (762) 6 (152)	Air connector	•	•
F	Liquid additions	1/2 × 3/4	60 (1524)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
G	Liquid additions	1/2 × 3/4	120 (3048)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
H	Sample	1/8 × 1/4	60 (1524) 12 (306)	Luer needleless valve	•	•
I	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
L	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
M	Temperature	1/4 × 7/16	6.5 (165)	Thermowell	•	•
N	Secondary sparger (tee)	3/8 × 5/8 1/4 × 7/16	3 (76) 99 (2516)	Air connector	•	•
O	Harvest	3/4 × 1	36 (914)	ReadyMate	•	•
P	Exhaust	3/4 × 1 1/2 × 3/4	12 (304) 6 (152)	Filter, 0.2 µm AseptiQuik	•	•
T	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
U	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•

Slot	Details
1	20 µm sparge disk
2	Blank
3	20 µm sparge disk
4	Blank
5	20 µm sparge disk
6	Blank
7	20 µm sparge disk
8	Blank

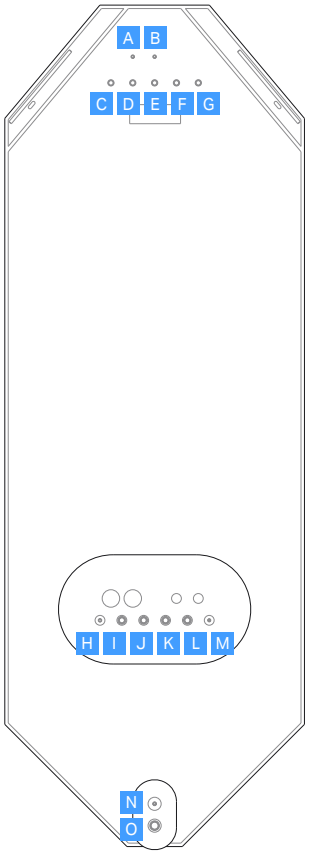


Front Back

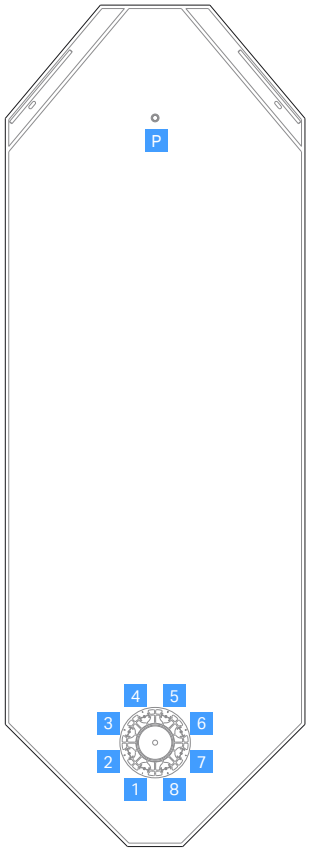
Biocontainer for Xcellerex XDR-1000 bioreactor

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-1000L ReadyKleer Pro Bag with AseptiQuik (29713205)	XDR-1000L ReadyKleer Pro Bag with ReadyMate (29713203)
A	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
B	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
C	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
D	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
E	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	30 (762) 6 (152)	Air connector	•	•
F	Liquid additions	1/2 × 3/4	60 (1524)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
G	Liquid additions	1/2 × 3/4	120 (3048)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
H	Sample	1/8 × 1/4	60 (1524) 12 (306)	Luer needleless valve	•	•
I	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
L	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
M	Temperature	1/4 × 7/16	6.5 (165)	Thermowell	•	•
N	Secondary sparger (tee)	3/8 × 5/8 1/4 × 7/16	3 (76) 99 (2516)	Air connector	•	•
O	Harvest	1 × 1.375	48 (1219)	ReadyMate	•	•
P	Exhaust	3/4 × 1 1/2 × 3/4	12 (304) 6 (152)	Filter, 0.2 µm AseptiQuik	•	•

Slot	Details
1	20 µm sparge disk
2	20 µm sparge disk
3	20 µm sparge disk
4	20 µm sparge disk
5	20 µm sparge disk
6	20 µm sparge disk
7	20 µm sparge disk
8	20 µm sparge disk



Front

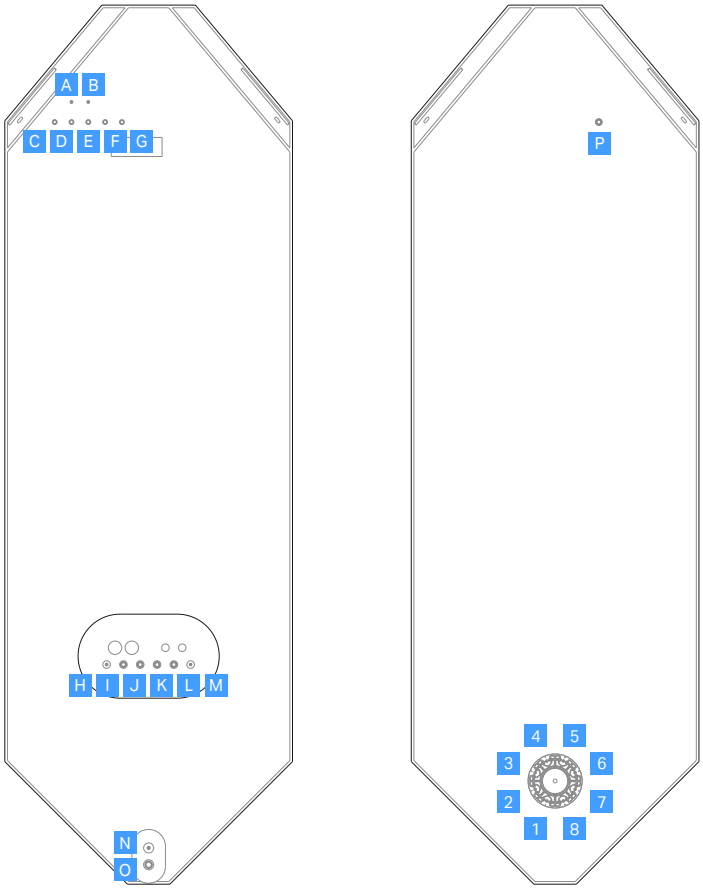


Back

Biocontainer for Xcellerex XDR-2000 bioreactor

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-2000L ReadyKleer Pro Bag with AseptiQuik (29710571)	XDR-2000L ReadyKleer Pro Bag with ReadyMate (29710570)
A	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
B	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
C	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
D	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
E	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	30 (762) 6 (152)	Air connector	•	•
F	Liquid additions	1/2 × 3/4	60 (1524)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
G	Liquid additions	1/2 × 3/4	120 (3048)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
H	Sample	1/8 × 1/4	60 (1524) 12 (306)	Luer needleless valve	•	•
I	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
L	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
M	Temperature	1/4 × 7/16	6.5 (165)	Thermowell	•	•
N	Secondary sparger (tee)	3/8 × 5/8 1/4 × 7/16	3 (76) 120 (3048)	Air connector	•	•
O	Harvest	1 × 1.375	36 (914)	ReadyMate	•	•
P	Exhaust	3/4 × 1 1/2 × 3/4	14.3 (363) 36.2 (920)	Filter, 0.2 µm AseptiQuik	•	•

Slot	Details
1	20 µm sparge disk
2	20 µm sparge disk
3	20 µm sparge disk
4	20 µm sparge disk
5	20 µm sparge disk
6	20 µm sparge disk
7	20 µm sparge disk
8	20 µm sparge disk

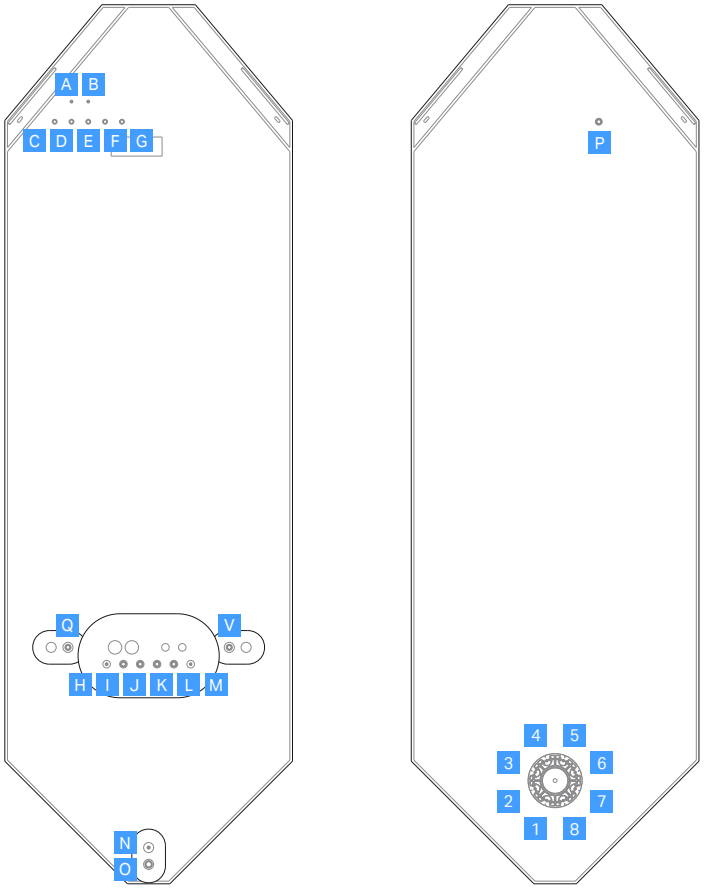


Front Back

Biocontainer for Xcellerex XDR-2000 bioreactor

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-2000L ReadyKleer Pro WP Bag with AseptiQuik (29721438)	XDR-2000L ReadyKleer Pro WP Bag with ReadyMate (29721436)
A	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
B	Liquid additions	1/8 × 1/4	120 (3048)	Plug	•	•
C	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
D	Liquid additions	1/2 × 3/4	36 (914)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
E	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	30 (762) 6 (152)	Air connector	•	•
F	Liquid additions	1/2 × 3/4	60 (1524)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
G	Liquid additions	1/2 × 3/4	120 (3048)	Aseptic connection	AseptiQuik, 1/2"	ReadyMate, 1/2"
H	Sample	1/8 × 1/4	60 (1524) 12 (306)	Luer needleless valve	•	•
I	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
L	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
M	Temperature	1/4 × 7/16	6.5 (165)	Thermowell	•	•
N	Secondary sparger (tee)	3/8 × 5/8 1/4 × 7/16	3 (76) 120 (3048)	Air connector	•	•
O	Harvest	1 × 1.375	36 (914)	ReadyMate	•	•
P	Exhaust	3/4 × 1 1/2 × 3/4	14.3 (363) 36.2 (920)	Filter, 0.2 µm AseptiQuik	•	•
Q	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•
V	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•	•

Slot	Details
1	20 µm sparge disk
2	20 µm sparge disk
3	20 µm sparge disk
4	20 µm sparge disk
5	20 µm sparge disk
6	20 µm sparge disk
7	20 µm sparge disk
8	20 µm sparge disk



Microbial biocontainer specifications

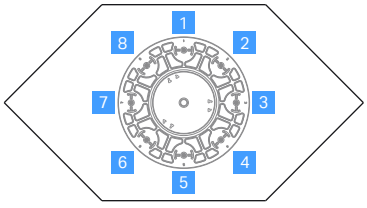
Biocontainer for Xcellerex XDR-50 MO fermentor system*

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-50L ReadyKleer Microbial Bag (29713155)
A	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	●
B	Liquid additions	1/4 × 7/16	48 (1219)	Plug	●
C	Exhaust and condenser	Various	Various	Filter, 0.2 µm	●
D	Liquid additions	1/4 × 7/16	48 (1219)	Plug	●
E	Liquid additions	3/8 × 5/8	78 (1981)	ReadyMate, 3/8"	●
F	Overlay with pressure sensor	1/2 × 3/4 1/4 × 7/16	18 (457) 6 (152)	Air connector	●
G	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	●
H	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 48 (1219)	Plug	●
I	Temperature	1/4 × 7/16	2.5 (64)	Thermowell	●
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	●
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	●
L	Sample	1/8 × 1/4	60 (1524) 12 (305)	Luer needleless valve	●

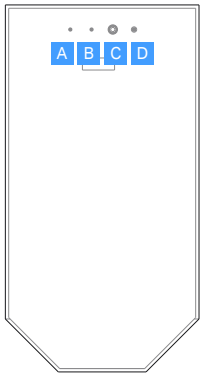
*For specifications of Xcellerex XDR-50 MO fermentor system, see data file Xcellerex XDR-50 MO fermentor system.

Slot	Details
1	Hose barb
2	Hose barb
3	Hose barb
4	Hose barb
5	Hose barb
6	Hose barb
7	Hose barb
8	Hose barb

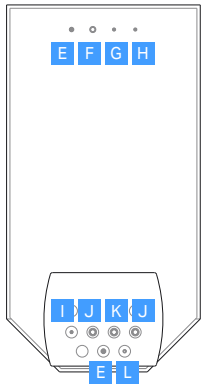
Sparger



Bottom



Back



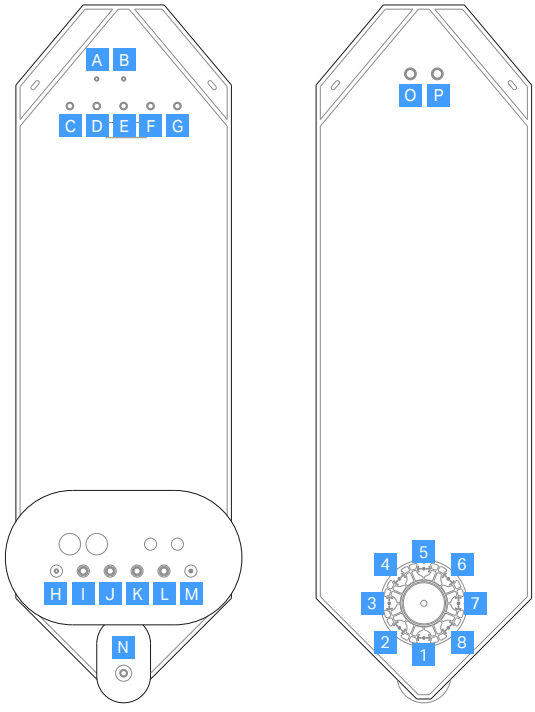
Front

Biocontainer for Xcellerex XDR-200 MO fermentor system*

Bag port	Intended function	Tubing size (ID × OD), inch	Tubing length, inch (mm)	Terminal connector	XDR-200L ReadyKleer Microbial Bag with Kleenpak (29712055)
A	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 120 (3048)	Plug	•
B	Liquid additions	1/4 × 7/16 1/8 × 1/4	3 (76) 120 (3048)	Plug	•
C	Liquid additions	1/2 × 3/4	18 (457)	Kleenpak HT, 1/2"	•
D	Liquid additions	1/2 × 3/4	18 (457)	Kleenpak HT, 1/2"	•
E	Pressure sensor	1/2 x 3/4	30 (762)	Plug	•
F	Liquid additions	1/2 × 3/4	18 (457)	Kleenpak HT, 1/2"	•
G	Liquid additions	1/2 × 3/4	120 (3048)	Plug	•
H	Sample	1/8 × 1/4	60 (1524) 12 (306)	Luer needleless valve	•
I	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•
J	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•
K	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•
L	Sensor port	3/4 × 1/2 reducer	3.4 (86)	AseptiQuik, 1/2"	•
M	Temperature	1/4 × 7/16	6.5 (165)	Thermowell	•
N	Harvest	1/2 × 3/4	36 (914)	Kleenpak HT, 1/2"	•
O	Exhaust and condenser	Various	Various	Filter, 0.2 µm	•
P	Exhaust and condenser	Various	Various	Filter, 0.2 µm	•

*For specifications of Xcellerex XDR-200 MO fermentor system, contact your Cytiva sales representative.

Slot	Details
1	Hose barb
2	Hose barb
3	Hose barb
4	Hose barb
5	Hose barb
6	Hose barb
7	Hose barb
8	Hose barb



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