xylem

Online Monitoring & Control

BIOPROCESS SERIES

BROCHURE

B86-01

YSI

a xylem brand

Table of Contents

Thank you for considering YSI as your supplier of bioprocess monitoring and control solutions. As increasing consumer and regulatory demands mandate the need for safe, efficacious, low-cost biologically-derived products, it is imperative that robust, cost-effective manufacturing processes are developed for meeting the global demands of biopharmaceutical, biofuel and other industrial biotechnology commodities.

With over 40 years of providing rapid, accurate bio-analytical instruments, YSI Life Sciences has established a legacy of expertise in various industrial applications, including bioprocess monitoring and control. Our online monitoring and control solutions have been designed to help make your job easier, increase your process knowledge and improve your process efficiency.

YSI Life Sciences is here to support you. Our knowledgeable customer service and technical support staff can help with any instrument or application questions you may have.

Thank you for your interest in YSI and for reviewing our catalogue. Please contact us with any questions, comments or concerns. Your input is highly valued.

Christopher Warner
YSI Life Sciences, Product Manager

Monitoring & Control

bioprocess

2900M

2940/2980

Products

2900M
Monitor 1 vessel
Analyze up to
2 chemistries

2940
Monitor 4 vessels
Analyze up to
6 chemistries

2980
Monitor 8 vessels
Analyze up to
6 chemistries

OPC Connectivity
2920 OPC Data Manager
2925 OPC Software

Applications

Cell Culture
Fermentation
Cell Therapy
Process R&D
Process Optimization
Design of Experiments
Continuous Processing
cGMP Manufacturing

Features at a glance

Automated Bioreactor Sampling. Fully automated around-the-clock process monitoring.

Near Real-time Analysis. YSI's innovative biosensor technology and online monitoring systems assure rapid, accurate measurements of critical nutrients and metabolites in near real-time.

Aseptic Operation. YSI monitoring systems ensure bioreactor sanitary environment is maintained through automated system sanitization and microfiltration sampling probes.

Flexibility. Interfaces with virtually any bioreactor size or type, including single-use systems.

Scalability. Scale-independent technology allows you to seamlessly scale-up your unit of operations, regardless of bioreactor size.

Connectivity. Connect to any bioreactor controller, SCADA, DAS or LIMS via analog (0-5V), serial (RS-232), ethernet or OPC communication.

Data Management. Intuitive user interface allows various graphical displays, data download and acquisition options and remote data access.

Feed Control. Online control of nutrients can be achieved with YSI's monitoring systems by direct communication to a feed pump, bioreactor feed control system or SCADA.

21 CFR, Part 11 Compliance. Assures FDA regulatory compliance for electronic records.

2900M

Online Monitoring & Control Systems

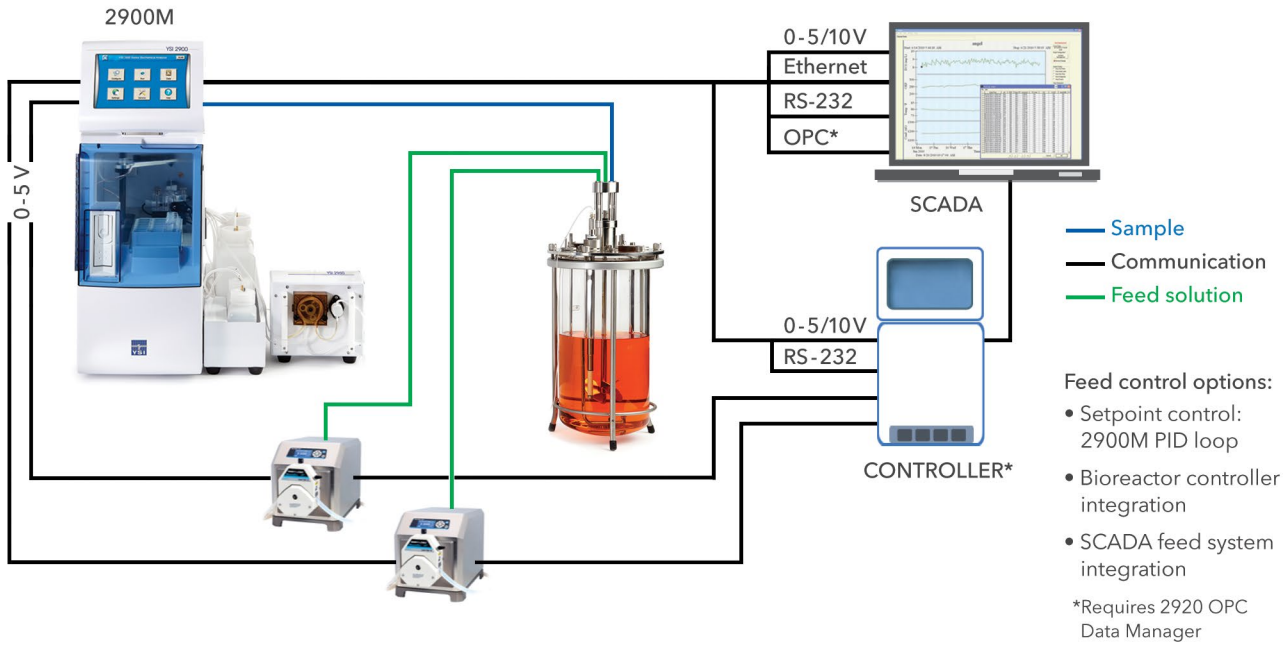
2900M

Our single-vessel sampling systems are designed to provide simple and reliable online monitoring and control solutions for your bioreactor process. Closed-loop monitoring and control capability are easily achieved for any scale of operation or type of bioreactor.

YSI 2900

- Monitor up to 6 chemistries
- Analytical results in 60 seconds per chemistry
- Touchscreen, icon-driven HMI for easy viewing and menu navigation
- Simultaneous online monitoring and 96-well plate sampling
- Connectivity options for SCADA, DAS or LIMS
- Direct control of up to 2 feed pumps
- Automated cleaning cycle
- Autoclaveable components
- CIP and SIP compatible
- 21 CFR, Part 11 compliant
- GAMP® 5 compliant

Multiple Connectivity Options include RS232, Analog (0-5V), Ethernet and OPC



2900M Specifications

Aspirated Sample Volume:	User-defined from 10 to 50 µl
Analysis Time:	60 seconds
Precision:	Application specific, typical CV <2%
Linearity:	+/- 5% Cal value to maximum
Dimensions:	8"w x 20.5"d x 15.75"h | 20.3cm w x 52.1cm d x 40cm h Bottle rack adds 9" (22.9cm)
Weight:	28lbs/12.7kg | YSI 2950: 39lbs/17.7kg (without bottle rack)
Working Environment:	15 to 35° C ambient temperature 10 to 75% relative humidity (noncondensing)
Power Requirements:	100 –120 VAC or 220 – 240 VAC, 50 – 60 Hz, 50 Watts nominal
Regulatory Compliance:	CE, RoHS
Automation:	Up to 96 samples
21 CFR, Part 11:	Compliant

2960 Online Monitor Specifications

Vessel Inputs:	1-channel Autosampler: 1 input
Dimensions:	6.25"l x 4.75"w x 5.50"h
Weight:	3lbs
Power Requirements:	90 – 264 VAC, 1.5 A, 47 – 63 Hz, 30 Watts nominal
Regulatory Compliance:	CE, RoHS
Sample Flow Rate::	0.1 – 2.5 ml/min (user defined)
Sample Purge Time:	30 seconds minimum recommended (user defined)
Sample Interval:	Time unit: minutes (user defined)
Vessel Tubing Length:	Maximum recommended length is 3 meters (10 feet)
Antiseptic Cycle:	Time unit: minutes (user defined)
Tubing ID:	Sample inlet: 0.020" Peristaltic pump: 0.035" Pinch valve: 0.03" Waste: 0.10"
Tubing Wetted Materials:	Pharmed® tubing (peristaltic pump) C-flex® tubing (pinch valve) Silicone (sample inlet and waste lines)

I/O Communication Interface Specifications

Ethernet (FTP):	1 port
OPC:	1 port (2920 OPC Data Manager Module required)
Serial Communication (RS-232):	1 port
Analog (0-5/10V):	Selectable: +10.0 VDC or +5.0 VDC Capable of communicating up to 2 chemistries/vessel
USB :	1 port

Parameters

Glucose
Lactate
Glutamate
Glutamine
Galactose
Lactose
Sucrose
Xylose
Choline
Ethanol
Methanol
Hydrogen Peroxide

2940/2980

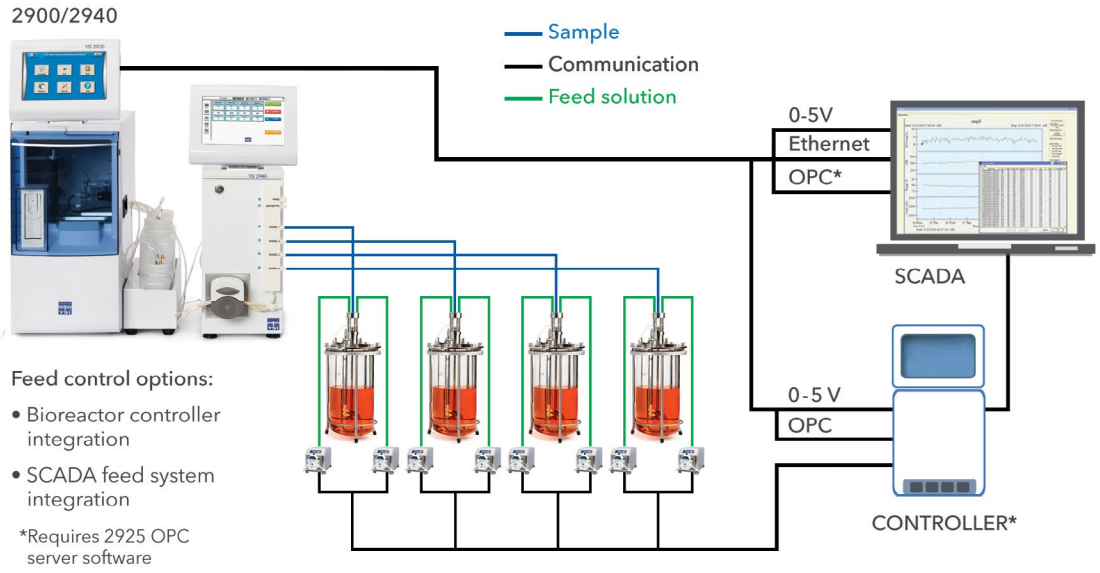
Multi-Channel Online Monitoring Systems

For multiple and parallel bioreactor systems, our 4-channel and 8-channel sampling systems provide many simple and reliable online monitoring and control solutions for your bioreactor processes. Closed-loop monitoring and control capabilities are easily achieved for any scale of operation or type of bioreactor, including single-use systems.

YSI 2940/2980

- Automated, aseptic sampling of up to 8 vessels
- Monitor up to 6 chemistries
- Analytical results in 60 seconds for each chemistry
- Simultaneous online monitoring and 96-well plate sampling
- Automated cleaning cycle
- Autoclaveable components
- CIP and SIP compatible
- Touchscreen, icon-driven HMI for easy viewing and menu navigation
- Connectivity options for SCADA, DAS, LIMS and feed-control systems
- Remote access and control via web-based server
- OPC server option
- 21 CFR, Part 11 compliant

Multiple Connectivity Options include RS232, Analog (0-5V), Ethernet and OPC



2900/2950 Biochemistry Analyzer Specifications

Aspirated Sample Volume:	User-defined from 10 to 50 µl
Analysis Time:	60 seconds
Precision:	Application specific, typical CV <2%
Linearity:	+/- 5% Cal value to maximum
Dimensions:	YSI 2900: 8"w x 20.5"d x 15.75"h | 20.3cm w x 52.1cm d x 40cm h YSI 2950:14"w x 20.5"d x 15.75"h | 35.6cm w x 52.1cm d x 40cm h Bottle rack adds 9" (22.9cm)
Weight:	YSI 2900: 28lbs/12.7kg | YSI 2950: 39lbs/17.7kg (without bottle rack)
Working Environment:	15 to 35° C ambient temperature 10 to 75% relative humidity (noncondensing)
Power Requirements:	100 –120 VAC or 220 – 240 VAC, 50 – 60 Hz, 50 Watts nominal
Regulatory Compliance:	CE, RoHS
Automation:	Up to 96 samples
21 CFR, Part 11:	Compliant

2940/2980 Online Monitor System Specifications

Vessel Inputs:	2940: 4 vessel inputs 2980: 8 vessel inputs
Dimensions:	15.2cm w x 46.2cm h x 27.9cm l (6"w x 18.2"h x 11.0"l)
Weight:	7.26kg (16lbs)
External Power Requirements:	Auto-sensing power adapter: 100 –120 VAC/220 – 240 VAC, 1.5 A (50/60 Hz ± 5%)
Regulatory Compliance:	CE, ETL,UL, RoHS
Sample Size:	0.5 – 2ml (user defined)
Sample Flow Rate:	0.1 – 2.5ml/min (user defined)
Sample Interval:	Time unit: minutes (user defined)
Antiseptic Cycle:	User defined flow rate (ml/minute) and time (minutes)
Vessel Tubing Length:	1.5 meters (5 ft) (autoclavable and gamma irradiated options) 3 meters (10 ft) (autoclavable and gamma irradiated options)
Tubing ID:	Sample inlet: 0.030" Peristaltic pump: 0.030" Waste: 0.0625"
Wetted Materials:	Pharmed® tubing (peristaltic pump) C-flex® and C-flex Ultra® tubing (sample inlet and waste lines) PBT (Sample Manifold) Nylon (connectors)

I/O Communication Interface Specifications

Ethernet (FTP):	2 ports (additional ports if Ethernet hub is used)
OPC:	2 ports (additional ports if Ethernet hub is used)
Analog (0-5/10V):	2940 – 4 ports (1 port per vessel) 2940 – 8 ports (1 port per vessel) Each port capable of communicating up to 2 chemistries
USB :	4 ports

Parameters

Glucose
Lactate
Glutamate
Glutamine
Galactose
Lactose
Sucrose
Xylose
Choline
Ethanol
Methanol
Hydrogen Peroxide

FISP®
Bioreactor Sampling Probes

YSI proudly offers Flownamics FISP® *in-situ* Sampling Probes as part of our online monitoring systems. FISP sampling probes have been the standard *in-situ* bioreactor and vessel sampling device for over 20 years. Employing ceramic microfiltration technology, FISP sampling probes provide simple, cell-free sampling while ensuring bioreactor or fermentor sterility. FISP sampling probes are available in a variety of sizes to fit most types of bioreactors, including single-use vessels.

FISP Features

- Aseptic, cell-free vessel sampling
- 0.2 micron filter assures vessel sterile barrier
- Wetted materials provide excellent chemical resistance
- SIP/CIP/Autoclave compatible
- Minimal dead volume provides consistent, accurate sampling
- Resistant to temperatures, pressures, viscosities and shear forces
- For use in lab, pilot and industrial scale vessels
- Compatible with bacterial, yeast, fungal, algal and mammalian cell culture processes
- Animal-derived component free (ADCF) wetted materials
- Membrane meets ISO 10993:5, *in vitro* Cell Cytotoxicity, requirements

F-series FISP Probe

- Fits 12 & 19mm headplate ports
- Dead volume 0.24 – 0.44ml, depending on probe length
- Immersion lengths (mm): 120, 200, 310, 410
- Can be used with single-use bioreactors
- Can be used with 1.5 and 2 inch sanitary fitting ports (adapter required)

D-Series FISP Probe

- Fits standard and safety 25mm Ingold ports
- Dead volume 0.24 – 0.44ml, depending on probe length
- Immersion lengths (mm): 90 (standard) & 115 (safety port)

2920
OPC Data Manager

2925
OPC Server

YSI's OPC data management technology seamlessly acquires data from both off-line and on-line YSI analyzers and exports your data into any OPC-enabled SCADA, bioprocess management system or data historian. Our OPC Data Manager and OPC-enabled online monitoring systems feature an internal web server, which allows easy remote access using a web browser. Whether you are networking a single bioreactor system, an entire PD lab or multiple labs or suites, YSI's OPC data management options provide simple connectivity and data management solutions for your process systems.

2920 OPC Data Manager

- Add-on module for off-line YSI 2900 Seriesbiochemistry analyzers or YSI 2900M/2950M Online Monitoring & Control Systems
- Add-on module for off-line YSI 2900 Series biochemistry analyzers or YSI 2900M/2950M Online Monitoring & Control Systems
- Internal web server
- Remote access using IP address and web browser
- Performs extensive error tracking and management
- Sleek, modular design

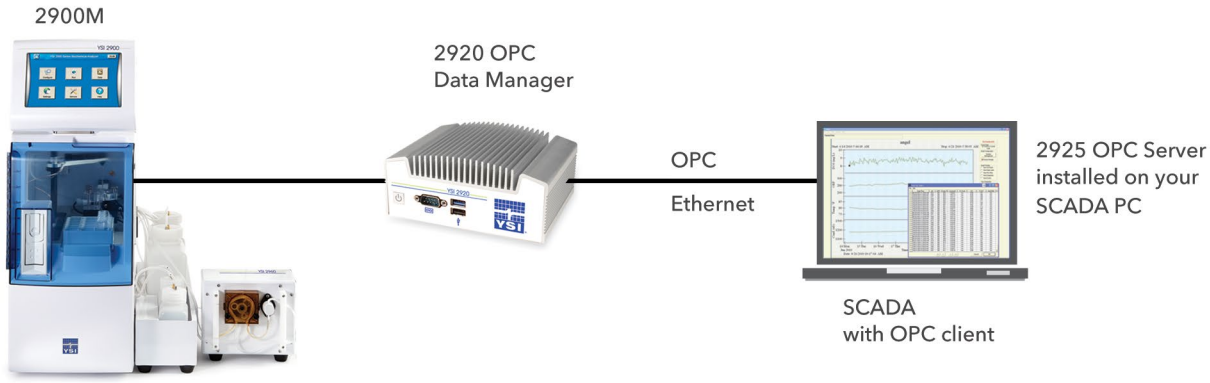
2925 OPC Server Software

- Software for YSI 2920, YSI 2940, and YSI 2980
- Fully compliant OPC UA (Universal Architecture)
- OPC Server only, communicates to OPC-enabled systems with OPC Client
- Exports data into any OPC-enabled system

YSI OPC Server System Requirements

- OS: Windows 7, 32/64 bit
- Ethernet connectivity
- 512 MB RAM
- 10 MB of available hard disk space
- Mouse pointing device

YSI OPC Connectivity and Systems Integration



questionnaire

Customer Information

Name _____

Company _____

Email _____

Phone _____

Process Information

1. Type of bioreactor process:
__Animal Cell Culture __Insect Cell Culture
__Suspension Cell Culture __Bacterial Fermentation
__Yeast Fermentation
__Fungal/Filamentous Bacterial Fermentation
__Continuous Process __Other

2. Cultivation Method:
__Batch __Perfusion __Fed Batch __Chemostat __Other

3. Process Duration:
__≤ 24 hours __2 – 7 Days __1 – 2 Weeks
__2 – 4 Weeks __> 4 Weeks

4. Process Working Volume:
__≤ 500 ml __500 ml – 1 L __2 – 5 L __6 – 10 L
__11 – 50 L __51 – 200 L __> 200 L __Other

5. Process Operating Pressure:
_____ psi/bar

6. Fermentation/Cell Culture Media:
__Chemically Defined __Complex __Other

7. Maximum Cell Density:
__OD/AU __Dry Cell Weight __Wet Cell Weight __cells/ml

8. What is the viscosity of your culture/fermentation?
__≤ 1000 centipoise (cP) __1000 – 3000 cP __Other

9. Fermentation/Cell Culture Product Information:
__Intracellular __Secreted
If secreted, what is the molecular entity?_____

10. Will YSI be required to perform feed control?
__Yes If yes, number of pumps/vessel?____ __No

Note: YSI feed control systems provide setpoint (feedback) control using either a PID control loop or simple threshold algorithm. For other feed control options, the YSI analyzer data can be communicated directly to your bioreactor controller or SCADA system using an anolog signal (0-5V), RS-232 communication or ethernet (FTP).

Vessel Information

1. Type of bioreactor system:
__Stainless steel stirred tank __Glass stirred tank
__Single-use – stirred bag __Single-use – wave bag
__Single-use – Other_____
__Airlift bioreactor __Hollow Fiber __Other

2. Make/Model of bioreactor system:
__Sartorious __Eppendorf/New Brunswick _Eppendort/Dasgip
__Applikon __HyClone SUB/SUF __GE/Excellerex
__Broadley-James __Infors HT __Other

3. Vessel Total Volume:
_____ L

4. How many vessels will be sampled?
__1– 4 __4 – 8

5. What is the vessel sample port size and type?
__12mm Headplate __19mm Headplate
__19mm Ingold
__25mm Ingold (standard – 40mm port depth)
__25mm Ingold (safety – 52mm port depth)
__Sanitary Fitting (1.5 inch tri-clamp)
Other_____

6. What type of sample interface will the vessel have?
__Filtration Sample Probe (cell-free sampling)
__Dip Tube (cell-containing sampling)
Other_____

Note: As a best practice, YSI recommends the use of a filtration sample probe to prevent cell metabolism of the process sample as well as ensure bioreactor sterility.

7. What will be the maximum distance between the vessel and the YSI analyzer?
__< 5 feet (1.5 meters) __5 – 10 feet (1.5 – 3 meters)
Other_____

8. What are the vessel sterilization/cleaning requirements?
__Steam-in-place __Clean-in-place __Autoclave
Other_____

Process Analytical Information

1. What analytes will be monitored by the YSI analyzer? Check all that apply:

__Glucose __Galactose __Glutamine __Choline
__Sucrose __Xylose __Ethanol __Ammonium
__Fructose __Lactate __Methanol __Potassium
__Lactose __Glutamate __Glycerol __Hydrogen Peroxide

2. How frequently will the vessel need to be sampled?

__< 15 minutes __15 minutes __30 minutes __60 minutes
__1 – 4 times per day Other _____

3. Will manual samples be analyzed using the same instrument as the automated samples?

__Yes __No

4. Will sample dilution be required prior to conducting sample analysis ?

__Yes __No

5. If yes on #4, what dilution factor will be used?

Dilution factor =_____ X

Data Management Information

1. What type of bioprocess management/SCADA system will be used for process monitoring and control?

__Sartorius BioPAT MFCS/win __New Brunswick Biocommand
__Dasgip Dasware __Applikon BioXpert __Infors HT
__Delta V Other_____

2. Does the process management/SCADA system have an OPC server or OPC client?

__Yes – OPC Server __Yes – OPC Client __No

3. Does the process management/SCADA system have other I/O communication options?

__Yes – analog 0 - 5V __Yes – RS - 232
__Yes – ethernet (TCP/IP or FTP)

4. Would you like the YSI analyzer to integrate the real-time analytical data into your bioprocess management or SCADA system?

__Yes __No

Additional Comments

_____
_____
_____
_____

2900/2940

2900M

order guide

STEP 1

Complete OnlineMonitoring & Control Questionnaire

Completion of questionnaire assures correct YSI online monitoring system and configuration is ordered.

STEP 2

Order Online Monitoring System

All systems include required sample and communication interface hardware.

2900M: 1-channel online monitoring & control system for up to 2 chemistries. Includes 2900D, 2 Chemistry Analyzer, and 2960 online monitor & control accessory.

2940: 4-channel online monitor system. Accessory may be interfaced with any 2900 Series analyzer. (Refer to YSI Biochemistry Analyzer Selection Guide for 2900D/2950D configuration.)

2980: 8-channel online monitor system. Accessory may be interfaced with any 2900 Series analyzer. (Refer to YSI Biochemistry Analyzer Selection Guide for 2900D/2950D configuration.)

STEP 3

Order Sample Tubing Set

2981: Tubing Assembly, autoclaveable, 1.5 meter (5 feet).
2982: Tubing Assembly, pre-sterilized, 1.5 meter (5 feet).
2983: Tubing Assembly, autoclaveable, 3 meter (10 feet).
2984: Tubing Assembly, pre-sterilized, 3 meter (10 feet).

Notes:

1. *Tubing sets only required for 2940 and 2980 online monitoring systems.*
2. *Pre-sterilized tubing sets are gamma irradiated.*
3. *Consult Online Monitoring & Control Questionnaire to determine quantity and tubing length.*

STEP 4

Order Sampling Probes

2854: D-series. Fits 25mm vessel port with 40mm depth.
2855: D-series. Fits 25mm vessel port with 52mm depth (safety ports).
2850: F-series. 120mm insertion length. Fits 12mm headplate port or sanitary fitting. Sanitary fitting must use FISP 1.5 inch or 2 inch sanitary fitting adapter.
2851: F-series. 200mm insertion length. Fits 12mm headplate port or sanitary fitting. Sanitary fitting must use FISP 1.5 inch or 2 inch sanitary fitting adapter.
2852: F-series. 310mm insertion length. Fits 12mm headplate port.
2853: F-series. 410mm insertion length. Fits 12mm headplate port.

Notes:

1. *FISP® in-situ sampling probes ensure bioreactor sterility and aseptic, cell-free sampling of bioreactor media.*
2. *All FISP sampling probes are shipped completely assembled with 0.2 um ceramic membrane.*
3. *Consult Online Monitoring & Control Questionnaire to determine quantity and vessel port type, size and length.*
4. *For F-series FISP probes, the probe length is usually similar to the pH probe length used for the customer's bioreactor.*

STEP 5

Order Accessories

2932: IQ/OQ Documentation Package, 2900
2925: OPC Server Software (required for OPC communication with 4-channel & 8-channel online monitoring systems)
2868: 12 –19mm Adapter for PG 13.5 fitting
2870: 1.5 inch Sanitary Flange to PG 13.5 Adapter, 316 stainless steel
2871: 2 inch Sanitary Flange to PG 13.5 Adapter, 316 stainless steel
2872: PG 13.5 Male Thread to 12mm Compression Fitting

Notes:

1. *Consult Online Monitoring & Control Questionnaire to determine quantity and accessory type.*
2. *FISP probe starter kit is highly recommended.*

2858: D-series 25mm FISP Probe Starter Kit (includes (2) ceramic membranes, (10) 25 main shaft o-rings, (10) membrane shaft o-rings, (5) 10-32 PEEK nut/ferrule combo and (5) end cap screws.
2859: F-series FISP Probe Starter Kit (includes (2) ceramic membranes, (3) 12mm Teflon washers and o-rings, (10) membrane shaft o-rings, (5) 10-32 PEEK plugs, (5) 10-32 PEEK nut/ferrule combo and (5) end cap screws.

Notes:

1. *Compression fitting allows user to manually adjust immersion depth of sampling probe.*
2. *This is most commonly used with 2851 (200mm probe) and 2852 (310mm probe)*

YSI Life Sciences Media

Application Notes

A wide range of application notes is available online for download **ysi.com**/lifesciences

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To read the blog: ysi.com

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com

BROCHURE B86-01

YSI Life Sciences develops and manufactures scientific instruments, sensors and systems that serve a variety of scientific and industrial markets worldwide. YSI has a long history in the life sciences and bioanalytical markets, most notably with our introduction of the world's first commercial whole blood glucose analyzer in 1975. Today there are over 10,000 YSI instruments installed around the world, trusted in critical situations to provide the most accurate data in the shortest time.

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