



# Online Monitoring and Control

BIOPROCESS SOLUTIONS



a xylem brand

**Life Sciences**  
Data for Life.™



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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.

*William Miller*

William Miller | YSI Life Sciences, Product Manager



## Monitoring & Control

# bioprocess



2900M

### Applications

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



2950M

### 2900M

Monitor 1 vessel  
Analyze up to 2 chemistries

### 2950M

Monitor 1 vessel  
Analyze up to 6 chemistries



2940/2980

### 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

## 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/2950M

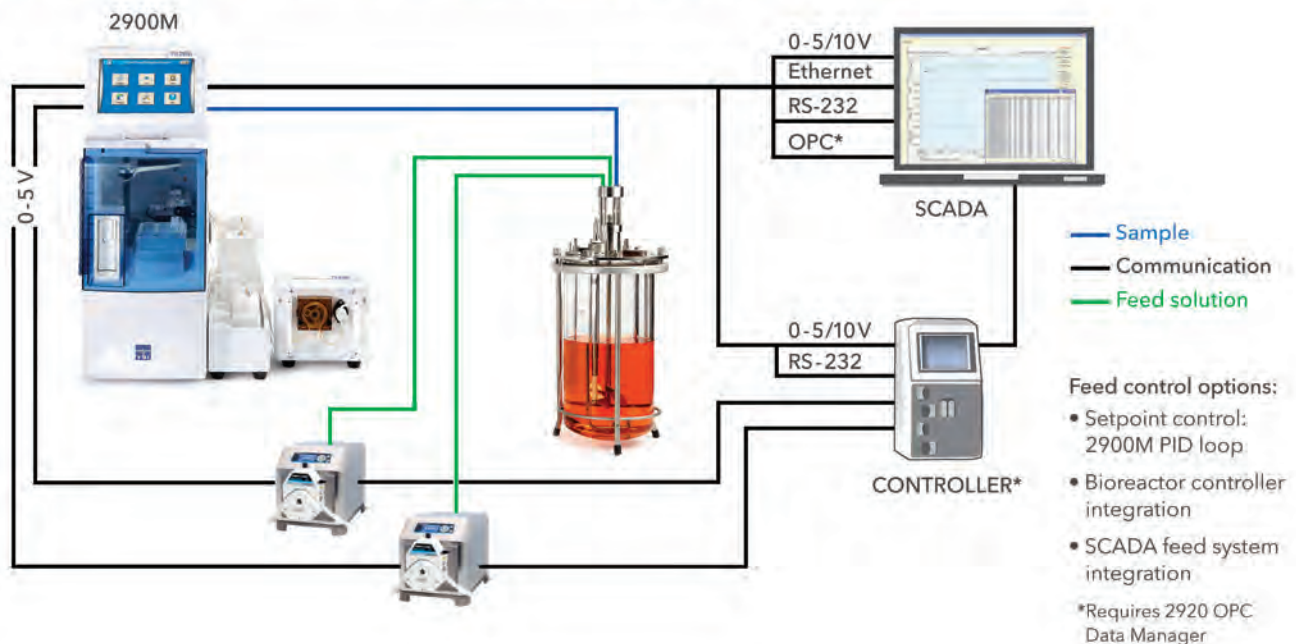
## Online Monitoring & Control Systems

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 2900M/2950M

- 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/2950M Specifications

**Aspirated Sample Volume:** User-defined from 10 to 50  $\mu$ l

**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: 28 lbs./12.7 kg | YSI 2950: 39 lbs./17.7 kg. (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:** 3.0 lbs

**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 3.0 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  
 Ammonium\*  
 Potassium\*

\*2950M only

# 2940/2980

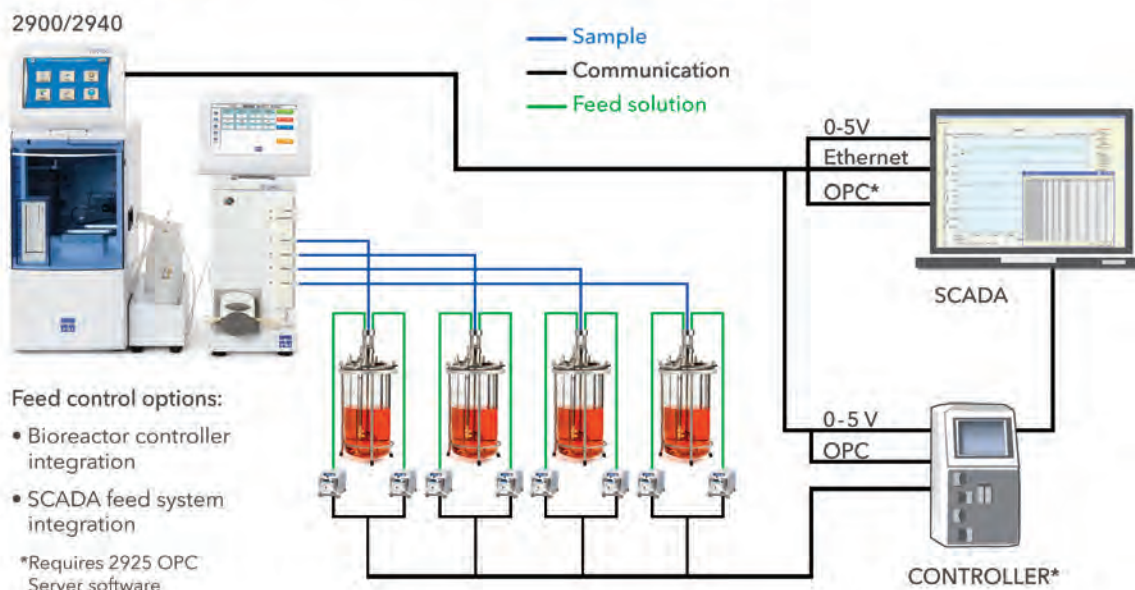
## Multi-Channel Online Monitoring Systems

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/YSI 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 Analog (0-5V), Ethernet and OPC





## 2900/2950 Biochemistry Analyzer Specifications

**Aspirated Sample Volume:** User-defined from 10 to 50  $\mu$ l

**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: 28 lbs./12.7 kg | YSI 2950: 39 lbs./17.7 kg. (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 Systems Specifications

**Vessel Inputs:** 2940: 4 vessel inputs  
 2980: 8 vessel inputs

**Dimensions:** 15.2cm w x 46.2cm h x 27.9cm l  
 6.0" w x 18.2" h x 11.0" l

**Weight:** 7.26kg (16.0 lbs)

**External Power Requirements:** Auto-sensing power adapter: 100 - 120 VAC/220 - 240 VAC,  
 1.5 A (50/60 Hz  $\pm$  5%)

**Regulatory Compliance:** CE, ETL, UL, RoHS

**Sample Size:** 0.5 - 2.0ml (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)  
 3.0 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 (TCP/IP):** 2 ports (additional ports if Ethernet hub is used)

**OPC:** 2 ports (additional ports if Ethernet hub is used)

**Analog (+5.0 VDC):** 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  
 Ammonium\*  
 Potassium\*

\*2950 only

# 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 - 0.44 ml, 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 2.0 inch sanitary fitting ports (adapter required)



### D-Series FISP Probe

- Fits standard and safety 25mm Ingold ports
- Dead volume 0.24 - 0.44 ml, 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 Series biochemistry analyzers or YSI 2900M/2950M Online Monitoring & Control Systems
- Fully compliant OPC DA (Data Access), v.1.0 and 2.0
- OPC Server only, communicates to OPC-enabled systems with OPC Client
- Exports data into any OPC-enabled system
- Internal web server
- Remote access using IP address and web browser
- Performs extensive error tracking and management
- Sleek, modular design
- Includes YSI 2925 OPC Server Software

## 2925 OPC Server Software

- Software option for YSI 2940 and YSI 2980 only
- Allows same OPC functionality as YSI 2920 OPC Data Manager

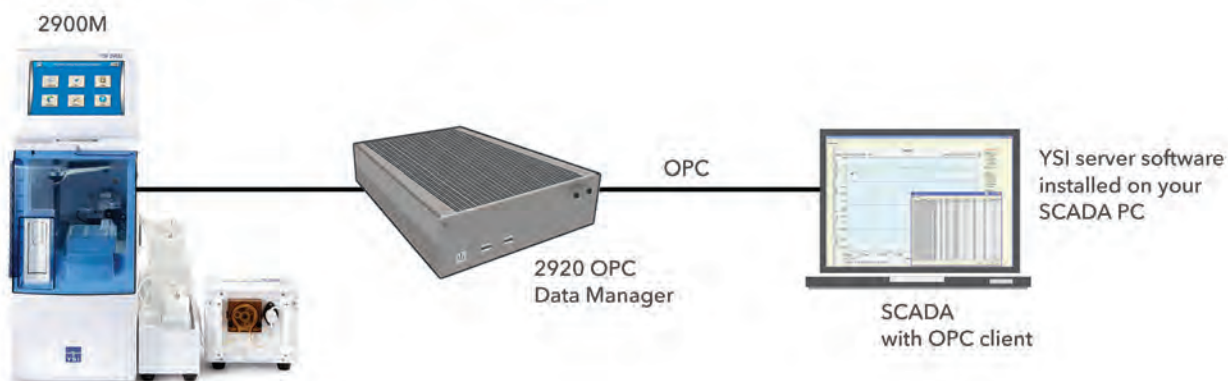
## YSI OPC Server System Requirements

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

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### YSI OPC Connectivity and Systems Integration

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# 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 analog 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:

Sartorius  Eppendorf/New Brunswick  
 Eppendorf/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?

12 mm Headplate  19 mm Headplate  
 19 mm Ingold  
 25 mm Ingold (standard - 40 mm port depth)  
 25 mm Ingold (safety - 52 mm 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 - 3.0 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



2950M



2900M

# Order Guide

## STEP 1 Complete Online Monitoring & 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.

**2950M:** 1-channel online monitoring & control system for 2 - 6 chemistries. 2950D and 2960 must be ordered separately. *Refer to YSI Biochemistry Analyzer Selection Guide for 2950D configuration.*

**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

### Notes:

*Tubing sets only required for 2940 and 2980 online monitoring systems.*

*Pre-sterilized tubing sets are gamma irradiated.*

*Consult Online Monitoring & Control Questionnaire to determine quantity and tubing length.*

**2981:** Tubing Assembly, autoclaveable, 1.5 meter (5 feet).

**2982:** Tubing Assembly, pre-sterilized, 1.5 meter (5 feet).

**2983:** Tubing Assembly, autoclaveable, 3.0 meter (10 feet).

**2984:** Tubing Assembly, pre-sterilized, 3.0 meter (10 feet).



## STEP 4 Order Sampling Probes

### Notes:

*FISP® in-situ sampling probes ensure bioreactor sterility and aseptic, cell-free sampling of bioreactor media. All FISP sampling probes are shipped completely assembled with 0.2 um ceramic membrane.*

*Consult Online Monitoring & Control Questionnaire to determine quantity and vessel port type, size and length.*

*For F-series FISP probes, the probe length is usually similar to the pH probe length used for the customer's bioreactor.*

2854: D-series. Fits 25mm vessel port with 40 mm depth.

2855: D-series. Fits 25mm vessel port with 52 mm depth (safety ports).

2850: F-series. 120 mm insertion length. Fits 12mm headplate port or sanitary fitting. Sanitary fitting must use FISP 1.5 inch or 2.0 inch sanitary fitting adapter.

2851: F-series. 200 mm insertion length. Fits 12mm headplate port or sanitary fitting. Sanitary fitting must use FISP 1.5 inch or 2.0 inch sanitary fitting adapter.

2852: F-series. 310 mm insertion length. Fits 12mm headplate port.

2853: F-series. 410 mm insertion length. Fits 12mm headplate port.

## STEP 5 Order Accessories

### Notes:

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

2932: IQ/OQ Documentation Package, 2900

2925: OPC Server Software (required for OPC communication with 4-channel & 8-channel online monitoring systems)

2868: 12 to 19 mm Adapter for PG 13.5 fitting

2870: 1.5 inch Sanitary Flange to PG 13.5 Adapter, 316 stainless steel

2871: 2.0 inch Sanitary Flange to PG 13.5 Adapter, 316 stainless steel

2872: PG 13.5 Male Thread to 12 mm Compression Fitting

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

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) 12 mm 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.

# YSI Life Sciences Media



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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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