



Aseptic Monitoring

ASEPTIC MONITORING & CONTROL WITH THE
YSI 2900M BIOCHEMISTRY ANALYZER

Technical Note
T200LS



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Aseptic Monitoring & Control with the YSI 2900M Biochemistry Analyzer



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Fermentations and cell cultures require tight control of system variables in order to achieve consistent, desirable results. The importance of nutrient availability and byproduct reduction on the health and productivity of these bioprocesses has been recognized and proven. Off-line analysis generally does not allow for timely adjustment of process variables. On-line analysis can provide this capability. The YSI 2900M Online Monitoring & Control System was designed to do just that.

The YSI 2900M system featuring the YSI Sitini Online Sampler is a key and reliable partner for the optimization of your:

- Critical bioprocess monitoring and fermentation control
- Biofuel production and research
- Food and beverage processing

PRINCIPLE OF OPERATION

To achieve aseptic monitoring, the YSI 2900M system pulls sample from a process vessel at programmed intervals. After analysis, antiseptic solution is flushed through the sample lines, thus disinfecting the stream path and eliminating potential for microbiological growth to occur. The antiseptic solution remains in the sample lines until the next sample analysis.

Regulation of a bioprocess is achieved through PID control on the 2900M. After entering the desired setpoint of the analyte(s), the YSI 2900M instrument triggers a feed pump to replenish nutrients, broth, or media when necessary. In this way, nutrients can be replenished to a setpoint as they are consumed, or byproducts can be diluted to a setpoint as they are produced.

MATERIALS

- YSI 2900M Online Monitoring and Control System
 - YSI 2900 Biochemistry Analyzer with one biosensor module
 - YSI 2960 Sitini Online Sampler
 - YSI 2938 Bottle rack with reagent level sensing (1 chamber)
- YSI Reagent Kits
- Bioreactor or fermentation vessel

- Antiseptic solution
- Filtration device or sampling probe
- Feed pump
- Power surge protector

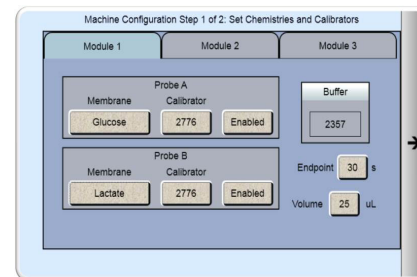
SETUP

Make sure to connect the cable to the Sitini Online Sampler and to your controller or computer in order to control a bioreactor.

A. Configure the instrument with the necessary membranes, reagents, and buffers



Main Screen - Click on **Configure**.



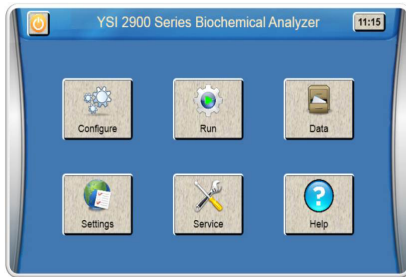
Assign Chemistries.



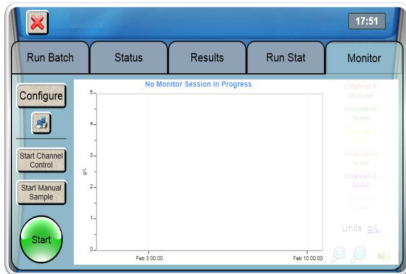
Assign Reagent Locations.

B. Calibrate the instrument

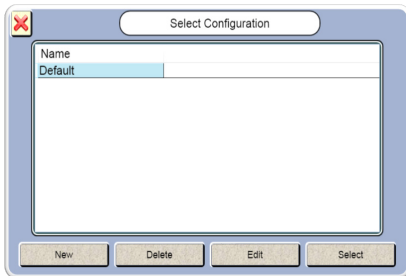
C. Name your online monitoring session.



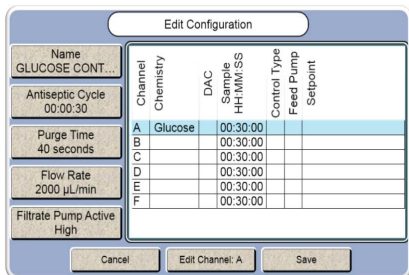
Main Screen Click on Run.



Click Monitor Tab Then Configure.



Click on New.

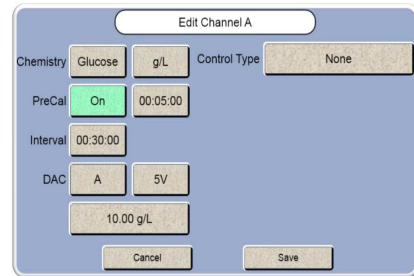


Monitor Configuration Screen.

D. Configure your online monitoring session

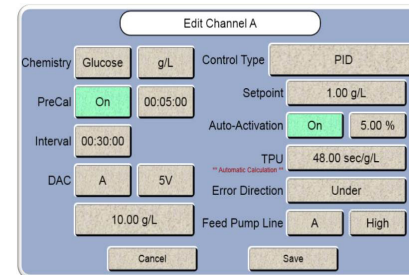
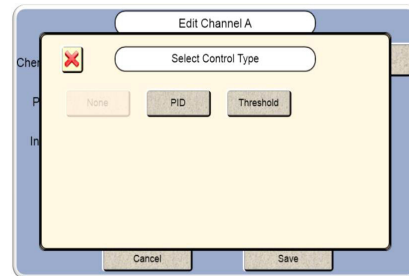
E. Setup a Channel for each chemistry you want to monitor and control

- 1) Select any channel, A through F, from the configuration screen.
- 2) Edit the following parameters: chemistry, concentration unit, PreCal, monitoring interval, DAC (digital-to-analog converter)



The concentration listed below DAC is the DAC maximum and it should correspond with the maximum voltage.

- 3) To control a bioreactor, select **PID** as your control type



- 4) Specify a setpoint. It is the concentration at which the analyte will be regulated.

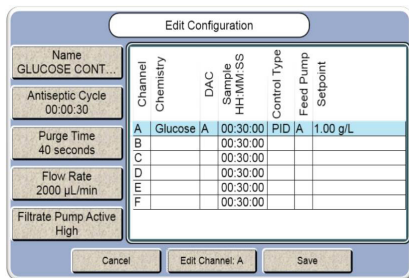
- 5) Set the auto-activation to **On** and input at what percentage of the setpoint the analyzer should start adding feed stock solution.

- 6) The Time-Per-Unit error (TPU) is the amount of time that the feed pump must run to correct for an error in concentration equal to the unit of measure (e.g. g/L, mg/L, etc.). It can be calculated either automatically or manually.

- 7) If in your process, the analyte is being consumed and tends to fall under the setpoint, please select **Under**. If you wish the analyzer to trigger the feed pump to dilute the analyte when the concentration is above the setpoint, please select **Over**.

- 8) Select Feed Pump output A or B. Choose **Low** if the feed pump requires an Active Low signal (0 Volt) to turn on. Otherwise, please choose **High**.

9) Press **Save** and now your routine is shown in Channel A.



NOTES

Antiseptic - Sodium hydroxide (1%) or hypochlorite (0.25%) solutions are recommended. Other reagents compatible with silicone tubing may also be used. The antiseptic cycle is the time that the pump will run to pump antiseptic through the lines. The default setting is 30 seconds. This is adequate if the antiseptic solution, the bioreactor, and the 2900M are all side by side on the bench. This setting can be increased if you would like the pump to run longer.

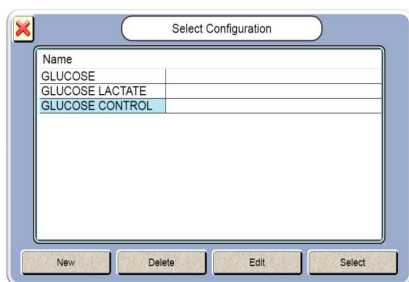
10) Repeat steps 1 - 9 for any additional Channel.

Channels - The channels are routines that you can set up, save, and run at any time.

F. Run your online monitoring and control session

Data Signal - Analog signals that represent analyte(s) concentration(s) are available from the YSI 2900M system and can be sent to a computer's data acquisition software, a process loop controller, or a process management instrument. If analog signals will be used, the PC will need to be equipped with a data acquisition program and an A to D converter that accommodates +5V or +10V full scale. Sample results are also available via Ethernet using FTP (File Transfer Protocol), or RS232 using remote commands.

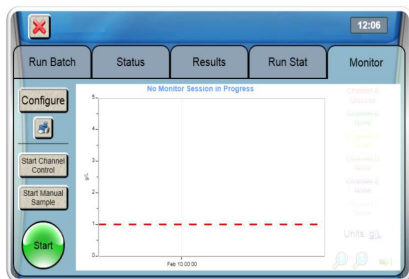
1) Highlight the configuration you wish to run and press **Select**.



External Feed Pump - When nutrient concentration or byproduct concentration fluctuates from the programmed setpoint, the 2900M will signal the operation of external feed pump (up to 2) using normal or inverted transistor-transistor logic (TTL) signal output(s). This will initiate the replenishing of nutrients or the dilution of byproducts. Therefore, the pump chosen must have TTL on/off remote logic.

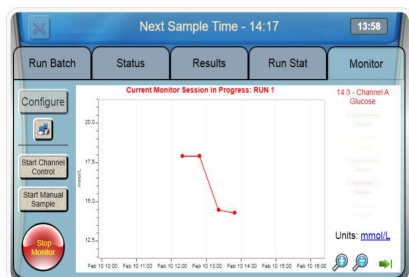
2) Press **Start** to begin and name the monitoring and control session.

Filtration Device - An on-line filtration device or sampling probe with 0.2µm pores or smaller provides a barrier to environmentally born contaminants. If cell loss is a concern, an in-line filtration device will be needed.



3) Results of run samples will be displayed in the graph.

Purge Time - The purge time is the amount of time the pump runs to push the last sample through the lines before a new sample is taken. The default setting is 40 seconds and can be increased depending on the flow rate and distance between the bioreactor, the Sitini pump, and the instrument.



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