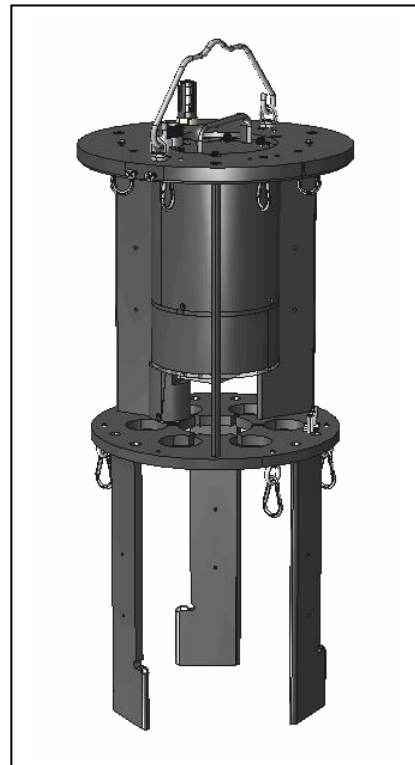
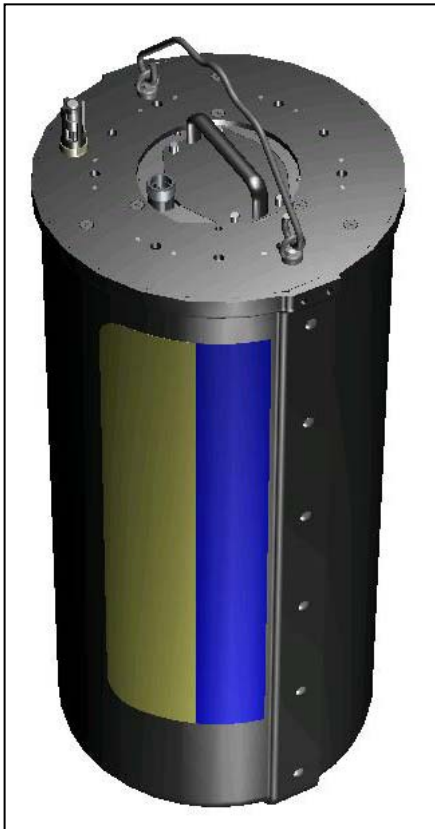




YSI Environmental

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YSI 9600 Nitrate Monitor Operations Manual

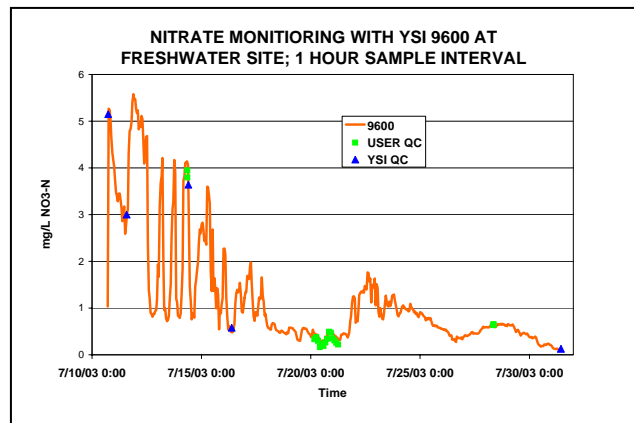


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SAFETY AND EMC CONSIDERATIONS

9600 NITRATE MONITOR

Before using the 9600, the user should carefully read the caution messages listed below and should review Sections 11 and 12 of this manual on Safety and EMC considerations.

⚠ CAUTION: Operation of the YSI 9600 Nitrate Monitor requires the use of a variety of chemicals. With one exception (elemental cadmium), the user is required to purchase these chemicals from a vendor of their choice. Users should consult the Material Safety Data Sheets (MSDS) supplied by these vendors for all reagents before their use. Users should ALWAYS wear appropriate personal protective equipment including gloves and safety glasses with side shields when handling any of these chemicals.

For proper operation of the YSI 9600, cadmium metal MUST be purchased in packaged form as the YSI Model 9612 Cadmium Column Assembly. An MSDS for the material captured in the cadmium column is automatically supplied to the user by YSI. To protect against potential hazards associated with inhalation of cadmium dust, the cadmium column should be handled in a fume hood during activation. After the reducing capacity of the cadmium column has been exhausted, the entire sealed column should be disposed of in accordance with regulatory requirements, e.g. hazardous waste. Users should NEVER open the cadmium column in attempts at regeneration. If the cadmium is accidentally spilled, appropriate spill measures should be taken.

The waste generated from use of the YSI 9600 contains potentially toxic organic chemicals, but most importantly, contains Cd^{2+} that according to the USEPA is toxic and a probable human carcinogen. Users should NEVER discharge waste from the YSI 9600 into the environment, instead retaining it in the waste bags that are provided with the instrument. Likewise, unless specifically approved by the local wastewater authority, users should NEVER dispose of the reaction waste into a sanitary or storm sewer. The waste should be disposed of in accordance with regulatory requirements with an approved waste handler.

⚠ CAUTION FOR INSTRUMENTS USED IN EUROPEAN COMMUNITY (CE) COUNTRIES: As described in the Declaration of Conformity (YSI Item # 699298), the YSI 9600 Nitrate Analyzer complies with the Residential, Commercial and Light Industrial Class B Limits for radio-frequency emissions specified in EN55011 (CISPR11) for Industrial, Scientific and Medical laboratory equipment with no qualifiers. However, if you are using your YSI 9600 Nitrate Monitor in a European Community (CE) country or in Australia or New Zealand, when communicating with the instrument you must attach a ferrite bead to the interface cable in order to comply with the industrial immunity specified in EN61326 for Industrial, Scientific and Medical laboratory equipment. The ferrite bead (YSI Item Number 699296) is NOT supplied as standard equipment with the 9600 and should be purchased as an accessory by customers requiring its use. Attachment of the bead is shown graphically in Section 11.

SECTION 1 INTRODUCTION TO THE 9600

The YSI 9600 Nitrate Monitor is a powerful instrument that allows the user to continuously record nitrate levels at a variable sample interval and thus provides a much greater capability to detect nutrient events than the spot sampling activities which have historically been carried out. The 9600 can be custom configured with regard to detector cell to provide maximum accuracy for the type of water that you normally monitor. For applications where typical nitrate levels are over 2 mg/L of nitrate-nitrogen, the 9600 should be configured with a 2 mm cell (designated 9600-02 for ordering purposes). For applications where typical nitrate levels are below 2 mg/L, the monitor should be equipped with a 10 mm detector cell and designated 9600-10. The 9600-02 and 9600-10 are designed primarily for freshwater and estuarine/near coastal applications, respectively, but there may be some cases where the greater range of the 9600-02 will be required for brackish water studies and some cases where freshwater nitrate levels are consistently low enough to require the greater accuracy of the 9600-10. Note that users cannot change the detector cell that was purchased with their particular 9600 in order to meet the requirement of a new application. While detector cells can be switched from 2 mm to 10 mm or vice versa, this action must be carried out by factory-trained personnel.

To accurately measure nitrate, the 9600 uses flow injection technology combined with a chemical reaction sequence which is defined in literature from both the USEPA and *Standard Methods for the Examination of Water and Wastewater*. The intensity of the color produced by the chemical reaction sequence is determined by standard absorbance spectroscopy and compared to that of a standard of known concentration in order to quantify the amount of nitrate in an environmental sample. The use of flow injection technology minimizes the amount of reagents required and the amount of waste generated.

Key features of the YSI 9600:

- Works on standard cadmium reduction/diazotization principle. Standard Methods #4500-NO₃⁻ E.
- Can be custom configured relative to detector cell for most freshwater applications (2 mm) or for most estuarine and near coastal applications (10 mm).
- Easy-to-use NUviewTM PC software for simple set-up and deployment. Proven EcoWatch for WindowsTM software for data analysis and custom presentations. Both software packages are provided with each instrument.
- Easy access to reagent and waste bags and internal battery pack for field replacement.
- Good battery life (approx. 70 days at a 1 hour sample interval at 20 C) with internal D-cell battery pack. Also can be powered externally by 12 V lead acid battery, AC adapter, or data collection platform for longer deployments.
- Automatic calibration at user-selected interval. Calibration points do not affect data continuity for sample intervals of 30 minutes and greater.
- SDI-12 and RS-232 interfaces standard for use with computers and data collection platforms.
- Waste collection system included with instrument to avoid cadmium²⁺ discharge into the environment
- Minimal waste volume because of pump design – approximately 7 liters of waste in 30 days at a 1 hour sample interval.
- CE and Australian C-Tick Compliance

- Large, non-volatile memory for data storage.
- System can be used at depths up to 200 feet.
- All firmware and software is user-upgradeable via the YSI Web page.

SECTION 2 GETTING STARTED

This section is designed to quickly familiarize you with the hardware and software components of the YSI 9600 and its accessories. By the end of Section 2 you will have...

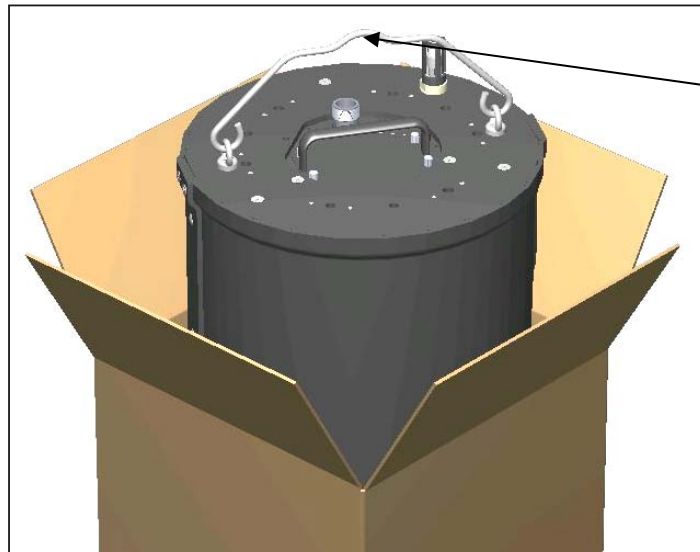
- ▶ Unpacked the 9600 Nitrate Monitor and confirmed that all components are present
- ▶ Become familiar with the general features and set-up configurations of your 9600
- ▶ Prepared the required reagent solutions
- ▶ Filled and installed the collapsible reagent delivery bags and the waste bags
- ▶ Activated and installed the cadmium column
- ▶ Assembled the instrument in preparation for a deployment or laboratory test

Successful completion of the above list is essential for you to continue on to Section 3, which focuses on setting up the hardware to allow a successful computer interface with the 9600. In subsequent sections, you will learn about how to set up the 9600 to log data during a deployment, deploy the monitor, and manage the data files which are generated during field studies.

2.1 UNPACKING

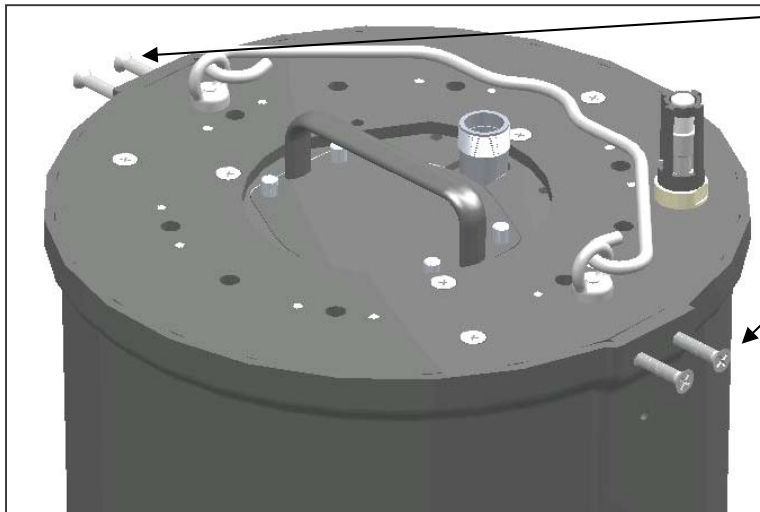
When unpacking your 9600 Nitrate Monitor, be certain not to discard any parts or supplies that were supplied with the instrument. As you proceed through the unpacking process, use the packing list (available immediately after opening the box) to ensure that all items are included. Finally, be sure to inspect all assemblies and components for damage. Proceed by the following steps to unpack the 9600:

- Open the flaps at the top of the box and remove the packing list and sealed information packet which contains several items, including the manual and the software necessary to interface with the 9600 and analyze the data, and set the items aside.
- After removing the cardboard tray that contains the information packet, remove the 9600 from the shipping box by grasping the bail and pulling straight up as shown in the picture below. It may be prudent to have two people present for this initial unpacking step: one to lift the instrument by the bail and another to pull the box from the assembly. Note carefully that the 9600 weighs approximately 30 pounds with no chemicals present so make certain that the person removing the instrument from the box is capable of lifting this amount of weight.



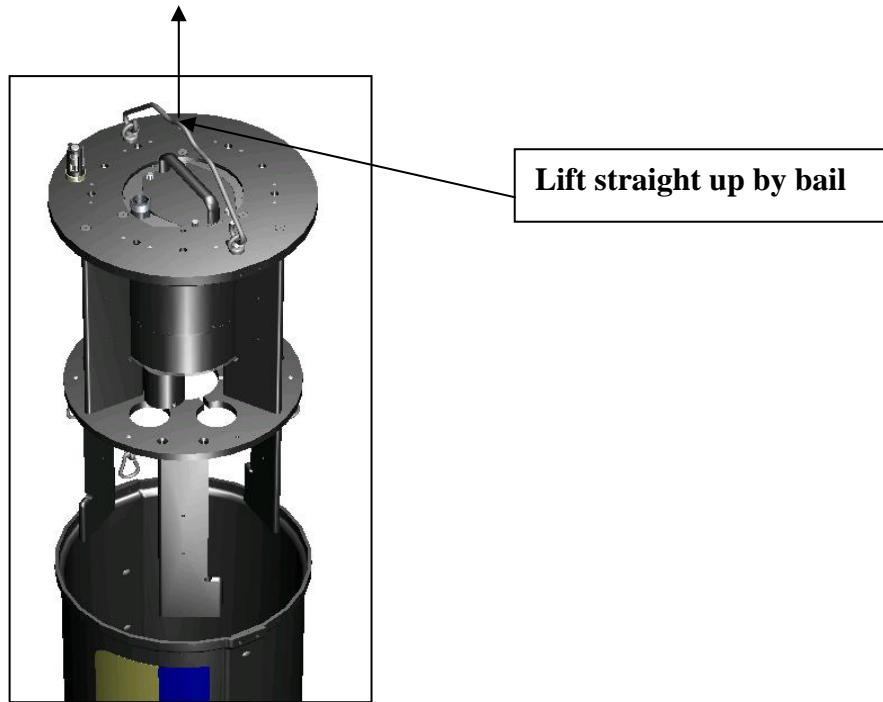
Lift by Bail

- After removal from the box, place the 9600 on a flat surface, usually the floor, and inspect it for any damage that might have occurred in transport. If any parts are damaged or missing, contact your YSI representative immediately. If you do not know which YSI dealer you obtained your YSI 9600 from, refer to Section 13 of this manual for contact information.
- If no damage is present, proceed with the removal of the carousel from the outer housing of the 9600 as defined in the steps below:
- Using a large Phillips head screwdriver, remove the four (4) screws from the sides of the instrument assembly which hold the inner carousel to the outer assembly as shown in the picture below. Make certain to retain the screws in a safe place for reassembly prior to use of the 9600.



Remove these screws

- After the screws have been removed, grasp the bail and lift straight up to remove the carousel as shown in the picture below. If the carousel binds to the outer shell, have a second person hold the outer shell. Place the carousel in an upright position on the floor or a bench top after removal.

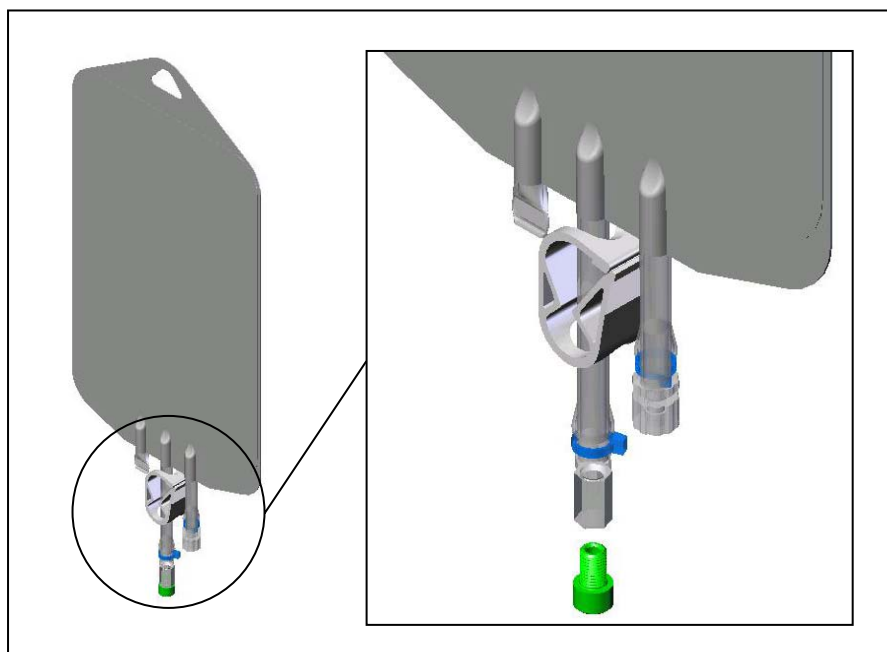


- Locate the package containing the cadmium column and remove the box from the carousel. Also locate the 9615 Syringe Kit which is near the cadmium column. Set these items aside for later use.
- Locate the seven (7) one liter reagent bags that are present in the individual compartments of the carousel. Note that one of the bags is loose in the compartment and has a tubing assembly attached to its middle port. This bag should be removed immediately and set aside for later use. Note that the other six bags are attached to tubing by multicolored threaded fittings. Note also that each bag has a colored tie-wrap on the top of the container that is coordinated with the color of the fitting to which the bag is attached.
- As you inspect the reagent bags, note carefully that there is a small (50 mL) plastic bag that is permanently attached to the side of the internal cylinder as shown in the picture below. This bag **MUST NOT BE REMOVED** as it contains silicon oil. The 50-mL bag is designed to expand and contract with temperature and depth changes to equalize the pressure between the pump chamber and the water at the site.

Note Permanent Attachment



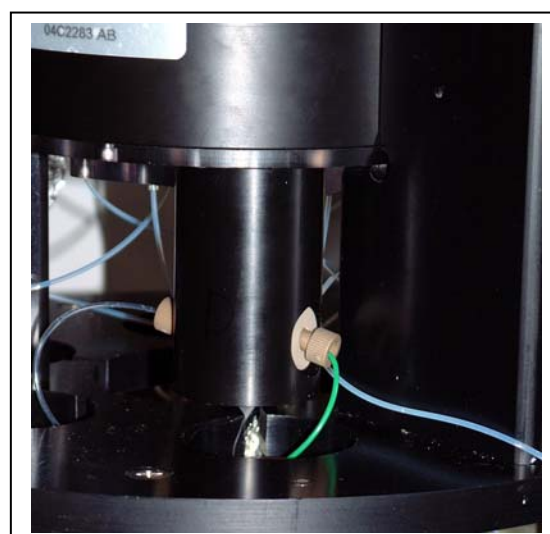
- Using only your fingers (no tools), remove each 1 L reagent bag from its color-coded fitting by grasping the bag-end of the assembly with one hand and turning the nut counterclockwise with the other as shown in the picture below. Set the bags aside for later use.



- Inspect the detector cell that protrudes from the underside of the pressure manifold as shown in the pictures below and confirm that it is correct according to your order – either a 9600-02 with a 2 mm cell or a 9600-10 with a 10 mm cell. Besides the label that is attached to the cell as an identifier, it is also possible to differentiate the cells by the fact that the 10 mm cell has two tan colored nuts attaching the tubing while the 2 mm cell has one tan colored nut and one smaller stainless steel fitting.



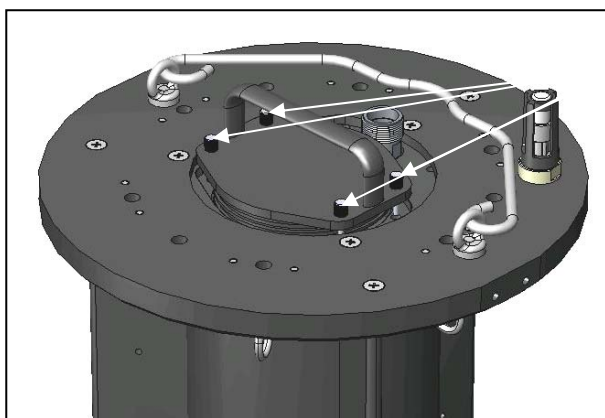
2 mm Detector Cell



10 mm Detector Cell

- Remove the battery lid by loosening the four (4) knurled screws on the top of the battery lid as shown in the picture below. If the screws cannot be turned, use any slotted screwdriver to loosen them slightly and then screw them out until the battery lid can be removed

CAUTION: The battery lid screws are captive. Do NOT continue to turn them after the battery lid can be removed.



**Loosen 4 battery lid screws
and lift battery lid straight up**

- Confirm that the battery pack is present in the compartment, but do NOT connect its battery lead to the mating connector at this time.
- Replace the battery lid.

After completing the unpacking and inspection sequence outlined above, proceed to Section 2.2 below to gain a basic understanding of the Model 9600 mode of operation.

2.2 UNDERSTANDING THE 9600 MODE OF OPERATION

The Model 9600 is designed to allow users to monitor the nitrate concentration in environmental water over long periods of time with minimal maintenance required. It is NOT designed for spot sampling of nitrate since the minimal interval between samples is 15 minutes. The system operates by the principle of flow injection analysis (FIA) using a series of precise low-volume pumps to mix an aliquot of the water at an environmental site with user-prepared reagents that produce a colored solution. The intensity of the color is measured in a detector cell using a green light-emitting-diode (LED) as the light source and a photodiode as the detector and this intensity is proportional to the concentration of nitrate in the sample. The detector cell is also equipped with a reference photodiode to automatically compensate for any changes in LED intensity during a study. Because the pumps are low-volume, minimal waste is generated by the 9600 FIA system during field studies and this waste can readily be captured in the containers supplied to prevent environmental contamination.

It is important to understand that, in its normal configuration with the cadmium column in place, the 9600 measures the sum of the nitrate AND nitrite in the water being monitored. Normally, however, because the biological process of nitrification is active at most sites, there is very little nitrite in most environmental water and therefore the 9600 reports its readings as nitrate. Users who are concerned that there is indeed a significant quantity of nitrite in the water at their monitoring sites should either carry out studies with the 9600 with no cadmium column in place or should collect water samples at the site and perform laboratory analyses for nitrite to determine if its presence is having a significant effect on the overall accuracy of the measurement.

Users interface to the Model 9600 via a PC that is running the YSI software designated as NUview™ which is supplied with each nitrate monitor as part of the information packet. This software provides a simple interface for set-up and deployment of the nitrate monitor that is ideal for the vast majority of studies. Under the standard set-up routine, the user inputs specific information about the pending

deployment, such as study name, sample interval, and the frequency of auto calibration, into a “Wizard” based interface, with this portion of the set-up taking a minute or less. The Wizard then guides the user through a predeployment pumping routine which takes approximately 60 minutes to assure that the instrument is functioning properly and provides error messages if any problem is apparent. After a successful predeployment test, the user simply starts the deployment and transports the 9600 to the desired site for deployment. The study can either be started immediately during laboratory set-up of the nitrate monitor, or delayed by several hours to allow the study to start after deployment. The key is that the default FIA sequence for the pumps is ideal for the monitoring of nitrate, and no user “programming” of the 9600 hardware is required.

During deployments, a blank (purified water) and a standard (made up to a concentration that matches the typical nitrate values at a particular site) are automatically run at an interval selected by the user. Use of these periodic blank and standard reagents allows the instrument software to automatically compensate the data for any instrument drift during deployment and provides an on-board quality assurance methodology. For most deployments, it will be sufficient to run a blank and standard twice during each 24 hour logging period. For sample intervals of 30 minutes and greater (typical for most deployments), the calibration reagents are run through the system between samples so that no discontinuity occurs in the logged data.

The overall length of a deployment is generally limited by a combination of the quantity of reagents present in the instrument assembly at the beginning of the study and the sample interval chosen by the user. For example, the reagents will be expended in approximately 30 days if an interval of 1 hour is chosen between samples, but approximately 60 days if the interval is set to 2 hours.

While most studies will be carried out using the pumping sequence (number of pumping pulses for each particular pump at a specified time in the overall routine) for “typical” nitrate-N concentrations in the 0-5 mg/L range, NUview software also allows users who are monitoring water with very high nitrate concentrations (5-10 mg/L) to select a special pumping sequence to enhance their accuracy.

You now should have a basic understanding of the capabilities of the YSI 9600 and be ready to proceed to the next section where you will prepare reagents for use in the deployment of the nitrate monitor.

2.3 PREPARING THE REAGENTS

Four different reagent solutions and distilled or deionized water are required for the use of the Model 9600 nitrate monitor. In this section, you will be given instructions on how to prepare these reagents. In addition, the 9600 utilizes a column of elemental cadmium which must be “activated” prior to use and instructions for this procedure are also provided.

CAUTION: All chemicals are potentially harmful and should be handled with care. Be sure to consult the MSDS for each of the chemicals before preparing any of the reagent solutions. It is very important to wear appropriate protective equipment including safety glasses with side shields and use disposable gloves when handling solid chemicals and when preparing and transferring solutions of these chemicals.

2.3.1 PURCHASING THE REAGENTS

The sources used for the various reagents that have been used in YSI development studies on the 9600 are provided below. However, users can purchase reagents from any source of their choosing as long as the chemicals are (a) identical in formulation and (b) equivalent in purity – ACS Reagent Grade or better. An appropriate quantity of the reagents should be purchased based on the frequency of deployment of your 9600.

Ammonium Chloride – Fisher Scientific, Item Number A661-500

Sulfanilamide – Sigma , Item Number S-9251

N-(1-naphthyl)ethylenediamine dihydrochloride (NED) – Aldrich, Item Number 22,248-8

Potassium Nitrate -- Alfa Aesar Chemical, Item Number 13443

Hydrochloric Acid (10 % v/v; 1.2 M) -- Fisher Scientific, Item Number LC15070-6 (10 liter container)

Copper Sulfate Solution (10 % w/v) -- Spectrum Chemical Mfg. Corp., Item Number C-283

BRIJ 35 Surfactant, Sigma -- 430AG-6

Kodak Photo-Flo 200 Wetting Agent -- Warehouse Photographic, Carrollton, TX, 800-400-8203, www.warehousephoto.com, 146-4502. Alternatively, this chemical can be purchased at most camera stores or photo supply houses.

2.3.2 REQUIRED EQUIPMENT AND CONTAINERS

Before proceeding with solution preparation, YSI recommends that you first make sure that you have available the necessary equipment and storage vessels. First, you should have the proper bottles for storage of at least 1.5 liters of each reagent. The plastic bottles recommended by YSI for this purpose are 2 liters in capacity and are graduated so that 1.5 liters of solution can be prepared to the required accuracy for most of the reagents. These bottles can be purchased from Fisher Scientific in packs of 6 or 12 as Fisher Item Number 03-311-3g. Second, for preparation of the nitrate standards in various concentrations, you will need a 1000 mL glass volumetric flask to obtain the desired accuracy. Third, users will require an adjustable volume pipet for the 0 to 1 mL range such as the Brinkman Eppendorf model which can be ordered from Fisher Scientific under Item Number 05-402-50. Fourth, if you wish to prepare nitrate standards above 2 mg/L, you will need glass pipets with the appropriate volumes. For example, to prepare a 5 mg/L nitrate standard, you will need a 5 mL glass pipet. Finally, users will require a balance that will weigh accurately to at least 0.01 gram and preferably one which has an accuracy of 0.001 gram. In summary, the following parts are required prior to reagent preparation:

- Graduated Plastic Bottles with 2 L capacity (at least 6)
- Volumetric Flask for 1000 mL (at least 1)
- Adjustable pipetter for 0-1 mL volumes (at least 1)
- Glass pipets of various denominations (depending on standard concentrations required)
- Laboratory balance with weighing accuracy of 0.01 g

2.3.3 SOLUTION PREPARATION

The following instructions should be followed to prepare the aqueous solutions that will be required for use with the 9600 Nitrate Monitor. At least 1.5 L of the reagents and 3 L of the final standard should be prepared in order to have enough solution volume to set up the nitrate monitor properly for a deployment.

CAUTION: Be sure to consult the MSDS for each chemical before proceeding and use safe laboratory practices as outlined above during their handling.

BUFFER – Weigh 128 g of ammonium chloride to the nearest gram and place the solid in a 2 L graduated plastic bottle. Add 1.5 L of purified water (distilled or deionized) and stir or shake until the solid is completely dissolved. Using the adjustable pipetter, add 75 uL of 10 % copper sulfate solution and shake well to mix.

SULFANILAMIDE – Weigh 15 g of sulfanilamide to the nearest gram and place the solid in a 2 L graduated plastic bottle. Add 1.5 L of 10 % hydrochloric acid and shake or stir until all of the solid is dissolved. Using the adjustable pipetter, add 1.5 mL of BRIJ 35 surfactant.

NED – Weigh 1.50 g of N-(1-naphthyl)-ethylenediamine dihydrochloride (NED) to the nearest 0.01 g and place the solid in a 2 L graduated plastic bottle. Add approximately 1.5 L of purified water and shake or stir until the solid is completely dissolved. Then add 3.75 mL of Photo-Flo 200 and shake well to mix.

NOTE CAREFULLY: The NED reagent is light sensitive and the storage bottle should be either kept in the dark or covered with some material, e.g., aluminum foil, to prevent premature degradation.

WASH – Place 1.5 L of water in a 2 L graduated plastic bottle. Add 3.75 mL of Photo-Flo 200 and shake well to mix.

CAUTION: It is CRITICAL for proper operation of the 9600 for the Photo-Flo 200 to be included in both the NED and Wash reagents. Do not attempt to deploy without adding the Photo-Flo to these solutions.

1000 MG/L NITRATE-NITROGEN STANDARD – Weigh 7.22 g of potassium nitrate to the nearest 0.01 g and quantitatively transfer the solid to a 1000 mL volumetric flask. Add approximately 500 mL of purified water and swirl the mixture until the solid is completely dissolved. Then add additional water to fill the flask to the top graduation mark. Mix well by repeated inversion of the flask. Transfer the standard to a dry 2-L plastic bottle for storage. YSI recommends that this standard be stored in a refrigerator and then warmed to ambient temperature prior to use. If refrigerated, the standard will be stable for approximately 3 months.

VARIABLE NITRATE-NITROGEN STANDARDS – Nitrate-nitrogen standards in various concentrations can be prepared by diluting the 1000 mg/L standard prepared in the section above. Using this method, accurate aliquots of the concentrated standard are transferred to the 1000 mL volumetric flask and then the flask is filled to the top graduation mark and inverted repeatedly to assure good solution homogeneity. Examples of the amount of 1000 mg/L standard to dilute to 1000 mL are shown in the Table below:

Final Nitrate-N Standard Conc	Amount of 1000 mg/L Standard	Final Volume
6 mg/L	6.00 mL	1000 mL
4 mg/L	4.00 mL	1000 mL
2 mg/L	2.00 mL	1000 mL
1 mg/L	1.00 mL	1000 mL
0.50 mg/L	0.50 mL	1000 mL
0.20 mg/L	0.20 mL	1000 mL
0.10 mg/L	0.10 mL	1000 mL

NOTE: Users can also purchase 1.0 mg/L nitrate-N standard from YSI in 500 mL quantities as Model Number 3885.

SELECTING A NITRATE STANDARD CONCENTRATION – For your initial deployment using either a 9600-02 (2 mm detector cell) or a 9600-10 (10 mm detector cell), YSI recommends using a standard that is 1mg/L in nitrate-nitrogen (nitrate-N). This standard will assure readings that are accurate to 5 % of the reading or 0.2 mg/L whichever is greater, with the 9600-02 and 5 % of the reading or 0.02 mg/L, whichever is greater, with the 9600-10. Once you obtain more information about the typical high and low limits of nitrate concentration at a particular site, you might want to use standards of different values to maximize accuracy. For example, with a 9600-02, if the water at your site is known to

consistently contain concentrations of nitrate higher than 6 mg/L, then users might consider employing a higher standard concentration such as 6 mg/L nitrate-N. For many estuarine and near coastal studies, where nitrate concentrations may always be below 0.5 mg/L nitrate-N, the use of a 0.2 mg/L standard will probably improve the data accuracy. Note, however, that YSI does not recommend using standards less than 0.1 mg/L of nitrate-N.

CAUTION: Use of standards with concentrations higher than 8 mg/L of nitrate-N may compromise the accuracy of the 9600.

NOTE: The procedure noted above for the variable nitrate-nitrogen standards will have to be carried out multiple times in order to generate enough standard to fill the two reagent bags as described below. Alternatively, a larger volumetric flask can be used in the preparation as long as the amount of 1000 mg/L standard shown in the table is increased appropriately.

After preparing the reagent solutions, be sure to label each storage bottle appropriately.

BLANK– The blank is typically purified water which has a salinity which is roughly that of the water at the site for brackish and oceanographic applications and simply deionized or distilled water for freshwater applications.

2.4 FILLING THE REAGENT BAGS

Under deployment conditions, chemical reagents are fed into the FIA system of the Model 9600 from collapsible reagent bags that you unpacked and set aside in Section 2.1 above. Thus, to operate the nitrate monitor, you must transfer solutions from the storage bottles to the bags prior to each deployment. The bags are nominally 1 L, but will in fact require approximately 1.2 L of solution for complete filling and maximum deployment times.

CAUTION: Be sure to wear appropriate protective equipment including safety glasses and gloves while filling the reagent bags. In addition, be certain to point the reagent bag fittings away from your face when you are expelling air from the bag through the partially-open fittings as described below.

NOTE: The reagent bags are color-coded to match the threaded fittings on the nitrate monitor tubing to facilitate installation. Be sure to put each reagent in the proper color-coded bag according to the information in the table below:

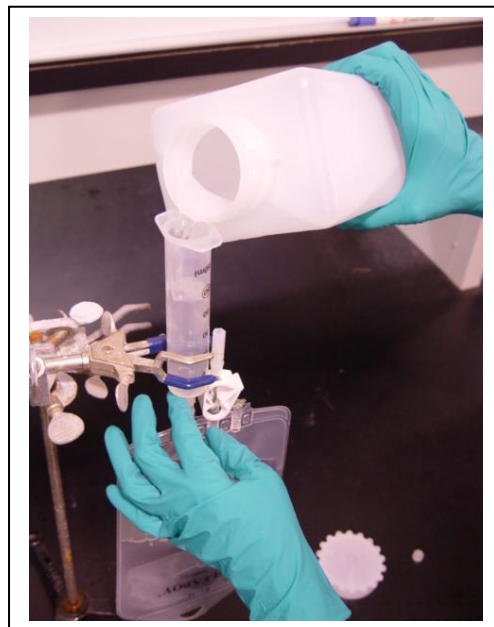
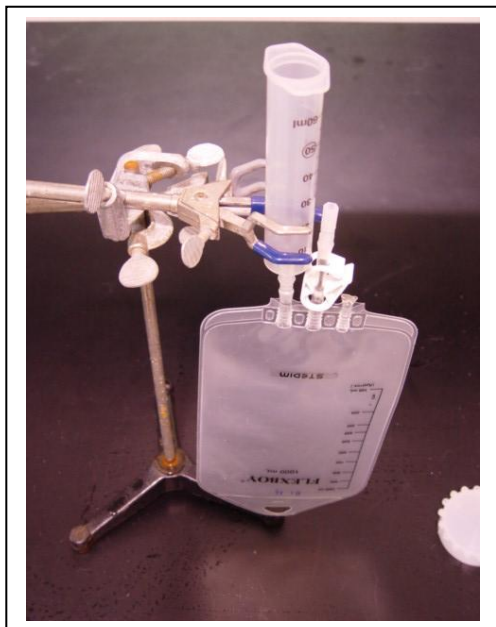
REAGENT BAG	COLOR
Standard – 2 bags	White
Blank – Purified Water	Black
Buffer	Blue
NED + Photo-Flo 200	Red
Sulfanilimide + BRIJ	Yellow
Wash – Purified Water + Photo-Flo 200	Green

It may also be prudent for the user to label each bag with a “magic marker” prior to filling.

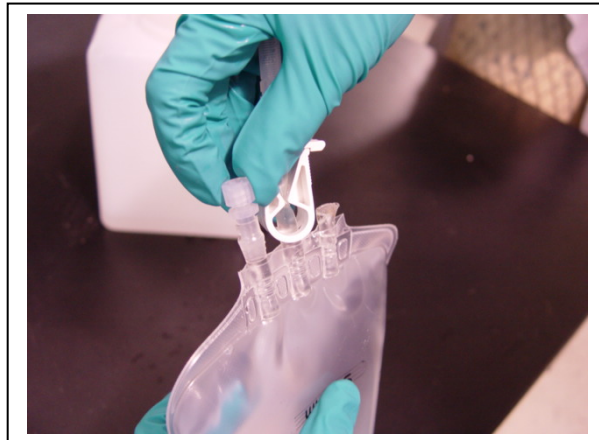
NOTE: For the Predeployment Check of the analyzer as described in Section 4.2 below, you will need TWO 1 liter bags filled with your standard solution. Note that you have been furnished with two bags labeled with a white tie-wrap, one of which has a tubing assembly attached.

YSI recommends that the method outlined below be used to fill each of the reagent bags:

- Locate the 60 mL plastic syringe that was supplied with your Model 9600 in the 9615 Syringe Kit and remove the plunger. Clamp the syringe to a ringstand with the Luer Lock bottom fitting “down” and the syringe opening “up”.
- Remove the Luer Lock plug from the side port on the reagent bag and make sure that the pinch clamp on the middle port of the bag is open. CAUTION: Make sure that you save the side port plug for resealing the bag after filling.
- Attach the reagent bag via the side port to the Luer Lock fitting at the bottom of the syringe and tighten securely. See the pictures below for the proper set-up to begin filling reagent bags.



- Make sure that the pinch clamp on the middle port of the bag is in the “open” position.
- Pour the appropriate reagent into the 60-mL syringe and allow it to drain into the reagent bag. Repeat the addition of reagent until the bag is full and reagent overflows slightly out of the middle port of the bag.
- Close the pinch clamp on the middle port of the reagent bag so that no solution can escape via this route.
- Carefully remove the syringe from the side port of the reagent bag and seal the side port with the plug which was set aside above. With the bag completely sealed, invert the bag back and forth several times to loosen any bubbles that might be present.
- Now hold the bag in your hand with the connectors “up” and move it slightly back and forth until any bubbles present are near the side Luer Lock fitting. Loosen the Luer Lock plug slightly (Do not remove it) and squeeze the bag gently to expel any bubbles out through the port as shown in the picture below. Then quickly retighten the Luer Lock plug. See the picture below.



The reagent bag is now ready for installation in the nitrate analyzer.

Repeat the filling process for all six reagent bags. Note that the wash (green fitting) and blank (black fitting) bags should be filled with purified water only.

NOTE: Be sure to rinse the 60 mL syringe with purified water before switching reagents to avoid cross contamination in the reagent bags.

2.5 PREPARING THE CADMIUM COLUMN

The cadmium column that was set aside during the unpacking process in Section 2.1 is a key ingredient in the Model 9600 function and **MUST** be activated prior to use in the nitrate monitor. Activation should be carried out according to the instructions below.

CAUTION: Cadmium, according to the USEPA, is toxic and a probable human carcinogen. Be sure to handle the column and perform the activation process in an approved fume hood. Be sure to wear appropriate personal protective equipment including eye protection and wear gloves while handling the column and performing the activation process. Failure to observe these precautions may lead to potentially serious health problems.

To activate the cadmium column, you must locate the 10-mL plastic syringe assembly that is part of the 9615 Syringe Kit that was supplied with the nitrate monitor. Note that the syringe is fitted with tubing and a threaded fitting. This syringe is used to push reagents through the cadmium column during the activation process. You will also require the following reagents that were prepared or purchased above:

- Hydrochloric Acid (10 % v/v)
- Ammonium Chloride Buffer Solution
- Copper Sulfate Solution (10 % w/v)

Once the reagents and the 10 mL syringe assembly have been located, you are ready to proceed to the next step.

2.5.1 PREPARING THE COPPER SULFATE REAGENT

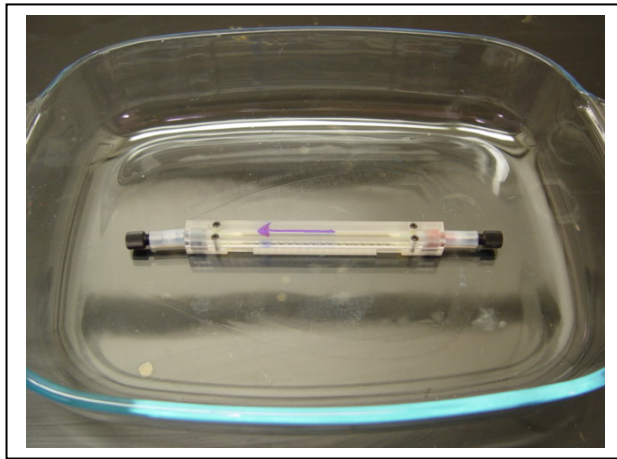
The copper sulfate solution (10 % w/v), purchased as described in 2.3.1 above, **MUST** be diluted prior to its use in cadmium column activation. Perform the dilution by placing 2 mL of the purchased 10 % (w/v)

reagent in a beaker or other suitable container and adding 8 mL of purified water. The resulting 2 % (w/v) solution will be used as part of the cadmium column activation process.

2.5.2 CADMIUM COLUMN ACTIVATION

CAUTION: In case an inadvertent leak occurs during the following procedure, it is prudent to perform all operations with the apparatus placed in a flat glass baking dish with dimensions of about 9" x 18 " x 1". This procedure allows all leaks to be contained and allows for proper cleanup and disposal of any spilled reagents.

- Working in an approved fume hood, open the box and remove the cadmium column assembly – shown in the picture below.



- Wearing appropriate protective equipment, remove the threaded plugs at the ends of the column assembly and set aside for later reassembly.
- Place about 15 mL of 10 % (v/v) hydrochloric acid in a beaker or other suitable vessel. With the syringe plunger fully depressed, place the threaded fitting at the bottom of the syringe assembly in the reagent and withdraw 10 mL into the syringe by pulling back on the plunger.
- Connect the threaded connector on the syringe assembly to one end of the cadmium column and tighten by hand – no tools should be used. Mark the direction of flow that you have chosen through the column by using a marker to place an arrow on the cadmium column assembly.
- Hold the open end of the cadmium column over a beaker or other suitable vessel and then depress the plunger on the syringe assembly to push the acid steadily through the column as shown in the picture below. The entire injection process should take approximately 15 seconds.



- Rinse and fill the syringe assembly with 10 mL of purified water and repeat the injection procedure through the column to rinse out the acid. Again, the injection process should take approximately 15 seconds.
- Rinse the syringe assembly with purified water and fill it with the 2 % (w/v) copper sulfate solution prepared in 2.5.1 above. Connect the syringe assembly to the cadmium column and slowly inject 5 mL of the reagent into the column while holding the open end of the column over a beaker. The injection of the 5 mL aliquot of reagent should take approximately 30 seconds. Do not remove the syringe assembly (which still should contain 5 mL of solution) from the cadmium column .
- Reinsert the threaded plug in the open end of the column assembly.
- Set the entire assembly aside for at least 15 minutes to allow proper activation. No damage to the column will occur if the assembly is left for several hours in this state.
- After the initial activation, remove the threaded plug from the open end of the column, slowly inject the remaining 5 mL of the copper sulfate solution into the cadmium column and again set the assembly aside for 15 minutes or longer after reinserting the plug in the open end of the column.
- Remove the syringe from the assembly and rinse it with purified water. Remove the threaded plug from the other end of the column assembly .
- Fill the syringe with 10 mL of the ammonium chloride buffer solution which was prepared as described in 2.3.3 above. Inject all of the buffer reagent through the cadmium column at a rate so that the entire injection takes about 15 seconds.
- Remove the syringe from the column assembly and reinsert the threaded plugs in each end of the assembly.

The cadmium column is now activated and ready for installation.

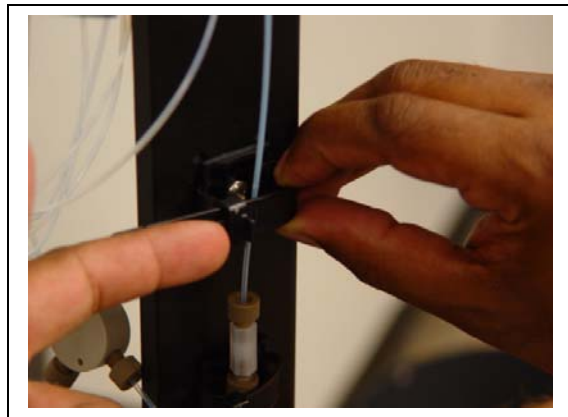
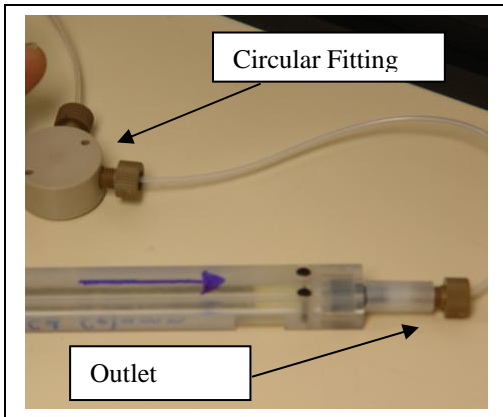
2.6 INSTALLING THE CADMIUM COLUMN

The next step in setting up for deployment is to install the cadmium column in the carousel of the nitrate analyzer. Remove the carousel from the outer shell of the analyzer and place it on the floor or a bench top in the vertical position supported by its three legs.

Locate the two black straps in one of the carousel segments that will be used to retain the cadmium column assembly. Note that there is a section of tubing within the straps with two ends with brown threaded fittings that are connected by a translucent nut.

NOTE: For optimum performance, the cadmium column should be installed in the flow system of the carousel so that the direction of flow through the column is the SAME as that used in its activation.

To make sure that the direction of flow through the cadmium column is correct, note that one of the sections of tubing within the carousel straps tubing goes to a circular tan fitting with two other pieces of tubing connected to it. This fitting on this section should be attached to the OUTLET of the cadmium column as marked during the activation process. See the picture below left to identify the tubing nut that goes to the cadmium tube outlet.



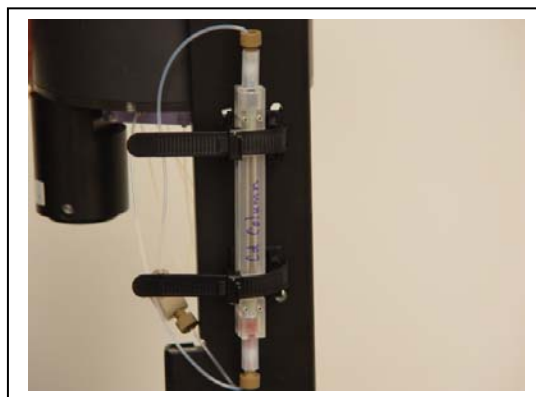
Loosen the straps by pushing up on the tab and pulling on the strap as shown in the picture above right.

Remove the translucent coupling nut so that the two threaded brown fittings are free. As noted above, identify the threaded nut that goes to the circular tan adapter. Remember that this nut should be attached to the OUTLET of the cadmium column assembly.

Screw the threaded fittings on the tubing ends into the ends of the cadmium column assembly after removing the plugs from the column. Use only finger tightening to make the connection – no tools should be used.

CAUTION: Be certain to retain the two black plugs that were removed from the cadmium column prior to its installation. These plugs will be required to seal the column assembly for proper disposal after its reducing capacity has been expended.

Align the connected cadmium column assembly vertically within the strap clamps and pull the end of the straps so that the column assembly is held in place firmly as shown in the picture below. Note that the straps should fit within the indentations on the cadmium column assembly.



Now proceed to the installation of the reagent bags as described in Section 2.7 below.

2.7 INSTALLING THE REAGENT BAGS

The next step in setting up the Model 9600 for field use is to install the six 1-liter reagent bags containing solutions prepared in Section 2.4 above into the nitrate monitor carousel. Remove the carousel from the outer shell of the analyzer and place it on the floor or a bench top in the vertical position supported by the three legs. Then follow the step-by-step instructions below to install the reagent bags.

- Locate the six lines of reagent tubing which have color-coded threaded fitting on the ends. The ends of the tubing with threaded fittings will be found hanging below the middle plate of the carousel and should be retrieved manually. Note that these are the only loose fittings within the carousel, so their identification should not be a problem.
- Note that there are three compartments in the top section of the carousel and that each compartment must hold two reagent bags. The bags will be placed on the hooks that are hanging from the top plate of the reagent compartments.
- Retrieve one of the fittings which is hanging in the carousel, note its color and then locate the filled reagent bag with the same colored tie-wrap on its middle port. Make sure that each bag has the proper reagent as shown in the table below. As long as the color code was followed in the filling of the reagent bags, no possibility of error exists at this step. Make sure that the recovered tubing is routed through the hole in the middle of the bottom plate rather than around the edges.

REAGENT BAG	COLOR
Standard – 2 bags	White
Blank – Purified Water	Black
Buffer	Blue
NED	Red
Sulfanilimide	Yellow
Wash – Purified Water	Green

- Make the tubing to reagent bag connection by screwing the threaded fitting on the tubing into the middle port of the reagent bag. Tighten securely with fingers only – no tools should be used.
- Hang the connected bag from one of the six hooks in the upper plate of the carousel.
- Repeat the sequence for the remaining five reagent bags making sure that there are two bags hanging in each compartment, one on each hook.
- Open the pinch clamps on all bags and flick the middle port of each of the bags with your finger to cause any remaining air bubbles to move to the top (closed end) of the reagent bags as shown in the picture below.



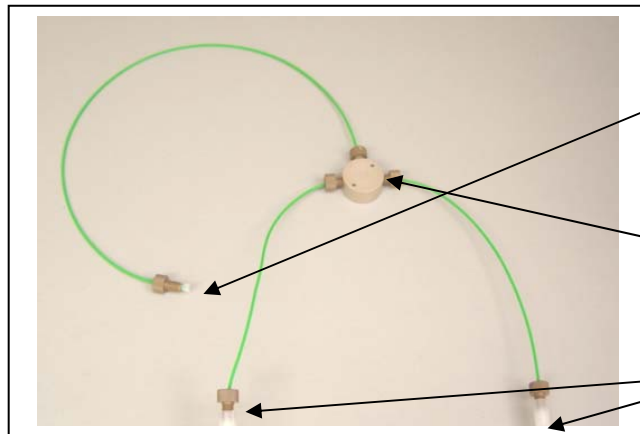
Flick fitting to force bubbles to top of bag

2.8 USING THE WASTE BAGS

As received by the user, the two 5 liter waste bags will already be connected and reside in the bottom compartment of the carousel. However, YSI suggests that users become acquainted with the routing of the tubing to the bags from the pump manifold so that reattachment after each deployment will be easier.

Note that each waste bag is enclosed in a plastic net that will support the weight of the liquid waste during a deployment. The net material is an integral part of the waste bag assembly and should NOT be removed. The waste bag assembly is attached via the metal clips to two hooks on the bottom of the carousel's middle plate. Each of the two waste bag assemblies should be attached to two different hooks for proper function.

Note also that a single waste line from the manifold connects to a "T" fitting which distributes the effluent from the system between the bags as shown in the picture below. Because the flow path to one bag may be slightly more facile than the other, it is not uncommon for effectively all of the waste to accumulate in a single bag until it is full and then the waste stream shift to the other bag. Users should not be concerned by this phenomenon.



From Pump Manifold

T-Fitting

To Waste Bags

2.8.1 REMOVING THE WASTE BAGS

To remove the waste bags, place the carousel on the floor or on a bench in a vertical orientation, supported by its three legs. Then follow the step-by-step instructions below:

- Make certain that the pinch clamps on the two waste bags are CLOSED.
- Remove the threaded fittings from the middle ports of the waste bags.
- Remove the waste bag assemblies (waste bag enclosed in netting) from the hooks on the underside of the center plate of the carousel.
- Set the waste bag assemblies aside for proper disposal of the waste.

CAUTION: The waste solution will contain potentially hazardous organic compounds, hydrochloric acid, and, most importantly, cadmium ions (Cd^{2+}) which are toxic and a potential human carcinogen. Users should be aware of two important warnings when dealing with this waste solution:

- **Be certain to wear appropriate personal protective equipment including disposable gloves and proper protective eyewear when handling the waste bags and the waste solution.**
- **Be certain to dispose of the waste properly. Unless specifically allowed by your local wastewater authority, the waste should NOT be emptied into a sanitary sewer, i.e. a sink drain. Instead, the waste should be collected in a suitable container and disposed of with an approved waste handler. This waste handler should be contacted BEFORE you accumulate waste in laboratory or field studies so that the proper storage vessels are available and a schedule for waste pick-up has been arranged.**
- To empty each bag into the appropriate container, invert the bag so that the port is in the “down” position and is over the waste container. Then carefully open the pinch clamp and allow the waste solution to flow out of the bag. Use gentle pressure on the bag to facilitate the process and make sure that all of the solution has been removed. Note, however, that it is not important to rinse the waste bag before reinstallation.

2.8.2 ATTACHING THE WASTE BAGS

To install the waste bags prior to deployments, place the carousel on the floor or bench in a vertical position supported by its three legs, as shown in the pictures above, and follow the step-by-step instructions below.

- Open the pinch clamp on the port of the waste bag and place the bag assembly on a flat surface.
- Place your hand on the closed end of the bag and move it across the bag toward the end with the fitting, squeezing out any air through the pinch clamp fitting.
- Close the pinch clamp.
- Locate one of the tan-colored threaded fittings on the waste lines and attach it to the pinch clamp port of the waste bag. Tighten securely with fingers only – no tools should be used.
- Hang the empty waste bag assembly (waste bag in netting) on two of the hooks on the underside of the center plate of the carousel.
- Install the second waste bag repeating the steps above.

- Open the pinch clamps on the ports of the waste bags.

2.9 ASSEMBLING THE NITRATE MONITOR

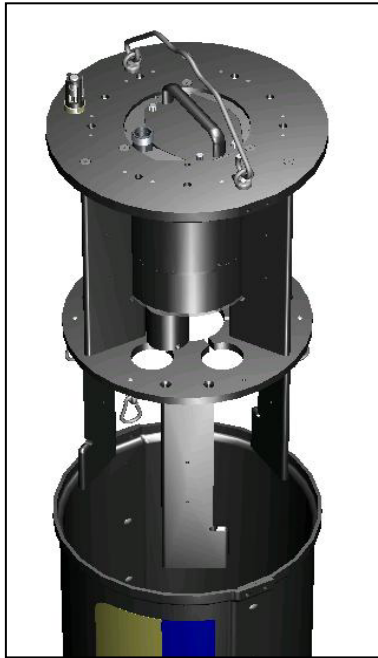
Before assembling the Model 9600 nitrate monitor for deployment, make sure the following has been done:

- The cadmium column has been activated properly and installed in the carousel.
- The six reagent bags have been filled, attached to the proper connectors, are properly installed, i.e., hanging from individual hooks in the carousel, and all of their pinch clamps have been OPENED.
- The two waste bag assemblies are properly attached to the effluent lines and the metal rings at the tip of each assembly are attached to the hooks on the bottom of the carousel center plate. OPEN the pinch clamps on the waste bag assemblies.

CAUTION: Make absolutely certain that the pinch clamps on all of the bags (reagent and waste) are OPEN so that fluid can be pumped within the system. Failure to open ALL pinch clamps will result in total failure and may damage the pumps.

After this check list has been completed, assemble the 9600 by following the instructions below:

- Place the outer shell of the monitor on the floor near the carousel.
- Lift the carousel by the bail, raising it above the top of the outer shell as shown in the picture below:



- Slide the carousel into the outer shell making sure that the two rectangular indentations on the top plate of the carousel are aligned with the black strips on the outside of the outer shell as shown in the pictures below. Note carefully that the inlet filter should be on the side of the strip that has two

eyebolts attached to it. The picture on the left below shows the correct orientation; the one on the right shows the incorrect placement of the carousel within the outer shell.

CAUTION: Make certain that no sections of tubing are pinched between the outer shell and the carousel during the assembly process.



Correct

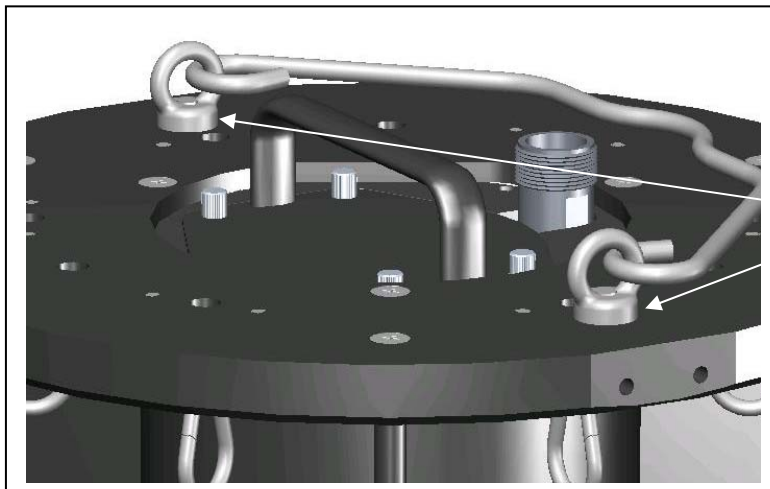


Incorrect

- With the carousel supported by the outer shell and the top plate slots aligned with the outer shell strips, press down on the top plate until the outer shell is seated in the circular slot on the carousel top plate and the four (4) side screw holes in the strips on the outer shell are aligned properly with the holes in the top plate.
- Install the four screws that were set aside in the disassembly process described in Section 2.1 above. Use either a standard Phillips head screwdriver for this process or a battery powered driver with a Phillips bit.

CAUTION: If a power driver is used, make sure that it is on a minimal torque setting to avoid overtightening the screws.

CAUTION: The eyebolts which are used to attach the bail to the top of the carousel are DESIGNED TO BE AT AN ANGLE as shown in the picture below. Do NOT attempt to straighten the alignment of the eyebolts.



DO NOT CHANGE ALIGNMENT OF EYEBOLTS

SECTION 3 PREPARING FOR A 9600 DEPLOYMENT

In Section 2, you set up the physical components of your Model 9600 – cadmium column, reagent bags, and waste bags. In this section, you will learn how to install the PC software which allows interface to your 9600, power your instrument with either a battery pack or a power supply, attach a cable to the 9600, and establish an interface between the nitrate monitor and your PC.

3.1 INSTALLING NUVIEW PC SOFTWARE

Locate the NUview CD-ROM which was shipped as part of your 9600 package and which you unpacked in Section 2.1 above. The CD contains a file that will install software to your PC that will allow you to interface to the 9600 in order to:

- Configure your instrument for a deployment
- Start a deployment
- Interact with the 9600 during deployments to upload data
- Stop a deployment

This software is designated NUview and the Model 9600 can ONLY be operated from a computer which is running this software.

3.1.1 SYSTEM REQUIREMENTS

NUview software will run properly on computers with the following characteristics:

- IBM Compatible PC
- Windows® 2000, or XP
- 32 MB memory
- 20 MB available disk space
- CD-ROM Drive
- RS-232 Serial Port
- Monitor capable of 800 x 600 resolution or better

3.1.2 SOFTWARE INSTALLATION

To install NUview software to your computer, perform the following steps:

- Place the NUview CD-ROM into the CD drive of your computer.
- Use Windows Explorer or My Computer to view files on the CD-ROM. Double-click on the **Setup.exe** file.

The display will indicate that the set-up routine is proceeding. Follow the instructions on the screen as the installation proceeds. For most applications, the default settings should work without problems. After installation, there is no need to restart the computer.

3.2 CHOOSING A CABLE FOR THE 9600

Depending on your applications, several YSI cables can be used to interface your 9600 to a computer running NUVIEW software. The use of each of the cable types is explained below.

3.2.1 MODEL 6067B LABORATORY CABLE

The 6067B is a short cable with a slide-in connector for the 9600 communication port on one end and a DB-9 (for serial computer connection) on the other. The cable also has an MS-4 connector which can be used to input power to the 9600 from the optional 9689 power supply – see section 3.3.2 below for more information on the 9689. If your applications involve the remote deployment of the 9600 where the instrument is powered on internal batteries and then recovered for data upload, then the relatively-inexpensive 6067B is probably the ideal cable interface to your 9600. The cable can be used in the laboratory to set up the instrument for deployments as described in Section 4 below and to upload data in the laboratory or in the field when no provision for a water tight connection to the 9600 is required. However, users should note the following limitation of the 6067B before choosing to purchase this cable for use with the 9600:

- The connection between the cable and the 9600 is NOT watertight and so the cable cannot remain in place for field deployments

To use the 6067B with your 9600, simply align the keys on the “sonde” end of the cable and the communication port on top of the 9600 and press the connectors together. Then plug the DB-9 end of the connector into a serial port on a computer running NUVIEW software. To power the instrument using the 9689 power supply, connect the MS-4 connector on the 9689 to the mating connector on the cable.

3.2.2 STANDARD YSI 6-SERIES CABLES

Users of the 9600 who also have YSI 6-series field cables, such as the Models 6090, 6091, 6092, or 6093, can utilize these cables for interface to the 9600 under limited conditions. These cables have a silver, water-tight “sonde” connector with a knurled nut on one end and a smaller military-style (MS) connector on the other end. When using these cables to interface to the 9600, the optional YSI 6095B MS-8 to DB-9 adapter must be connected to the MS-8 end of the cable. Place the MS-8 ends of the cable and adapter together, and rotate until the alignment pins engage and the male and female portions of the connector slide together. Once the bodies of the connectors are fully engaged, twist the knurled ring on the cable until the two pieces lock together.

Once the cable is assembled, attach the knurled silver connector to the communication port on the top of your 9600. Rotate the knurled end until the metal “key” engages and then tighten the connector by turning the knurled nut clockwise using fingers only – no tools should be used.

Connect the DB-9 end of the cable assembly to a serial port of the PC on which you have installed NUVIEW software in Section 3.1 above.

CAUTION: Users with existing 6-series field cables should be aware of the following limitation for use with the 9600.

- The 9600 CANNOT be powered by auxiliary devices such as the 9689 power supply, 12 volt lead acid batteries, or data collection platforms during deployments using these cables. The current draw when the 9600 is actually making measurements is too great for the wires in the cable.

3.2.3 MODEL 9600 FIELD CABLES

As noted in Sections 3.2.1 and 3.2.2 above, the major limitation of the use of existing YSI cables with the 9600 is that the nitrate monitor CANNOT be powered externally through these cables during deployments using the 9689 power supply, auxiliary batteries, or data collection platforms. However, special field cables such as the 9691, 9692, and 9693 are available for use with the 9600 under these conditions. These cables utilize heavier gauge wires than the standard YSI cables such that the 9600 can be remotely powered for distances of up to 100 feet between the power supply and the nitrate monitor.

NOTE CAREFULLY: The 96XX series field cables can be identified by the YELLOW plastic overmold on each of the connectors. The standard YSI 6-series cables have BLACK plastic overmolds on the connectors.

As described above for the standard 6-series cables in Section 3.2.2, users must utilize a 6095B adapter with the 96XX cables in order to interface to a computer running NUview software

Remember that if you will be powering your 9600 IN THE FIELD USING AUXILIARY POWER OF ANY TYPE you will need to use a 96XX field cable – a standard 6-series cable will NOT function in this mode.

Once you have selected the cable that is suitable for your application, proceed to the next section on applying power to the 9600.

3.3 POWERING THE 9600

3.3.1 INSTALLING AND USING THE BATTERY PACK

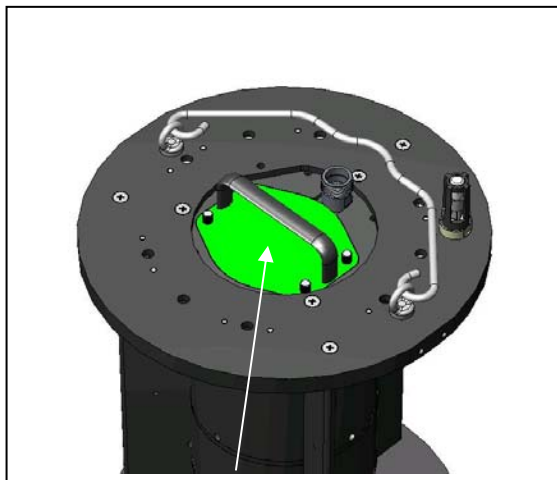
For remote deployments, the Model 9600 operates off a factory sealed battery pack containing 14 alkaline D batteries operating at an initial voltage of approximately 10.5 volts. A battery pack has been shipped with your 9600 and will be found in the battery compartment as described above in the unpacking instructions.

NOTE: For initial set-up of the 9600, YSI recommends using the battery pack as described below. However, if you have purchased the Model 9689 power supply, you may also use this item to power the instrument during the set-up process. If you wish to use the 9689 in the absence of batteries, proceed to Section 3.3.2 below.

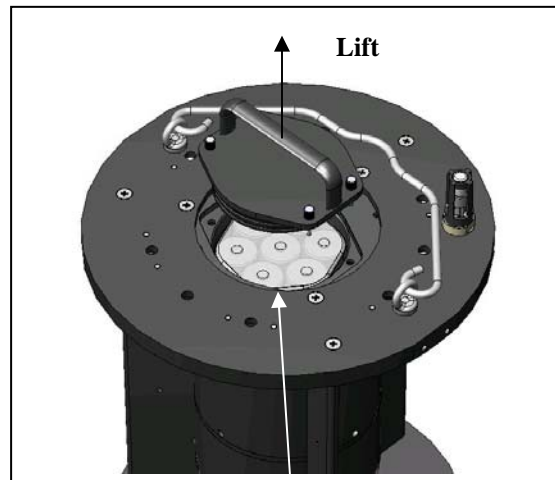
CAUTION: Users should use ONLY battery packs which have been purchased from YSI for use with the 9600. Use of alternative battery packs could damage the instrument.

To properly install the Model 9600 battery pack, follow the step-by-step instructions below:

- With the assembled Model 9600 in a vertical position on the floor or a benchtop, locate the battery lid on top of the instrument as shown in the picture below left:



Battery Lid



Battery Pack

- Using your fingers only, loosen the four captive screws on the battery lid until they turn freely. NOTE: If the screws are too tight to remove by hand, it is permissible to use a slotted screwdriver to loosen them.

CAUTION: The battery lid screws are captive. Do NOT continue to turn them after the battery lid can be removed.

- Grasp the handle on the battery lid and pull straight up to remove it, exposing the battery compartment as shown in the picture above right. Set the lid aside for later reassembly.
- Locate the hexagonal battery pack that is stored in the battery compartment and is shown in the picture above right. Note that there is a cable attached to the battery pack with a 2-wire connector.
- Note that there is also a cable coming out of the side of the battery compartment that also has a mating 2-wire connector.
- Connect the two 2-wire connectors together to power the instrument from the battery pack.
- Replace the battery lid and tighten the four screws using your fingers only.

IMPORTANT: If the two battery cables are connected, then the batteries are slowly being discharged even if the instrument is not being used actively. Therefore, for periods of inactivity lasting more than a few hours, YSI recommends that you remove the battery lid and disconnect the two connectors in order to maximize the lifetime of your battery pack.

3.3.2 USING THE MODEL 9689 POWER SUPPLY

Although the Model 9600 has internal batteries, using the optional Model 9689 power supply for laboratory studies and for instrument calibration and set-up is often convenient and extends battery life. The 9689 will automatically convert line voltages of 90 to 264 VAC to 12 VDC and allows for the use of line input cords from most countries world-wide. The Model 9689 is supplied with an American/Canadian cord.

To use the 9689, attach the four-pin connector from the power supply to the mating connector on the 6067B cable or the 6095B adapter when using a field cable. Twist the connectors together and then simply plug the power cord into the appropriate AC outlet. The 9600 is equipped with reverse voltage protection so

that both the battery pack described in 3.3.1 above and the 9689 power supply can both be plugged in with no concern about damage to the alkaline batteries.

CAUTION: Remember that it will ONLY be possible to power the 9600 with the 9689 for field applications when a special 96XX cable with yellow plastic ends is used. While the 9689 can be used with standard YSI cables for instrument set-up and data upload, it cannot be used to power the instrument for actual field studies.

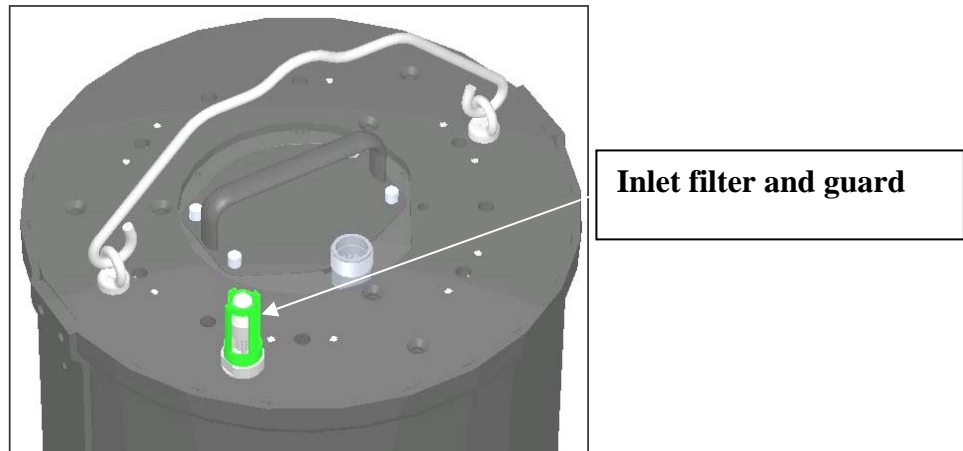
CAUTION: Note that, while physically compatible with the 9600 cables (see below), other YSI power supplies such as the 6037, 6038, and 6123 should NOT be used with the 9600 since they do not supply enough power to operate the pumps correctly, regardless of the cable used.

3.4 ATTACHING THE SECOND STANDARD BAG

For the Predeployment Check described in Section 4.2 below, the “sample” which is run should be identical to the standard used for the deployment. To carry out this step, you must locate the second standard bag which has tubing assembly attached to its middle port and which was filled with standard in Section 2.4 above.

To install the second standard bag for the predeployment check, follow the step-by-step instructions below:

- Use the picture below to locate the inlet filter and its guard which are located on the top of the top plate of the carousel.



- Remove the inlet filter guard by unscrewing it in a counterclockwise direction and set it aside for later use.
- Remove the inlet filter assembly by unscrewing it in a counter clockwise direction and set it aside for later use. Be sure to unscrew the entire assembly by grasping it close to the inlet port rather than grasping just the filter itself.
- Lay the second standard bag on the top of the carousel and attach the white threaded fitting on its tubing assembly to the inlet filter port as shown in the picture below. Tighten with finger pressure only – no tools should be used.



- Open the pinch clamp on the middle port of the second standard bag.
- Hold the bag vertically so that the ports are on the bottom and tap the middle port to cause any trapped air to move to the bottom of the bag.

If you have followed the step-by-step instructions above, your 9600 should be:

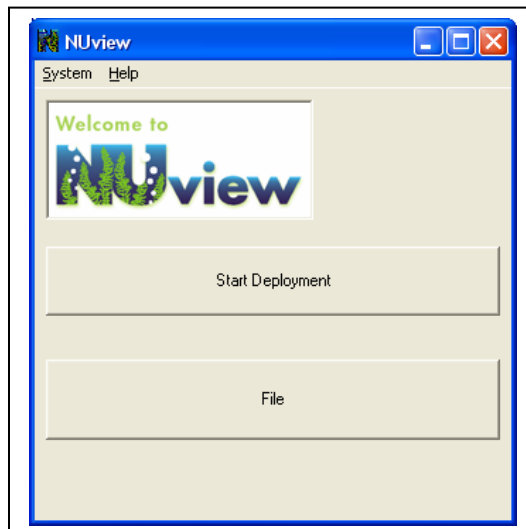
- Equipped with full reagent bags.
- Equipped with empty waste bags.
- Reassembled with the carousel inside the outer shell.
- Have the second standard bag attached to the 9600 inlet port.
- Powered using either the internal battery pack or the 9689 power supply.
- Attached to a serial port on a PC on which you have installed NUview software.

Make certain that all of these steps are complete before proceeding to the next section where you will interface to the 9600 using NUview software.

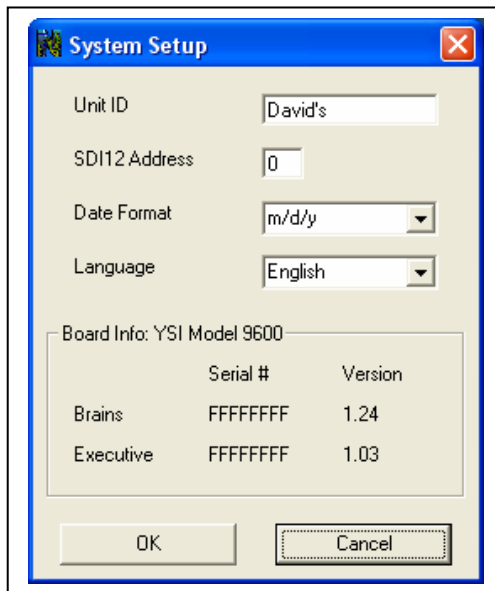
3.5 INTERFACING TO THE 9600

To run NUview software, click on the Windows **Start** button. Go to **Programs>NUview** and click on the NUview icon.

The program will display the following screen.



Clicking on the **System** selection in the top menu bar and then choosing the **Select** entry will display the following screen that allows you to set up several items for later use.



Before proceeding, you should enter the following information in the System menu:

- Select a designation for your 9600 and type it in under Unit ID. This entry must be 15 characters or less.
- Select an SDI12 address for your unit if you are going to use it with a data collection platform. YSI recommends leaving the value at the default of zero (0) unless you have a specific reason to change it.
- Enter the date format by clicking on the arrow and selecting the preferred format.
- In time, you will be able to select from a variety of languages for the NUview menus. At the time of release, however, only English is available, so no choice is possible for this item.

The **“Board Info”** data at the bottom of the display cannot be changed by the user and shows the current versions of firmware in the two circuit boards that are present in the 9600.

Clicking on the **Help|About** selection in the top menu bar will display the following screen and will allow you to ascertain the current version of NUview software on your PC.



Now proceed to Section 4 of the manual where you will begin a 9600 deployment.

SECTION 4 STARTING A 9600 DEPLOYMENT

4.1 UNDERSTANDING CALIBRATION OF THE 9600

As described above, part of the reagent package of the 9600 is a standard (usually 1mg/L or higher concentration for a 9600-02 and 1 mg/L or lower for a 9600-10) and a blank (purified water with no nitrate present). These reagents are run through the system periodically during a deployment providing on-board calibration that compensates for any instrument drift. These calibration points are used to convert the optical readings from actual samples into nitrate values in mg/L of nitrate-N. This calibration protocol is transparent to the user.

When starting a 9600 deployment, users will have to make three choices that will affect the calibration of the instrument during the study. These choices are input to the 9600 software in the deployment “Wizard” which is described in Section 4.4 below.

1. The first choice is the **frequency of calibration**, i.e., how often the standard and blank are run during a deployment. YSI generally recommends that calibration be carried out every 12 hours and no less often than once every 24 hours. The number that you will enter is the number of samples between calibration points. Thus, if you want to calibrate every 12 hours and your sample interval is 1 hour, you would enter 12. However, if your sample interval were 30 minutes (0.5 hours) you would enter 24 to obtain a calibration every 12 hours.
2. The second choice is the **concentration value for the nitrate standard** in units of mg/L of nitrate-N. YSI recommends the use of a standard with a concentration of 1 mg/L for your first deployment at a given site. If it turns out that the nitrate levels at this location are consistently lower or higher than this value, then you can choose standards of other concentrations for subsequent studies.
3. The final choice is your **sample interval** that does in fact have an indirect effect on the **timing** of the calibration. A standard calibration protocol (blank and standard analyzed by the 9600 flow system) takes slightly less than 15 minutes to complete. This means that it is not possible to run the calibration routine between samples at the lowest allowed sample interval of 15 minutes. If a 15 minute sample interval is selected, the calibration sequence will thus displace one data point, slightly interrupting the continuous data stream. For sample intervals over 15 minutes, the calibration will automatically occur between samples and a continuous data stream will be logged at the user-selected interval.

NOTE CAREFULLY: When using your 9600 with a data collection platform (DCP) via an SDI-12 interface, the MINIMUM SAMPLE INTERVAL ALLOWED IS 30 MINUTES. See Section 5.5 below for details on the setting up of your instrument for DCP interface.

More information on these selections is found in Section 4.4 below.

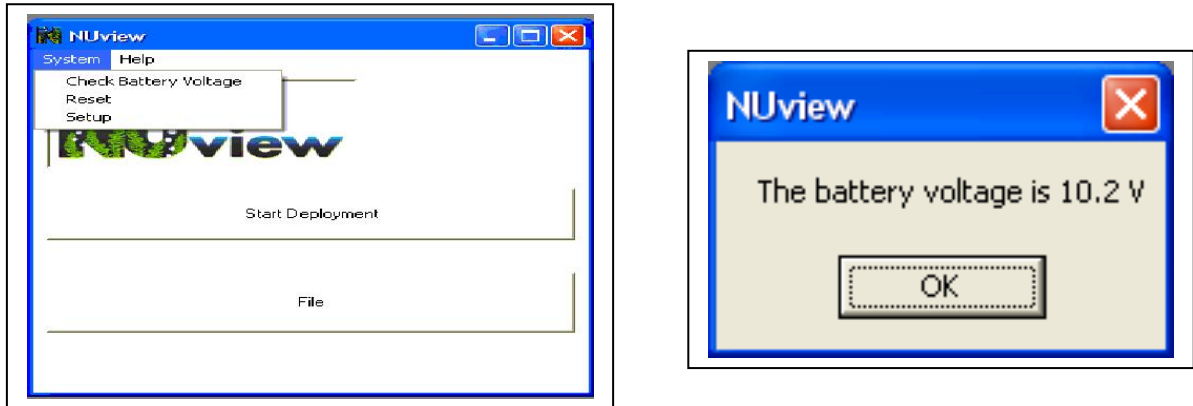
4.2 CHECK LIST FOR DEPLOYMENT READINESS

After interfacing to the 9600 with NUview software as described above, the following display will be shown.



4.2.1 PREDEPLOYMENT BATTERY VOLTAGE CHECK

The voltage associated with your alkaline batteries will help you to determine if you have sufficient battery capacity prior to a deployment. To read the battery voltage, click on the **System** selection in the top menu bar and the display shown below left will appear. Click on the **Check Battery Voltage** selection and the current battery voltage will be displayed as shown below right.

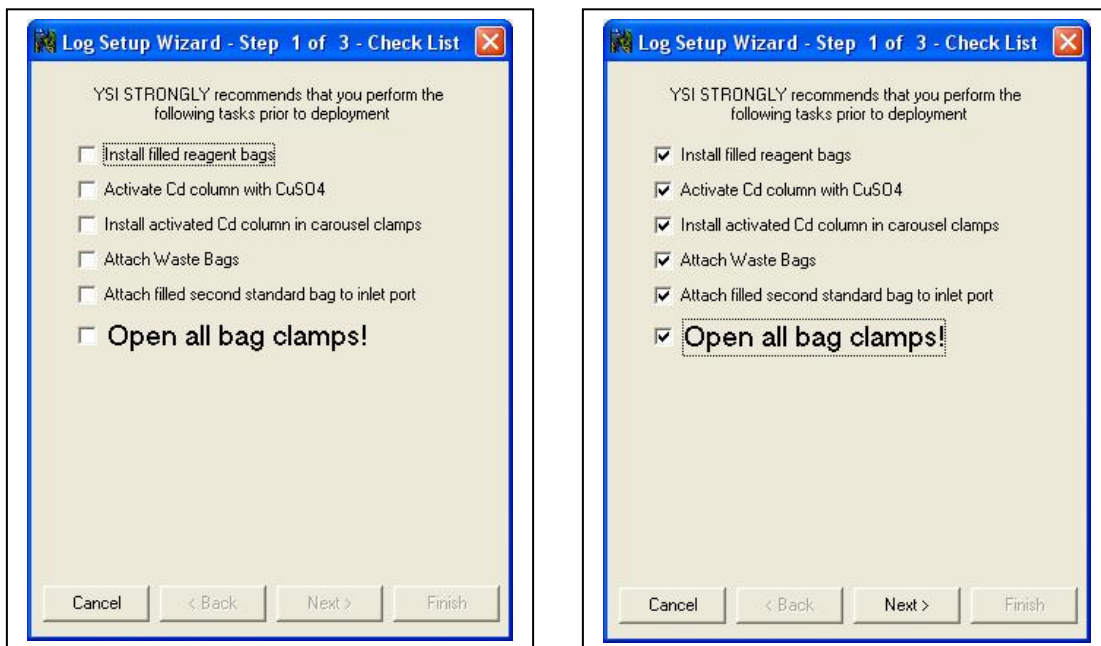


With regard to the battery voltage, YSI recommends the following:

- Check your battery voltage before each deployment.
- Make sure that the battery voltage is at least 10.0 volts prior to any deployment of 30 days or greater.

4.2.2 PREDEPLOYMENT HARDWARE CHECK

To continue the process of setting up the 9600 for a field deployment, click on the Start Deployment button to move to the screen shown below left. This screen is designed as a reminder to perform a critical system check prior to moving to the next step. Carefully read each item and when you are sure that the action has been completed, click the box to activate a check mark. Note that all items **MUST** be checked as shown below right before it is possible to proceed to the next step.



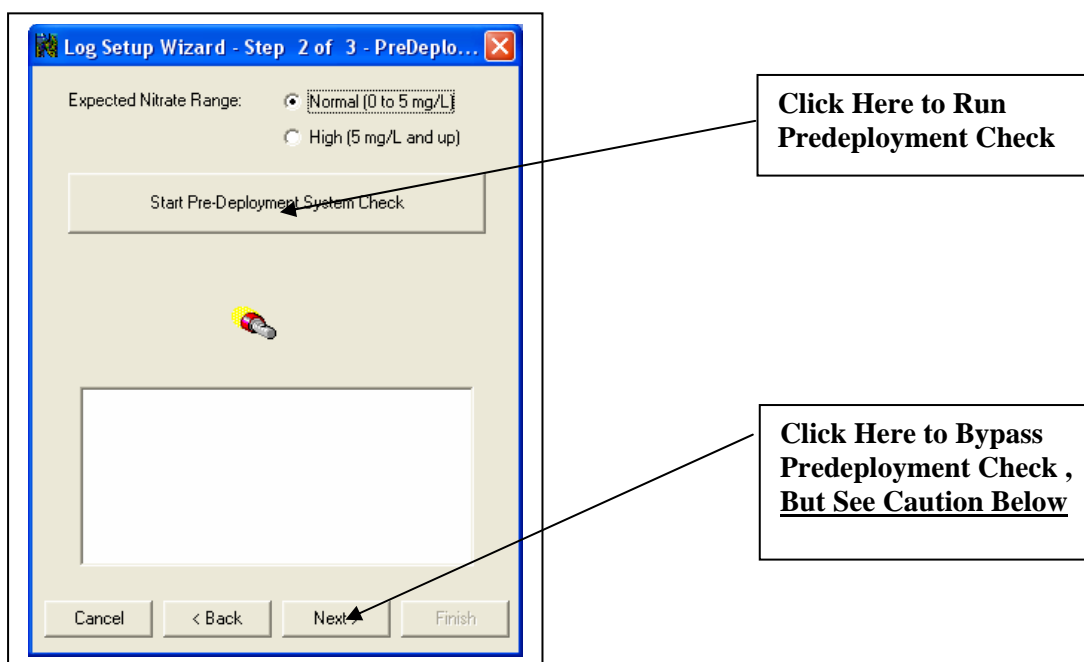
After all items have been checked, click the **Next** button to proceed to the Predeployment System Check as described in Section 4.3 below

4.3 PREDEPLOYMENT SYSTEM CHECK

After clicking the **Next** button in the Check List box, the following screen will appear:

First, select the range in which you anticipate your field nitrate readings to be – 0-5 mg/L for “Normal” readings and 5-10 mg/L for “High” readings – by clicking the proper button. Note that you should always select the “Normal” setting when using a 9600-10 with a 10 mm detector cell.

Now make a decision on the running of a Predeployment System Check as described below.



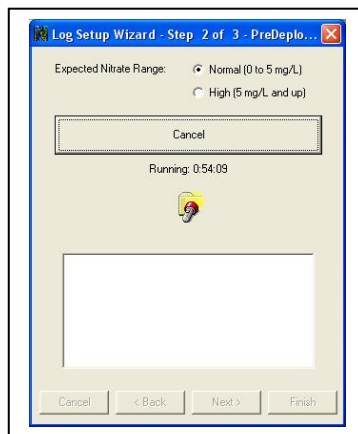
From the above screen, you have the ability to choose one of two options:

- **Run** a Pre-Deployment System Check which will assure that your instrument will function correctly in an upcoming deployment by clicking the button as shown in the figure above.
- **Bypass** the Predeployment System check and proceed immediately to the next portion of the Deployment Wizard by clicking the Next button as shown in the figure below.

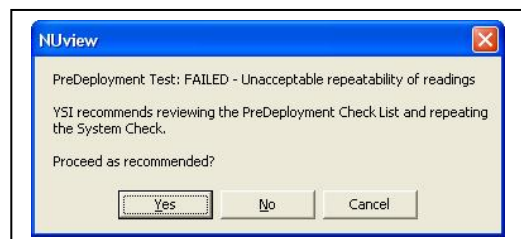
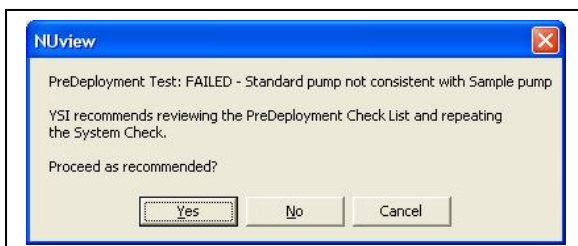
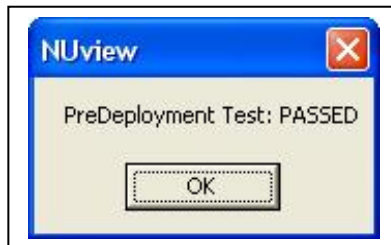
CAUTION: YSI strongly recommends that you perform a predeployment check prior to each deployment. If you do NOT carry out the test, you may deploy your instrument for several days and then find that your data is flawed because of some instrument malfunction, e.g., improperly installed reagent bags or pinched tubing. Further, without the predeployment test, the accuracy of your data may be compromised by the fact that you will not have calibrated the relative volumes of the sample and standard pumps as described in Section 8.6 below. Finally, if you deploy without performing a Predeployment Check and experience any difficulties with the system performance, it will be much more difficult for the problem to be isolated by YSI Technical Support personnel. With this in mind, USERS SHOULD ALWAYS PERFORM A PREDEPLOYMENT CHECK UNLESS ONE OF THE SPECIAL CONDITIONS DESCRIBED BELOW IS RELEVANT.

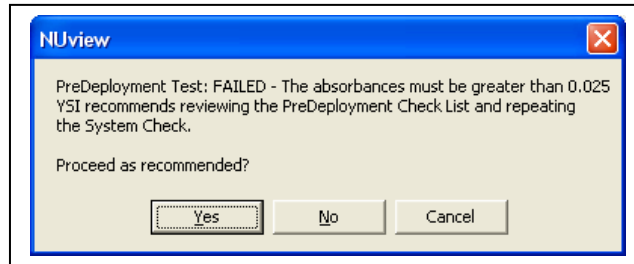
- You wish to start a deployment study IN THE FIELD as described in Section 4.4 below and you have already run (and passed) a Predeployment Check in the laboratory.
- After performing and passing the Predeployment Check and starting a deployment as described below, you realize that a mistake has been made in one or more of the entries you made in the Predeployment Setup Wizard as shown below. These entries include the sample interval, the file and site names, the standard concentration, and the time for starting the deployment. Under these conditions, you should stop the deployment and then return immediately to the Predeployment Setup screen, and then bypassing the Predeployment Check by clicking the Next button.
- After deploying an instrument following a successful Predeployment Check and valid Predeployment Setup entries, you return to the field, access the instrument in real-time with a laptop PC and decide that conditions warrant a change in either file/site name (you might be moving the instrument to a new location) or sample interval. As above, you should then stop the deployment, return immediately to the Predeployment Setup screen, and then bypass the Predeployment Check by clicking the Next button.

For most deployments, click the “Start Predeployment System Check” button to proceed. The following screen will appear indicating that the predeployment check has begun. Note that a countdown timer will indicate the progress of the test and that the test will take approximately 1 hour. If you want to stop the test for any reason, simply click the “Cancel” button at the top of the window.



After the test is complete, one of two types of display will appear – indicating that the test was successful or that it failed the test criteria – as shown below.



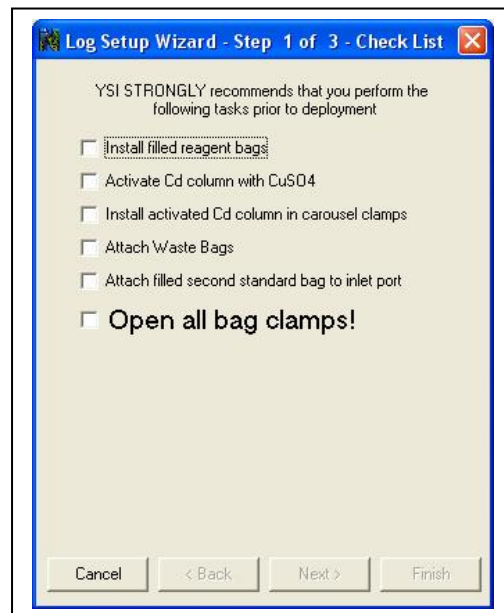


If the test was passed, simply click “OK” and then click the **Next** button to proceed to the final set-up screen.

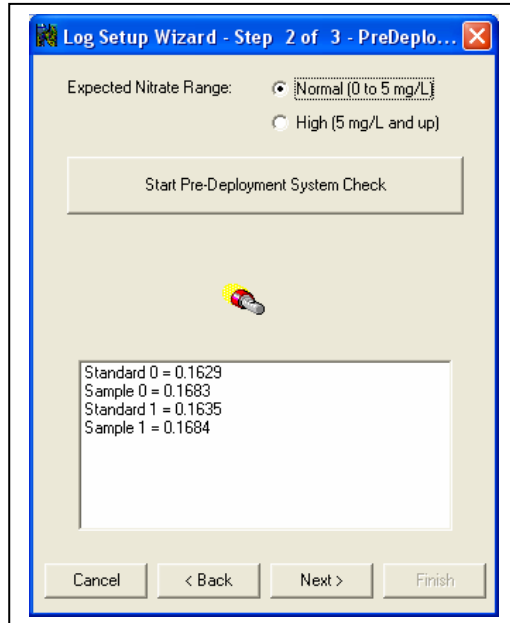
If the display indicates that there was a failure in the predeployment systems test, note the nature of the failure mechanism as shown above:

1. The error message on the left indicates that the absorbance readings from the sample and standard (which are identical in the Predeployment Check) differ by more than the standard tolerance.
2. The error message on the right indicates that the absorbance readings from the two runs differ by more than the standard tolerance.
3. The error message at the bottom indicates that the absorbance readings of either the standard or the sample (or both) are too low.

Next see Section 10, Troubleshooting, for help in overcoming the problem and repeat the Predeployment Check by clicking the “Yes” button on any of the error codes to return to the first screen of the Deployment Wizard as shown below.



If the error messages continue to be observed, click the “No” button in the error window to show the following diagnostic screen.



Then contact YSI Technical Support for advice and have the following information available for the YSI representative:

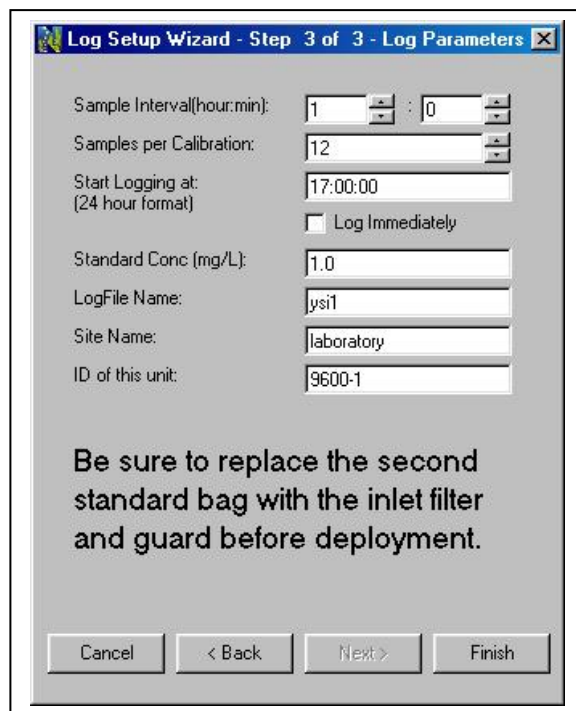
- The nature of the error message as noted in (1), (2), or (3) above.
- A copy of the absorbance values that are shown on the screen after the test has failed similar to that shown above.

Note that you also have the option to click the **Next** button after clicking the “No” button in the diagnostic screen and move ahead with the deployment with the knowledge that there could be a problem with your system. **HOWEVER, YOU SHOULD ONLY CHOOSE THIS OPTION IF, AFTER CONTACT WITH YSI TECHNICAL SUPPORT PERSONNEL, YOU UNDERSTAND THE NATURE OF THE FAILURE MECHANISM AND HAVE DETERMINED THAT IT WILL HAVE ONLY A MINOR EFFECT ON DEPLOYMENT DATA.**

After completing the Predeployment System Check, proceed to Section 4.4 below to set up the instrument software for your particular deployment.

4.4 PREDEPLOYMENT SET-UP

When clicking the **Next** button after the Predeployment System Check has either been passed or bypassed, the following screen will appear in which you will enter important information about your field study as described below:



- Select the **Sample Interval** for your study – the time between samples in hours:minutes. Use the incrementing/decrementing buttons or simply click on the box and enter a number from the PC keyboard. Allowed intervals are 15 minutes and all other even increments of 15 minutes such as 30, 60, 75, 90 minutes. The software will NOT allow the entry of Sample Intervals that are not increments of 15 minutes. For example, Sample Intervals of 25 minutes or 1 hour and 55 minutes would be rejected. For your first deployment, YSI recommends a Sample Interval of 1 hour.

NOTE CAREFULLY: When using your 9600 with a data collection platform (DCP) via an SDI-12 interface, the MINIMUM SAMPLE INTERVAL ALLOWED IS 30 MINUTES. See Section 5.5 below for details on the setting up of your instrument for DCP interface.

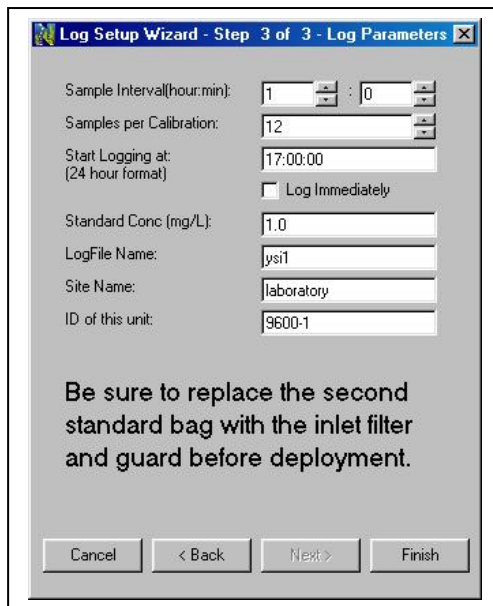
- Choose a value for the **Samples per Calibration** entry – the number of actual sample readings between calibration points. If you select a 1 hour sample interval and 12 Samples per Calibration, then your instrument will be calibrated every 12 hours or twice a day. For your first deployment, YSI recommends a **Samples per Calibration** value of 12 together with a **Sample Interval** of 1 hour
- Choose a time to **Start Logging** – the time that your deployment will actually start. Note, however, that the first two points in every deployment sequence are a blank and a standard and to complete this calibration routine requires slightly less than 15 minutes. The 9600 software takes this calibration into account and will automatically run the first actual sample at the next “even” sample interval point after the calibration. Thus, if you choose 15:00:00 as the time to “Start Deployment”, the calibration routine will start at 15:00:00 and your first sample will be run at various points depending on what sample interval you chose as documented below:

Sample Interval	Time of First Sample
15 minutes	15:15:00
30 minutes	15:30:00
1 hours	16:00:00
2 hours	17:00:00

Note that you can also choose to **Log Immediately** by clicking on the box to activate a check mark, in which case the calibration routine will start as soon as you complete the information on the set-up screen and click the **Finish** button. Users should be aware that choosing this option will almost always result in their samples being run at times that are not on the hour, the half hour, or the quarter hour. As an example, if you choose a 1 hour sample interval and choose the **Log Immediately** option and start the study at 15:50, the calibration routine will begin immediately and the first sample will be logged 1 hour after the start of the calibration, i.e., at 16:50.

- Enter the **concentration value** of the standard that you have chosen to use. **VALUES MUST BE ENTERED IN MG/L OF NITRATE-NITROGEN.** YSI recommends that you use a standard with a value of 1.00 mg/L nitrate-N for your first deployment.
- Enter the **LogFile Name** – the designation that will identify the data from the study both within the 9600 memory and after upload to your computer. **NOTE CAREFULLY:** The LogFile entry must be 8 characters or less and must not use illegal Windows filename characters such as /, \, |, period, colon, asterisk, question mark, greater than, less than, space and comma.
- Enter the **Site Name** – usually this is simply a phrase that describes the deployment such as “Upstream Bridge at Clear Stream”. Note that all keyboard characters can be used for the Site Name, but the length is limited to 31 characters.
- Confirm that the ID which you entered in Section 3.5 above is correct or alter it if desired.

Once you have entered all of the information into the set-up Wizard, simply click the **Finish** button at the bottom of the screen and the confirmatory display shown at right below will appear.

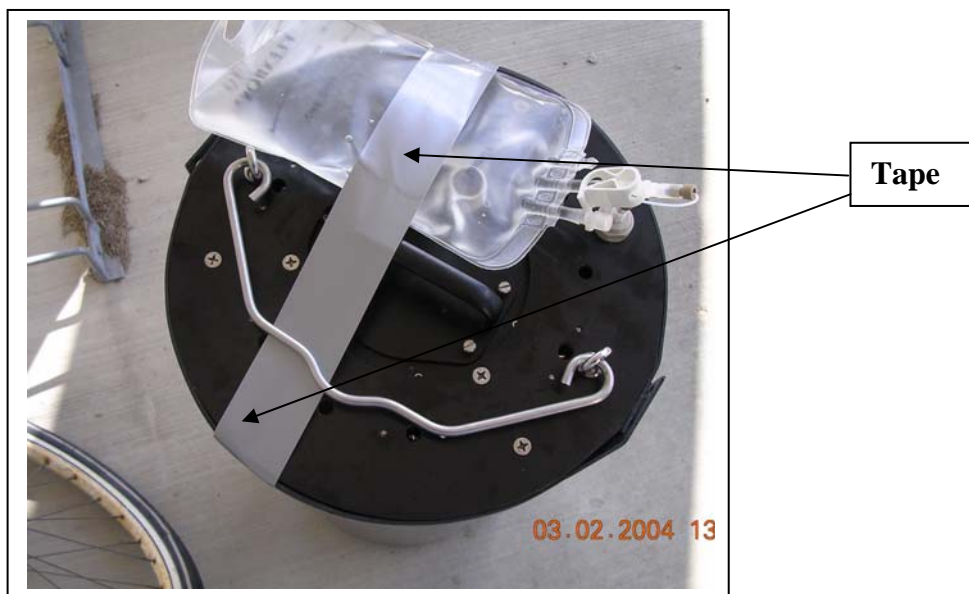


IMPORTANT: After you start your deployment, you **MUST** make a decision as to **WHEN** to remove the second sample bag from the inlet port and replace it with the inlet filter. The choice of time for the change is dictated by the fact that the 9600 should not attempt to run a sample when there is no liquid covering the inlet port. If the inlet filter is exposed to air when a sample routine is run, air will be sucked into the system and could compromise the accuracy of several subsequent points until all of the gas is purged from the system. In addition, extended pumping of air into the system will inactivate the cadmium column and result in complete instrument malfunction. To prevent problems from developing, you have two choices:

CHOICE 1:

Start the deployment but LEAVE THE SECOND STANDARD BAG IN PLACE UNTIL YOU ARE ACTUALLY AT THE FIELD SITE AND THEN REPLACE IT WITH THE INLET FILTER. This procedure effectively eliminates any chance that air will be sucked into the system no matter what the timing of your deployment. YSI GENERALLY RECOMMENDS THAT YOU FOLLOW THIS PROCEDURE FOR MOST DEPLOYMENTS. **NOTE, HOWEVER, THAT IF YOU CHOOSE THIS OPTION, YOU NEED TO BE SURE TO DO THE FOLLOWING:**

- **Tape the second standard bag to the top of the carousel as shown in the picture below so that it does not move in transit and disconnect from the analyzer inlet port.**



- **Remember to take the inlet filter assembly (filter and guard) with you when you proceed to the deployment site**

CHOICE 2:

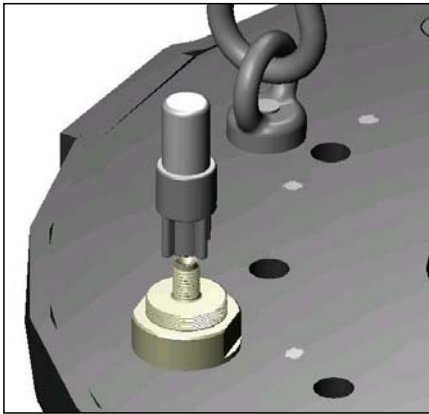
Replace the second standard bag with the inlet filter in the laboratory before the deployment begins. Then either start the deployment in the field via interface to a laptop PC at the site or start the deployment far enough into the future that you will be assured of having the instrument submersed at the site before a sample routine is run. The latter procedure will work in most cases, but there is always the chance that your trip to the deployment site will be delayed and a sample will be run before the inlet filter is submersed and air will be introduced into the system.

NOTE: You should run at least one Predeployment Test after attaching your 9600 to a PC in the laboratory and prior to starting a deployment. If you choose to exit NView and then start the study in the field using a PC you should follow the instructions in Section 4.3 above to BYPASS the Predeployment Check.

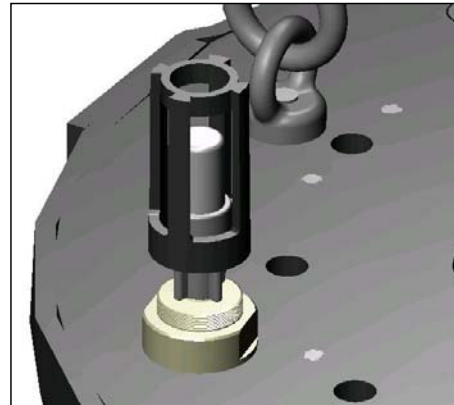
4.5 INSTALLING THE INLET FILTER

To install the inlet filter to the inlet port, refer to the pictures and step-by-step instructions below:

- Close the pinch clamp on the second standard bag.
- Remove the second standard bag fitting from the inlet port and set the bag aside for future use.
- Thread the inlet filter assembly onto the inner threads of the inlet port and tighten by hand – no tools should be used.
- Thread the inlet filter guard onto the outer threads of the inlet port assembly and tighten by hand – no tools should be used.



Install inlet filter assembly



Install inlet filter guard

Remember to submerge the inlet port of the 9600 at the deployment site **BEFORE THE FIRST SAMPLE IS RUN** to prevent air from being sucked into the system.

After completing Section 4 of the manual, you will have:

- Referred to a Check List to make sure that the hardware and reagent systems are set up properly.
- Run a Predeployment System Check to prove that your system hardware is functioning properly.
- Entered important information about your particular deployment into a set-up Wizard.
- Made a decision as to when you will install the inlet filter on your sample line.
- Started the deployment.

Section 5 below provides hints on how to pick a deployment site, how to power the 9600 in the field, how to interface to the nitrate monitor to access your data, and how to use the 9600 with a data collection platform.

SECTION 5 USING THE 9600 IN THE FIELD

5.1 PICKING A DEPLOYMENT SITE

Because of its relatively large size, selection of sites for deployment of the 9600 is likely to require more care than for deployment of smaller water quality instruments such as YSI 6-series sondes. The key requirement for the deployment site is that the ENTIRE ANALYZER MUST BE IMMERSED for the instrument to function correctly. Total immersion of the analyzer assures that the reagents are at the same temperature as the water being analyzed and is necessary for the quoted accuracy specification to be met.

The analyzer can be deployed in either an upright position with its inlet port “up” or in a horizontal position with its inlet port on the side. For the upright position, approximately 3 feet of water is required to immerse the inlet filter and provide a “cushion” to make sure that the inlet port remains under water during changes in water level. For the horizontal position, approximately 18 inches of water is required to take into account the same concern and provide a margin of safety.

For vertical deployments with the inlet port in the “up” position, the 9600 can either be suspended by a rope or chain attached to the bail or can be placed on the bottom of the water body and kept in place by stakes driven into the bottom around the outer shell of the instrument. Note that the 9600 should NOT be suspended from the cable alone for deployments where a cable is left attached to an instrument during the study.

CAUTION: Do NOT attach deployment ropes or chains to the handle of the BATTERY COMPARTMENT. This part is NOT designed to withstand the acute stresses that can sometimes occur during field deployments. When transporting the unit, be certain to carry it BY THE BAIL.

For horizontal deployments, a rope or chain (user-supplied) can be attached to the two eyebolts on the side of the 9600 outer shell and then a separate rope or chain can be attached to the MIDDLE of the first rope or chain to suspend the analyzer. The 9600 can also be placed on the bottom and kept in place with stakes driven into the bottom on the edges of the analyzer, but the unit MUST be placed so that the eyebolts are in the “up” position for proper function of the detector cell no matter whether a 9100-02 (2 mm cell) or 9600-10 (10 mm cell) is deployed.

Generally, the vertical deployment is most convenient if there is sufficient water at the site to allow total submersion of the instrument under these conditions. Advantages of the vertical deployment include the ability to use the existing bail for suspension deployments and easier access to the communication connector (for data upload) and the inlet filter (for cleaning or changing under heavy fouling conditions).

5.2 POWERING THE 9600 DURING A DEPLOYMENT

As noted above, users have basically three choices for supplying power to the nitrate monitor during deployment:

- An internal battery pack that contains 14 alkaline D cells with an output voltage of approximately 10.5 volts. One of these packs is supplied with each nitrate monitor and replacements are available from YSI as Model Number 9611.
- A power supply (Model Number 9689) which will automatically convert line voltages of 90 to 264 to 12 VDC and allows for the use of line input cords from most countries worldwide. The Model 9689 is supplied with an American/Canadian cord. Note that, while physically compatible with the 9600 cables, other YSI power supplies such as the 6037, 6038, and 6123 should NOT be used with the 9600 since they do not supply enough amperage to operate the pumps correctly.

- An auxiliary power source with a voltage range of 10 to 20 volts and supplying a current of at least 2 amperes. A typical application under these conditions would be a lead acid battery alone or one that is being powered by solar cells as part of a data collection platform package.

Combinations of the battery pack and power supplies can also be used. For deployments involving remote power sources such as the 9689 power supply or auxiliary batteries, YSI recommends that you also have an internal 9611 battery pack in place in the instrument. The presence of the battery pack will provide data continuity in the event of power outage (for the 9689 power supply) or premature auxiliary battery failure or discharge.

As described above in Section 3.3 on cables for the use with the 9600, it very important to purchase the proper cable if you are going to use an auxiliary power source for your 9600 deployments. Under these conditions, you **MUST** purchase the cables with a 96XX designation (9691, 9692, or 9693). While standard 6-series cables in the 60XX series, e.g., 6090 and 6067B, can be used for interface to set up a deployment, they **CANNOT** be used to transmit power from remote sources when actual operation of the 9600 pumps is required.

5.3 VIEWING AND UPLOADING DATA DURING A DEPLOYMENT

Using a laptop PC which is running NUview software, you will be able to visit your 9600 deployment site and both upload the data from the instrument memory or view the last 10 data points to make sure that the instrument is functioning properly.

CAUTION: If you have to remove the 9600 from the water at the site in order to interface to the communication port of the nitrate monitor, you should take care to do this **WHEN THE UNIT IS NOT TAKING A READING**. If the inlet filter is exposed to air when a sample routine is run, air will be sucked into the system and could compromise the accuracy of several subsequent points until all of the gas is purged from the system. With this in mind, make sure that you do **NOT** remove the analyzer from the water for at least 15 minutes after the start of each analytical sequence. For example, if you started you study on the hour at a 1-hour sample interval, only remove the 9600 from the water during the 35-minute period between 20 minutes after the hour and 5 minutes before the hour. The extra 5 minutes after the completion of the sequence and before the start of the next sequence is “insurance” to take into account any discrepancy between the 9600 internal time and external time keeping devices.

To upload or view your deployment data, simply connect your PC to the 9600 with one of the cable options described above and run NUview. The following display will be seen.



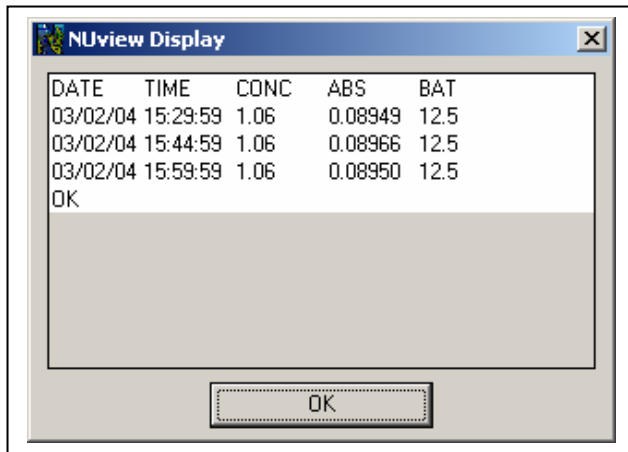
Use the options in this display to either view your data, upload your data, or stop your deployment as described in the two sections below.

NOTE CAREFULLY: There is no need to stop the deployment to view or upload the data that is being logged for the study currently in progress. **DO NOT STOP THE STUDY IF YOU ARE PLANNING ON LEAVING THE INSTRUMENT IN THE FIELD FOR A CONTINUATION OF THE EXISTING DEPLOYMENT.** See Section 5.4 below for more information on actually stopping a study.

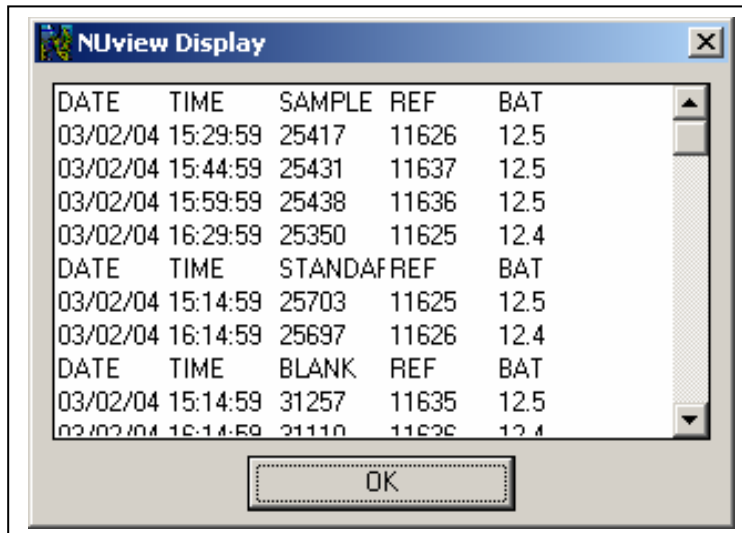
5.3.1 VIEWING DATA

Clicking the **Quick View** button at the top of the display for an actively logging 9600 will provide a display of the last 10 data points logged to the internal memory of the 9600. Two forms of the data can be viewed depending on whether the **Show Raw Values** box is checked.

If the Show Raw Values box is **NOT CHECKED**, then the nitrate-N concentrations and absorbances associated with the last 10 data points logged to 9600 memory will be displayed as shown below. Normally, you will use this mode to check that your 9600 is functioning properly by making sure that the data appears rational for your particular site.

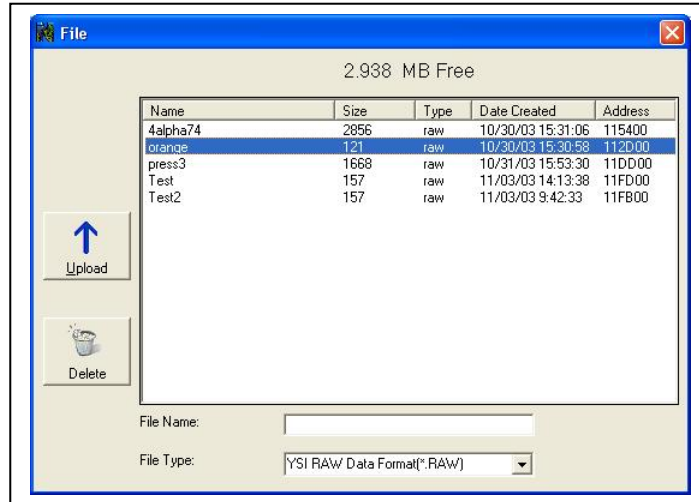


If the **Show Raw Values** box is **CHECKED**, then you will view the raw signal and reference photodetector outputs for the last 10 samples, the last 10 blanks, and the last 10 standards as shown below. This type of view will be particularly useful if the data found in the Quick View of the actual concentrations and absorbances indicates instrument malfunction. The window which contains the information in the Raw Value Quick View should then be saved to a file for analysis by YSI Technical Support personnel.

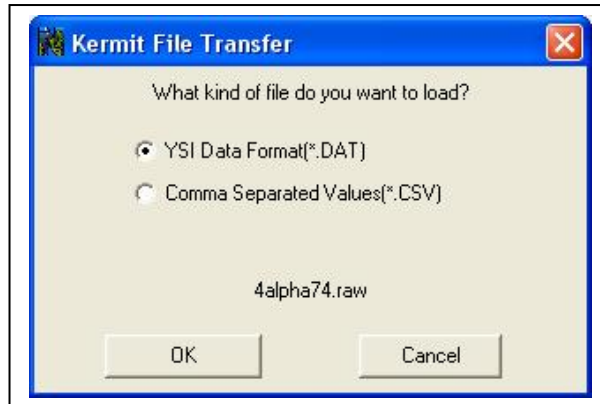


5.3.2 UPLOADING DATA

After interfacing the deployed 9600 to your PC that is running NUview software, click the **File** button to produce the following display.



Highlight the file that you want to transfer to your PC and then click the **Upload** button on the left of the display. The following screen will appear providing two choices for the data format of the uploaded data.



The raw data found in the memory of the 9600 can be uploaded in two formats by clicking the appropriate selection as described below:

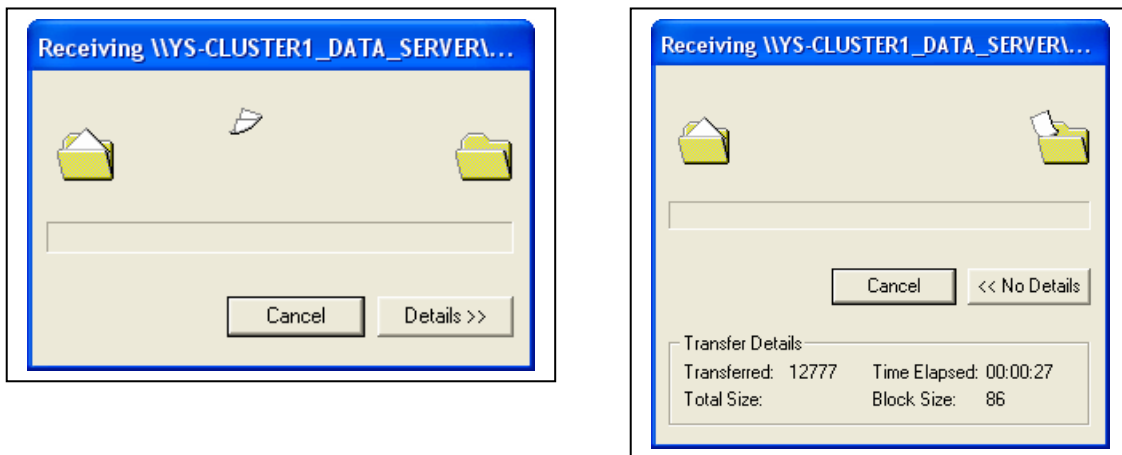
- **YSI Data Format (.DAT extension)** – This data format will probably be preferred by most users and is compatible with the proven YSI data analysis software EcoWatch for Windows™. This software will allow custom reporting and plotting of the data from the 9600 and will allow the interconversion between concentration units of mg/L of nitrate-N and uM (micromolar) nitrate. Most importantly, nitrate-N data uploaded in .DAT format will be processed to take into account the periodic calibration of the 9600, automatically compensating the data for any drift. When you upload in .DAT format, only three parameters are available for display in EcoWatch for Windows – nitrate concentration, the optical absorbances associated with each point, and battery voltage. Note that the optical absorbance has NOT been compensated for calibration drift.
- **Comma Separated Values (.CSV extension)** -- Uploading data from the 9600 in this data format will allow users to obtain the raw data parameters that are used to calculate the nitrate values uploaded in the YSI Data Format. Files of this type can readily be opened in spreadsheets such as Excel for

advanced data analysis and troubleshooting if required by the user. The following parameters are found in the file:

- The raw signal photodiode response for all samples, blanks, and standards in sequential listing.
- The raw reference photodiode response logged at the time of each sample, blank and standard reading.
- The battery voltage.
- A date and time stamp for each sample, blank, and standard reading.

In general, users will always want to upload their data in BOTH .DAT (YSI) and in .CSV (Comma Separated Variable) formats when visiting a site. If the monitor is functioning correctly, there is generally no need for the user to consult the .CSV file, but, if apparent data irregularities exist, the .CSV file will be required for troubleshooting by YSI Technical Support and this will require an additional trip to the deployment site unless the file was uploaded routinely along with the .DAT file.

After choosing the file type to be uploaded, click OK and the screen below left will appear allowing you to follow the progress of the upload. Click Details on the initial screen to follow the progress of the data transfer as shown at the right below.



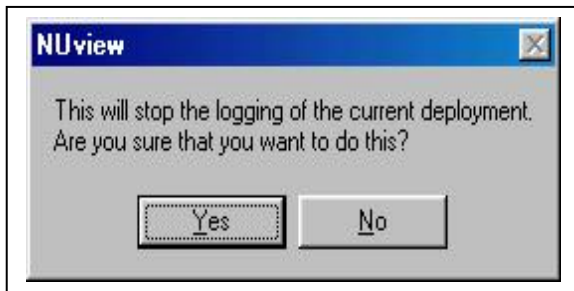
The file will automatically be uploaded to the C:\PROGRAM FILES\NUVIEW\DATA subdirectory on your computer hard disk. When the upload is complete, the display will return to the directory of files in the analyzer as shown above. Close this window to return to the deployment display as shown below.



NOTE CAREFULLY: When interfacing your PC to the 9600 to perform data uploads and quick views as described above, you have in no way affected the actual study which is presently in progress. Thus, there is no need to restart the study after performing these operations.

5.4 STOPPING THE DEPLOYMENT

To stop a deployment, interface to the deployed 9600 with your PC which is running NUview software to generate the active deployment screen as shown below left. Click on the Stop Deployment selection to show the display below left that requires you to confirm the Stop Deployment command in order to prevent accidentally terminating the study during field interfaces. To stop the deployment click “Yes” and the deployment will be stopped as evidenced by a return to the Start Deployment display.



5.5 DEPLOYING THE 9600 WITH A DATA COLLECTION PLATFORM

5.5.1 INTRODUCTION AND METHOD OF OPERATION

The most efficient method of communication for use of the 9600 with data collection platforms (DCPs) made by a variety of manufacturers is the SDI-12 protocol and the ability to utilize this protocol is built into the 9600 firmware.

SDI-12 is an industry-standard serial digital interface bus. The bus was designed to allow compatibility between data collection devices and sensors of various manufacturers.

Running the 9600 in SDI-12 mode requires it to be connected to a SDI-12 master device or, in this specific application, a data collection platform. These DCPs provide the commands necessary to communicate with the 9600 in SDI-12 mode. For complete SDI-12 technical specifications please contact:

Campbell Scientific, Inc.
P.O. Box 551
Logan, Utah 84321 USA
(801) 753-2342

When a 9600 is set up for this application, the external DCP requests data from the 9600 at preset intervals. The DCP then logs the data that is returned from the 9600 in its own internal memory for later download or

remote transmission. **NOTE CAREFULLY:** The ONLY data returned by the 9600 to the DCP will be the Nitrate-N concentration in units of mg/L.

It is important to note, however, that the 9600 operates in a slightly different manner from YSI 6-series sondes in the SDI-12 mode as described below. The important difference to the average user is the method of set-up before attachment of the sonde or 9600 to the DCP.

- For a multiparameter YSI 6-series sonde, the user attaches the instrument to a computer prior to deployment and makes sure that the desired sensor and report output are present and that other factors such as the number of wiping operations for the optical sensors and the warm-up time for the oxygen sensor are correct. The instrument is then attached to the DCP that has been programmed via its own software to control the data acquisition from the sonde. The first key is that it is NOT necessary to start a logging study in the sonde software prior to attachment to the DCP. The second key is that the timing of data acquisition by the instrument is controlled by the DCP.
- For the 9600, the user attaches the nitrate monitor to a computer prior to deployment and goes through the standard 9600 set-up procedure as for a study that does not involve use of a DCP. In addition, the user **MUST ACTUALLY START A DEPLOYMENT** with the 9600 during the predeployment interface with NUview software. The instrument is then taken to the field and attached to the DCP which, as for 6-series sondes, has been programmed to control the data acquisition from the 9600. The first key is that the 9600 **MUST** already be running a study prior to attachment of the DCP. The second key is that the DCP will NOT control the timing of the analytical sequence; instead only the acquisition of data from the 9600 is controlled by the DCP. Because the SDI-12 interface protocol is carried out in this manner, the data sent to DCP after it issues a request will be the last data point logged to 9600 memory. The date/time stamp on the data that originates in the DCP thus could be in error by as much as the Sample Interval of the 9600. For example, if the 9600 is logging data internally at a 1 hour sample with the analytical sequence starting on the hour, the data from this sequence will not be logged to 9600 memory until approximately 15 minutes after the hour. If the DCP, requests data from the 9600 at 10:00, then the last available data in memory will have been logged at 9:00 and it will be this data which will be transferred to the DCP. The DCP date/time stamp will thus be 10:00 for data which was acquired at 9:00 and this small error will have to be accounted for in data analysis. For this reason, the 9600 will upload the last sample time to the DCP, as well as the nitrate readings. **NOTE:** No Date/Time Stamp from the 9600 will be transferred to the DCP, only nitrate concentration values.

NOTE CAREFULLY: When using your 9600 with a data collection platform (DCP) via an SDI-12 interface, the MINIMUM SAMPLE INTERVAL ALLOWED IS 30 MINUTES.

5.5.2 USING THE 9600 WITH THE YSI 6200

The YSI 6200 Data Collection Platform can be purchased from Endeco/YSI along with the supporting software for the DCP that is designated EcoWatch DCP. Key advantages of the 6200 for use with the 9600 are (1) the physical interface is simple in that the MS-8 connector from a 96XX cable can be directly attached to its mating connector on the DCP and (2) the setting up of the software interface is more facile than for most generic DCPs due to the use of EcoWatch DCP. If you would like more information on the YSI 6200 or need additional support for setting up your existing 6200 with a 9600 Nitrate Monitor, please use the following contact information:

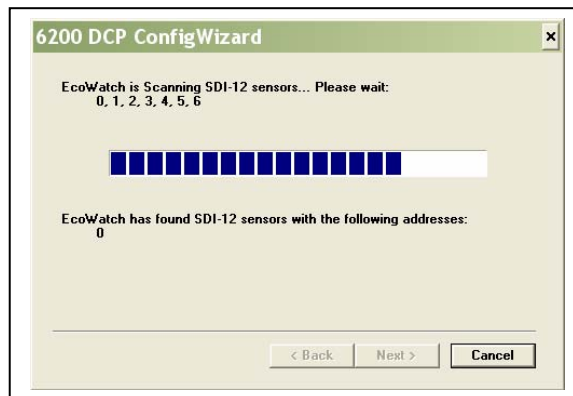
Endeco/YSI
13 Atlantis Drive
Marion, MA 02738
800-363-3269

There are three basic steps through which you will have to proceed to use your 9600 with the YSI 6200 Data Collection Platform:

- Start a deployment study as described above in Section 5.5.1.
- Connect the MS-8 end of a 96XX cable to the mating MS-8 connector on the DCP enclosure.
- Attach a serial cable between the proper connector on the 6200 and a serial port on your PC. Run EcoWatch DCP software and follow the abbreviated instructions outlined below that are specific for the interface between the 9600 and 6200.

Specific EcoWatch DCP/6200/9600 Set-up Instructions:

- Click on the 6200 selection in the top menu bar. Then select “Supervisor Mode” from the list.
- Enter “YSI6200” as the Supervisor Password. Note that the letters “YSI” MUST be capitals.
- Return to the main EcoWatch DCP screen and again click on the 6200 selection in the top menu bar. Now select “New” from the list and enter a file name.
- Select a file name and click “OK.” The 6200 will scan SDI-12 addresses from 0 – 9. The 6200 will acknowledge all SDI-12 sensors that have been properly connected, as pictured in the dialog box below.

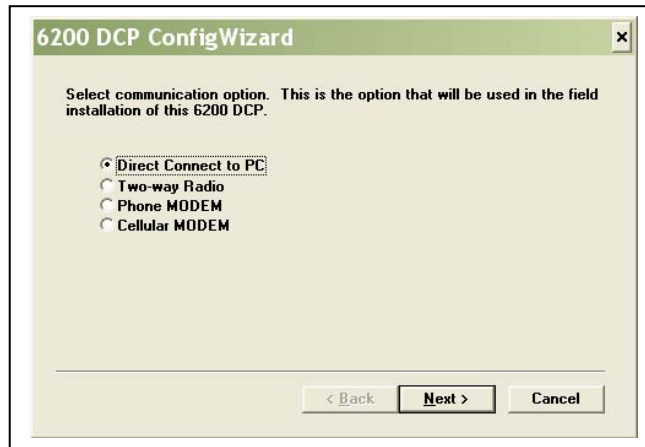


NOTE: If the 9600 is not detected in this operation, make certain that the cables between the 6200, the 9600 and your PC are connected correctly. Also make sure that the 6200 is powered properly, either from an internal battery pack or from AC power. Retry the interface, and if the 9600 is still not located, contact Endeco/YSI for help. See above for contact information

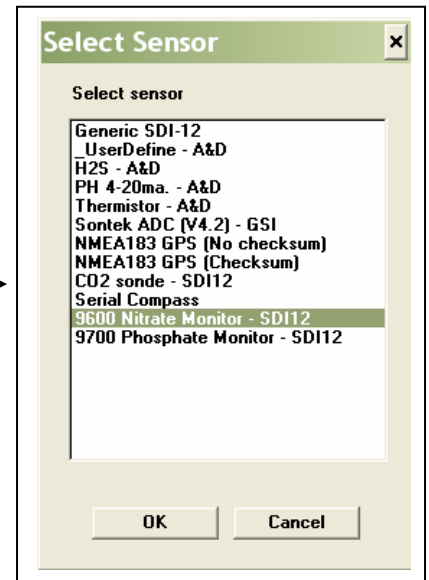
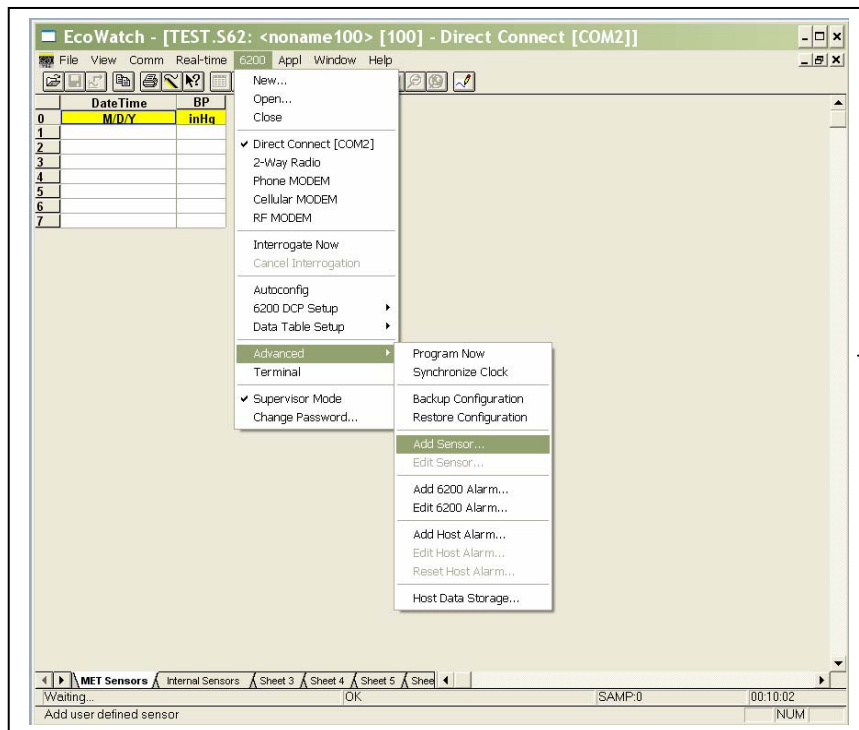
- After the 6200 has successfully scanned all of the SDI-12 address lines, the following display will appear:



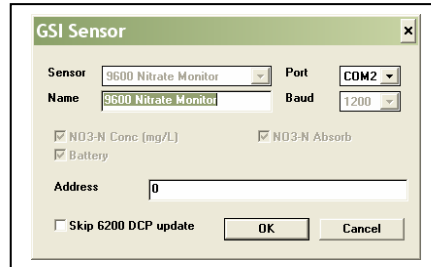
- Click “OK” and the system will detect all internal sensors (such as meteorological) which are associated with the 6200 package. Click the Next button every time a sensor is detected until the following screen is displayed.



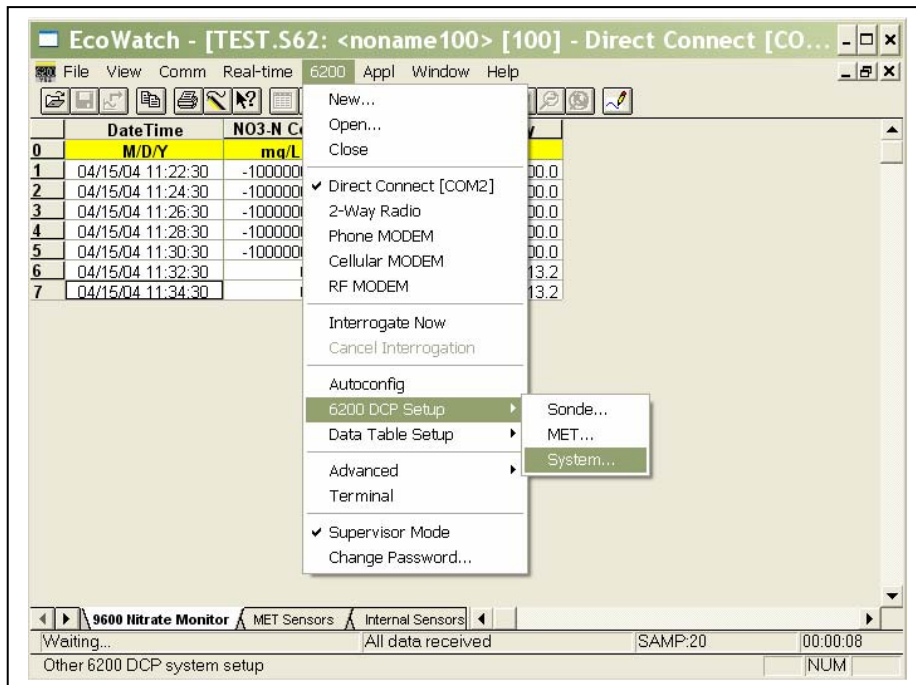
- Select **Direct Connect to PC** and click the **Next** button. The 6200 will take about 30 seconds to reboot and to synchronize its clock with that of the PC. Click Finish to complete the setup wizard.
- Click on the 6200 selection in the top menu bar and then choose the **Advanced|Add Sensor** selection as shown in the displays below.



- Select the “9600 Nitrate Monitor – SDI-12” option in the Select Sensor pop-up window. This will load the default settings for the nitrate monitor.
- After the default settings for the nitrate monitor have been loaded, the following dialog box allows the user to change the default COM port, sensor name, and SDI-12 address. Select OK after making the necessary changes.

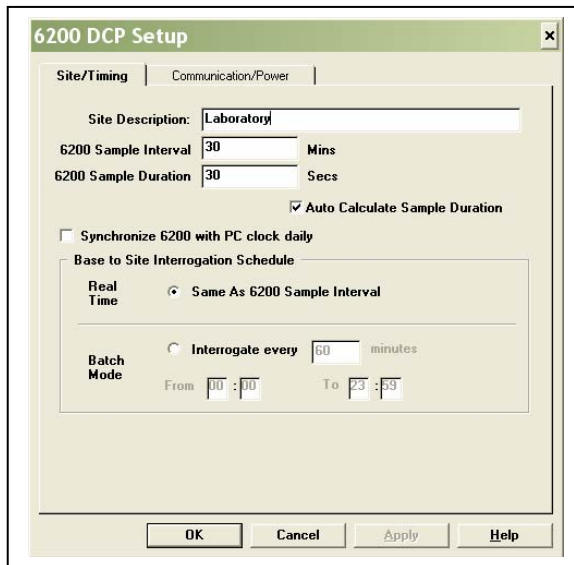


- Click on the 6200 selection in the top menu bar and then the **6200 DCP Setup|System** selection as shown below.

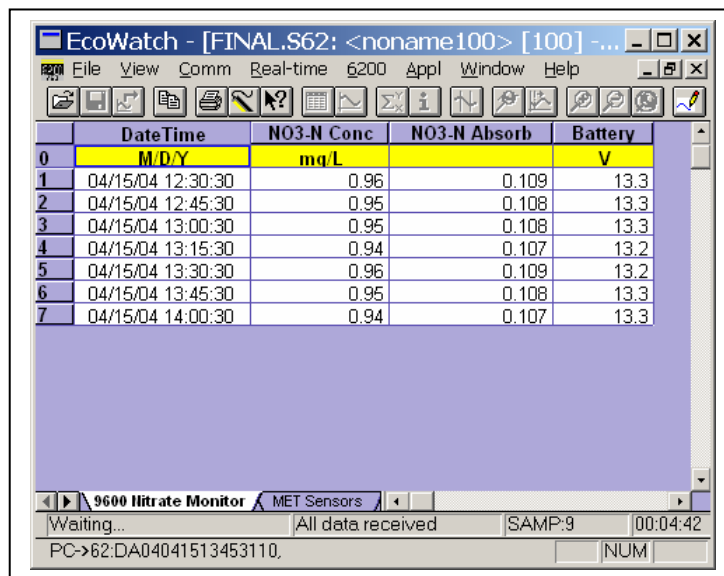


- Make the following entries into the following dialog box:
 - A site description
 - A Sample Interval for the 6200 that defines the rate at which the 6200 will query the 9600 for a data point.

Note: ensure that the Auto-Calculate Sample Duration box is checked. The nitrate monitor will automatically determine the appropriate sample duration.



- After finalizing your entries in the dialog box above, click **Apply** and, after a period of about 30 seconds for reprogramming, the 6200/9600 interface will be completely set up and data will begin to be acquired by the 6200 at your programmed interval. If the computer remains attached to the 6200, data will be shown in the following form under the 9600 Nitrate Monitor tab at the bottom of the display.



- After assuring that data is being acquired, remove the PC interface cable from the internal connector of the 6200 and the system will continue to collect data at your site.

To upload the data from the 6200 to your PC or to set up the system for remote transmission of the data, see the 6200 manual and the Help section of EcoWatch DCP. If you do not understand these operations, contact Endeco/YSI for assistance. See above for contact information.

5.5.3 USING THE 9600 WITH OTHER DATA COLLECTION PLATFORMS

To use the 9600 with commercial data collection platforms from manufacturers like Campbell, Sutron, or Handar, you will need to interface the 9600 to the DCP using the 6096 adapter which has a MS-8 connector on one end (which attaches to a 96XX field cable) and flying wire leads on the other (which attach to the DCP). The wiring between the 6096 and the DCP should be done according to the following color codes for the 6096:

WIRE COLOR	MS-8 PIN DESIGNATION	FUNCTION
Yellow	C	RS-232 TX
Orange	D	RS-232 RX
Green	E	Alarm
Grey	G	RS-232 Out
Blue	H	RS-232 In
Red	A	+12 V DC
Black	B	Ground
Purple	F	SDI-12
Bare	B	Shield

Consult the manual of your particular DCP or contact the manufacturer directly to obtain information on how to physically connect the 9600 to the DCP using the 96XX/6096 cable system. Once properly wired, you will need to set up the DCP software to issue the proper command to receive data from the 9600. You will again be required to consult your DCP manual to complete this software set-up.

IMPORTANT: Remember that, no matter whether a YSI 6200 or another DCP is used with the 9600, you **MUST ACTUALLY START A DEPLOYMENT** using NUview software before detaching the instrument from your PC and connecting it to the DCP.

5.5.3 USING THE 9600 WITH OTHER DATA COLLECTION PLATFORMS

To use the 9600 with commercial data collection platforms from manufacturers like Campbell, Sutron, or Handar, you will need to interface the 9600 to the DCP using the 6096 adapter which has a MS-8 connector on one end (which attaches to a 96XX field cable) and flying wire leads on the other (which attach to the DCP). The wiring between the 6096 and the DCP should be done according to the following color codes for the 6096:

WIRE COLOR	MS-8 PIN DESIGNATION	FUNCTION
Yellow	C	RS-232 TX
Orange	D	RS-232 RX
Green	E	Alarm
Grey	G	RS-232 Out
Blue	H	RS-232 In
Red	A	+12 V DC
Black	B	Ground
Purple	F	SDI-12
Bare	B	Shield

Consult the manual of your particular DCP or contact the manufacturer directly to obtain information on how to physically connect the 9600 to the DCP using the 96XX/6096 cable system. Once properly wired,

you will need to set up the DCP software to issue the proper command to receive data from the 9600. You will again be required to consult your DCP manual to complete this software set-up.

IMPORTANT: Remember that, no matter whether a YSI 6200 or another DCP is used with the 9600, you **MUST ACTUALLY START A DEPLOYMENT** using NUview software before detaching the instrument from your PC and connecting it to the DCP.

5.6 9600 POST DEPLOYMENT CHECK – QUALITY ASSURANCE

After completing a field deployment study, YSI recommends that you carry out one of the following protocols to assess the performance of your 9600. Note that the first protocol is the one recommended by YSI.

- **PREFERABLE:** At the time of recovery, **DO NOT STOP THE STUDY**. After removal of the 9600 from the water at the site, reattach the second standard bag containing the predeployment check standard solution to the inlet port after removing the inlet filter. Take the 9600 to your laboratory and let it run for a few hours with the second standard bag attached. Be sure to tape the second standard bag to the top of the analyzer as shown in Section 4.4 above. Compare the nitrate-N concentration readings recorded after attachment of the second standard bag with the known value to determine the quality of the 9600 performance.
- **ACCEPTABLE:** At the time of recover, **STOP THE STUDY**. After removal from the water at the site, take the analyzer to the laboratory and reattach the second standard bag containing the predeployment check standard solution to the inlet port after removing the inlet filter. Run a “Predeployment Check” and determine if any errors are observed at the end of the test. If no errors occur, the analyzer performance for the run was probably within specifications. If errors are observed after the test, note the form of the error and the absorbance readings on the screen and contact YSI Technical Support to assess the extent of the effect the presence of errors might have had on your deployment data.

5.7 9600 MAINTENANCE AND NEW DEPLOYMENTS

After your 9600 has been brought to the laboratory after a deployment, perform the following routine maintenance operations prior to the next deployment of the instrument:

- Remove the carousel from the outer shell and set it on a flat surface such as the floor or a bench top.
- Close the pinch clamps on all bags (reagent and waste).
- Inspect the tubing for pinch points and repair or replace the tubing (contact YSI Technical Support if any problems are found).

CAUTION: There are still hazardous chemicals in the reagent and waste bags and cadmium column assembly after the deployment is complete. Therefore, it is very important to wear appropriate personal protective equipment including safety glasses with side shields and use disposable gloves when handling solid chemicals and when preparing and transferring solutions of these chemicals.

- Remove the waste bags from the bottom of the carousel and dispose of the waste properly. See p. 5 and Section 12 of this manual for warnings and recommendations on waste disposal. Remove all air from the waste bags as described in Section 2.8.2 above and reinstall them.
- Remove the reagent bags and properly dispose of any excess solutions. Attach each bag to the 60-mL syringe and add ca. 50-60 mL of purified (deionized or distilled) water to each bag. Slosh the water around in the bag to rinse and then empty the bag, again properly disposing of the waste. Refill the bags with reagents prepared as described in Section 2.4 above.
- Rinse the two standard bags with new standard solution after the water rinse. Slosh the standard solution around in the bag to rinse out the water and then empty the bag. Refill the bags with new standard solution as described in Section 2.4 above.
- Remove the cadmium column assembly from the carousel and plug the ends with the two black fittings that were set aside after column installation as described in Section 2.6 above. Dispose of the cadmium column via a commercial hazardous waste handler as described on p. 5 and Section 12 of this manual.
- Activate a new cadmium column as described in Section 2.5 above and install it in the carousel as described in Section 2.6 above.
- Reinstall the reagent (filled) and waste (empty) bags as described in Sections 2.7 and 2.8 above.
- Replace the carousel in the outer shell as described in Section 2.9 above.
- Install a NEW inlet filter – available as part of the YSI Model 9617 Inlet Filter Kit.

NOTE: YSI strongly recommends the use of a new inlet filter for each deployment. In an emergency where a new inlet filter is not available you may attempt to clean the filter by soaking the used filter assembly in water for approximately 30 minutes and wiping clean with a towel. If biological residue remains on the outside of the filter, you may soak the assembly in a 1:1 dilution of commercial bleach for 30 minutes and then rinse extensively by repeated (at least 5 times) injections of purified (distilled or deionized) water through the filter to remove all traces of chlorine bleach from the filter. The injections should be carried out by attaching the threaded fitting of the 10 mL syringe assembly to the inlet of the filter, filling the syringe with water and slowly pushing it through the filter.

CAUTION: If residual chlorine bleach is pumped into the analyzer, the cadmium column may be damaged and system performance compromised. Be particularly careful about thorough rinsing of the filter (at least five 10 mL aliquots of water from the syringe assembly) if the use of chlorine bleach is required in the cleaning operation.

To begin your next deployment use the detailed instructions outlined in Sections 3 and 4 above.

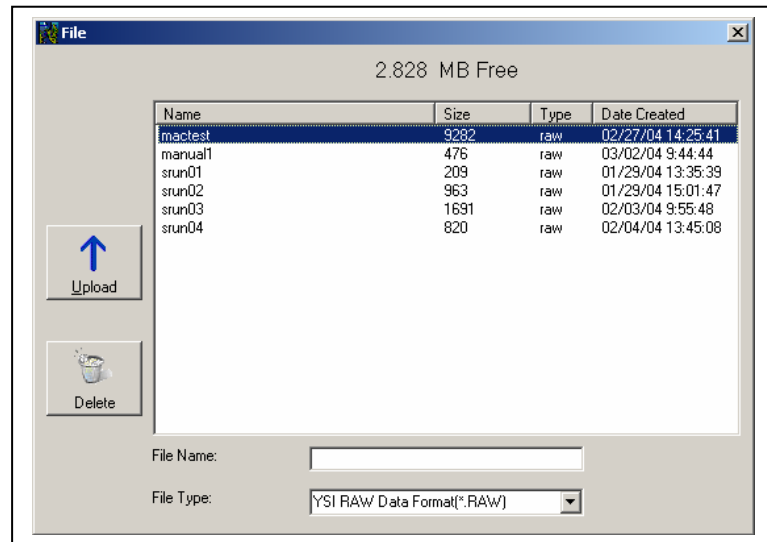
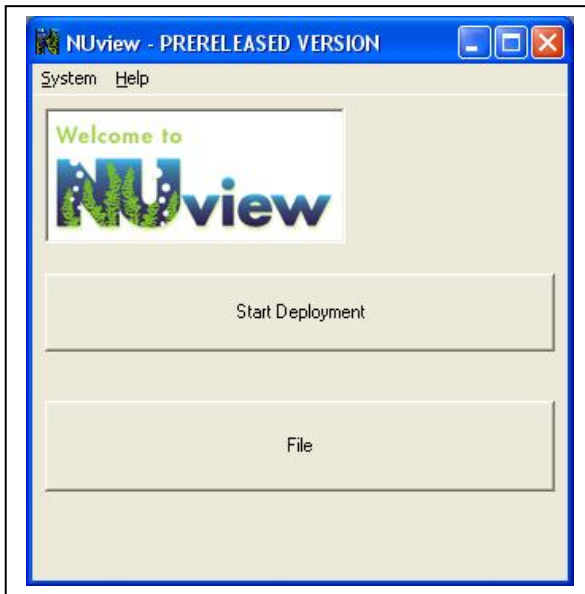
SECTION 6 MANAGING 9600 FILES

6.1 INTRODUCTION

This section deals with the management of data that have been logged to the memory of the 9600 during laboratory tests or field deployments. It is important to understand that data is stored in the 9600 in a raw format, i.e., only the outputs of the sample and reference detectors are present along with a designation as to whether the point is a sample, a standard, or a blank and the battery voltage. In addition, each raw reading is characterized by a date and time stamp. While data stored in this format can be very useful in troubleshooting problems, generally it will not be what is desired by typical customers. To obtain the data in the most desired format, i.e. nitrate-N concentration and sample absorbance, the user should select the YSI Data Format for transferring the data from 9600 memory. With this selection, all of the necessary calculations are made “on the fly” to convert the raw readings into absorbances and concentrations. During this calculation, the calibration values (standard and blank) will be automatically used to compensate readings between calibration points for any drift in the 9600 optical and/or FIA systems. The user can obtain the raw readings if required by choosing the Comma Separated Values (CSV) format that will generate a file that can readily be opened in spreadsheets such as Excel for diagnostic purposes.

It is also important to realize that the 9600 utilizes nonvolatile flash memory for data storage. Since the data is electronically written to the flash, no power or battery backup is required to maintain the integrity of the files. Thus, there is no worry about data loss if your batteries inadvertently are expended in a field study or there are power fluctuations during a deployment when the 9600 is powered from auxiliary devices.

To use the various commands which control 9600 file management, click the **File** selection in the main NUview display (below left) to generate the directory of the files which are stored in 9600 memory (below right).



6.2 DIRECTORY

The directory of the 9600 file memory is shown above right. Note that each file resident in the memory is characterized by 4 parameters as described below:

- Name – This is the designation entered by the user during the set-up of a study. Remember that the name can contain no more than eight characters and that it must not contain “illegal” Windows filename characters such as /, \, |, period, colon, asterisk, question mark, greater than, less than, space and comma.
-
- Size – The size value provides the number of bytes in the data file.
- Type – At the present time, the only type of file possible is “raw” which shows that the data is stored in a format which must be processed “on the fly” during upload and viewing to provide data in a more user-friendly format. Additional file types may be added in future versions of the 9600.
- Date Created – This parameter shows the date and time that the study was started.

To process each file within the directory as described below, you must click on the entry to highlight it. You can also hold the Control or Shift keys and click a series of files to be processed.

6.3 UPLOAD FILES TO YOUR PC

To transfer data files resident in the 9600 memory to a PC that is running NUview software simply highlight the file(s) and then click the **Upload** button at the left to show the following display.

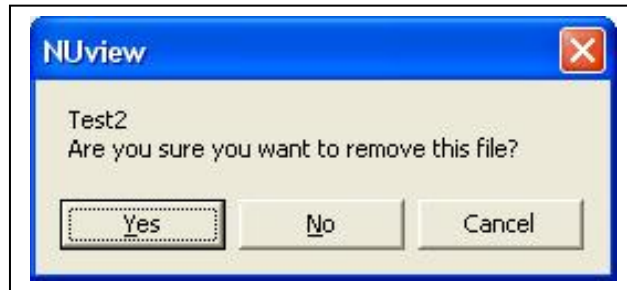


You will then be given a choice of file type to upload and the usual choice is the YSI Data Format. A detailed explanation of the differences in the file formats is provided in Section 5.3.2 above. Once you have chosen a format, click the OK button and the data will be transferred automatically to the C:\PROGRAM FILES\NUVIEW\DATA subdirectory on your computer. Use Windows Explorer or My Computer to move the file to other locations if you wish.

6.4 DELETING FILES

Use this selection to remove selected files from the memory of the 9600. In YSI 6-series sondes, it is necessary to remove ALL files from instrument flash memory (format) in order to free up space. Even though the 9600 also uses flash memory, because the memory is partitioned differently, it is possible to delete individual files to increase available space rather than carrying out a complete formatting operation. To

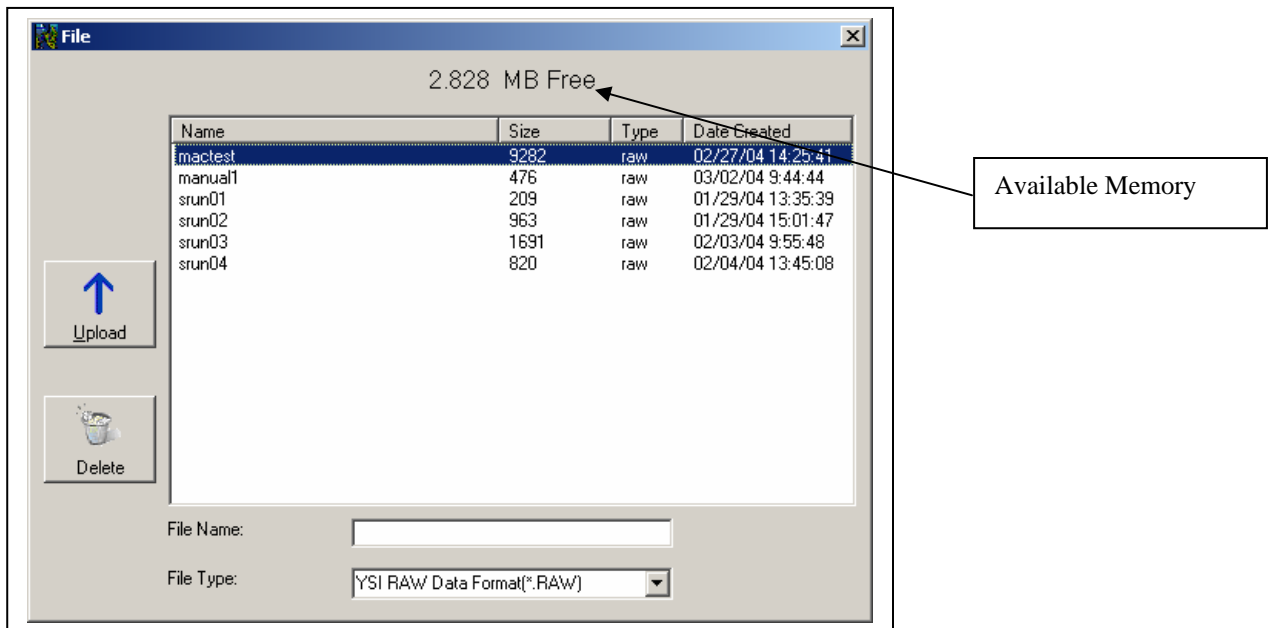
delete files, highlight them as for uploading and then click on the **Delete** button at the left of the window. The following confirmatory message will appear to make sure that you do not inadvertently delete files that you wish to retain.



Click the **Yes** button to delete the file or the **No** button to return to the Directory display.

6.5 DETERMINING AVAILABLE FILE MEMORY

The 9600 has a very large data capacity – approximately 3 MB – and it is therefore unlikely that you will ever be limited in your ability to set up deployments by this factor. For example, a 30 day study at a 1 hour sample interval will generate a file which is approximately 0.02 MB making it possible to carry out approximately 150 of these studies without deleting any files from 9600 memory. YSI does recommend, however, that you periodically upload files to your PC in either or both YSI and CSV format, archive them on your PC and then delete the files from the memory of the 9600. The amount of available memory is shown at the top of the file directory screen as shown below.



Note that users can also sort files with the directory by name, size or date/time by clicking on the header buttons.

SECTION 7 ANALYZING DATA WITH ECOWATCH FOR WINDOWS

7.1 INTRODUCTION

EcoWatch for Windows has been supplied on CD-ROM with your Model 9600 and is intended to be used to facilitate the analysis of data from the nitrate monitor. It is important to understand that several of the commands in EcoWatch for Windows will not be relevant to applications involving the 9600 since the program was also designed to provide direct interface to YSI 6-series sondes. As explained above, users MUST interface to the 9600 using NUview software, and thus the portions of EcoWatch which deal with 6-series sonde interface cannot be used with the 9600. These unusable software commands are identified in the following section.

Users should also be aware that ONLY 9600 files that have been uploaded in YSI Data Format can be opened with EcoWatch for Windows and that ONLY these files will provide calculated nitrate concentrations. These EcoWatch-compatible files are characterized by a .DAT extension. Users who have uploaded files in .CSV (raw data with no nitrate calculation) format must use a spreadsheet to view the data.

With these limitations in mind and, as was pointed out in Section 5.3 above, there are very few circumstances in which users should not upload their data in YSI Data Format (.DAT) and open it in EcoWatch. If users want to customize their data presentations at a later time using spreadsheets such as Excel, the data can be exported from EcoWatch in a spreadsheet-compatible format as described in Section 7.4 below and in Appendix A at the end of this manual. Use of the .CSV file upload format is designed for users who want to use their own algorithms for conversion of raw absorbance data to nitrate concentrations and/or for diagnostic use in troubleshooting operations.

7.2 INSTALLING ECOWATCH FOR WINDOWS

EcoWatch for Windows software must be used with an IBM-compatible PC with a 386 (or better) processor. The computer should also have at least 4MB of RAM and Windows Version 3.1 or later.

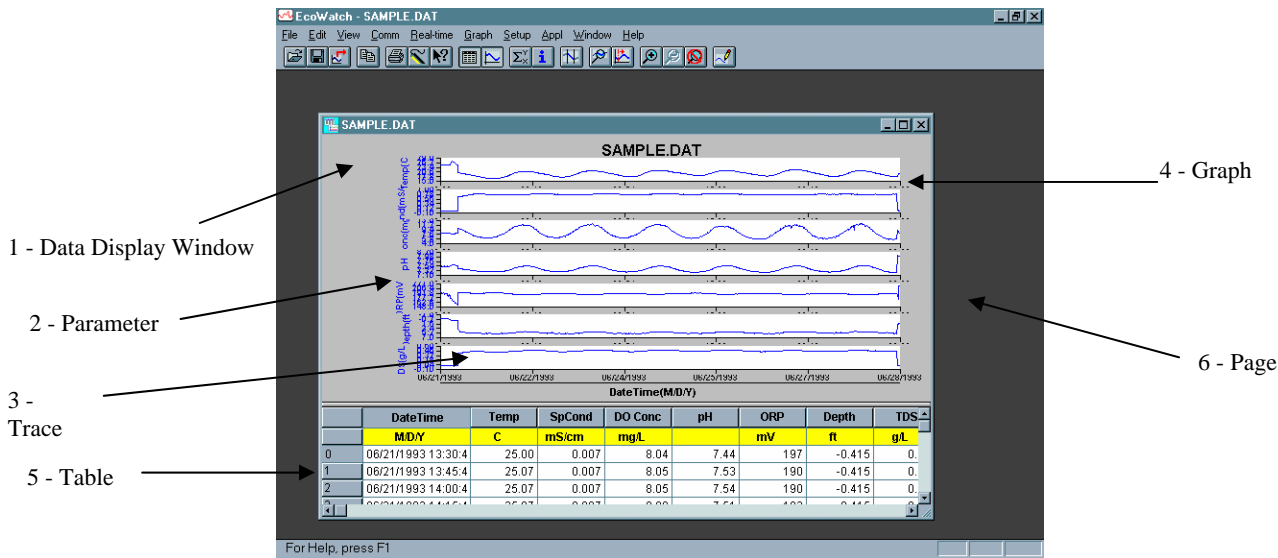
To install EcoWatch for Windows software to your computer, perform the following steps:

- Place the EcoWatch CD-ROM into the CD drive of your computer.
- Use Windows Explorer or My Computer to view files on the CD-ROM. Double-click on the **Setup.exe** file.

The display will indicate that the set-up routine is proceeding. Follow the instructions on the screen as the installation proceeds. For most applications, the default settings should work without problems. After installation, there is no need to restart the computer.

7.3 GLOSSARY

This section identifies a few of the more commonly used terms used in EcoWatch



Term

Definition

1 - Data display window

The window that appears when you open a .DAT file.

2 - Parameter

A measurement such as temperature, dissolved oxygen, pH, etc. On a graph, the data of a parameter is displayed as a trace.

3 - Trace

The plot of the data of any one parameter. There may be one or two traces per graph.

4 - Graph

There may be one or more graphs depending upon how many parameters are selected. Each graph may have one or two traces. Data can be displayed either in graphs or in a table, or both.

5 - Table

Numbers arranged in rows and columns. Data can be displayed either in graphs or in a table, or both.

6 - Page

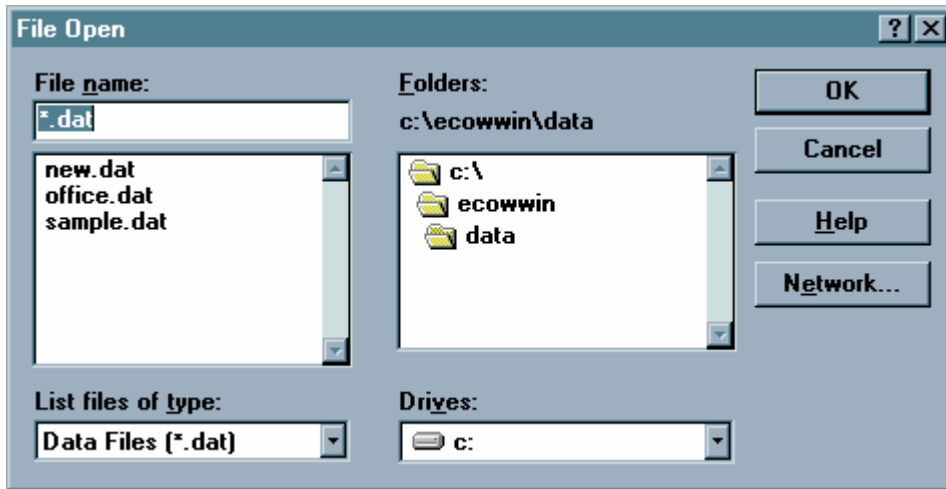
The Data Display Window can be divided in two pages, a graph page and a table page. A page becomes active when you click on it.

7 - Terminal window

This is the window that is open to display the 6-series sonde's internal menu. Allows the user to interact with the sonde or display/logger. The terminal window is a communication interface with another piece of equipment, whereas the Data Display Window is direct interaction with the EcoWatch software. NOTE THAT THIS ITEM IS NOT RELEVANT TO USE WITH THE MODEL 9600.

8 - Dialog box

A dialog box opens to display choices. Such as File|Open.



9 – YSI Data Format file

A data file that is in a format compatible with EcoWatch for Windows with a .DAT extension

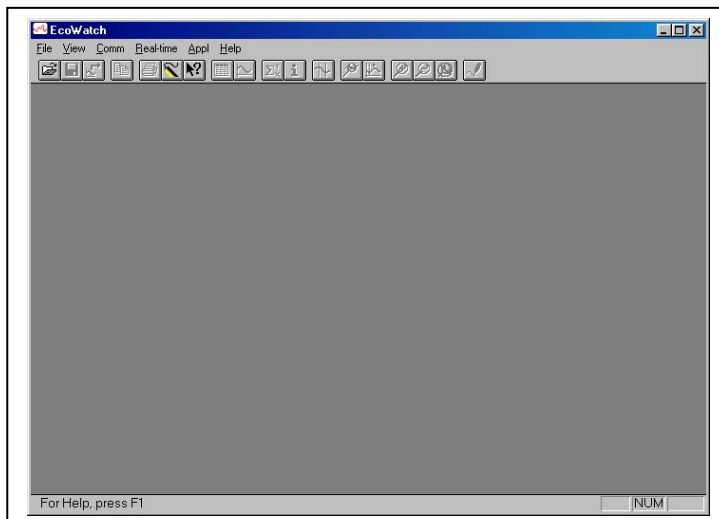
9 – Study

A single data file in YSI Data Format.

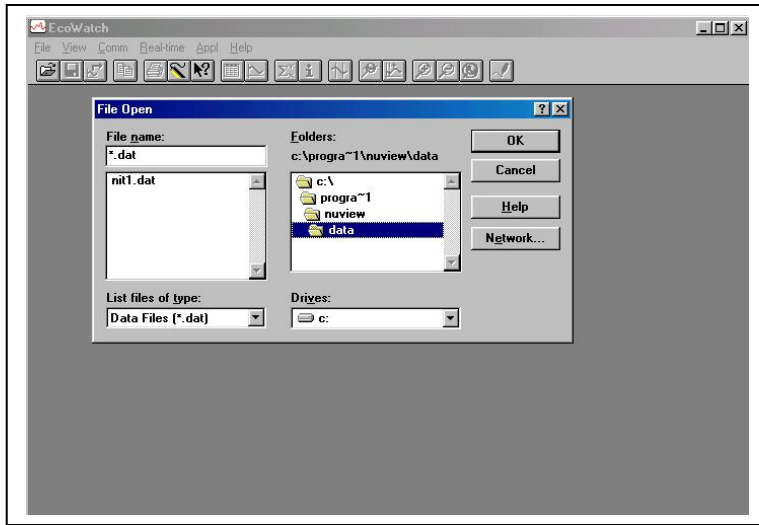
7.4 VIEWING AND GRAPHING YOUR NITRATE DATA

Once uploaded, data can be easily displayed in EcoWatch in the form of either a data table or a graph as demonstrated in this section. This section describes commonly-used operations which are possible in designing custom data presentations using EcoWatch for Windows. A detailed description of all EcoWatch commands is provided in Appendix A.

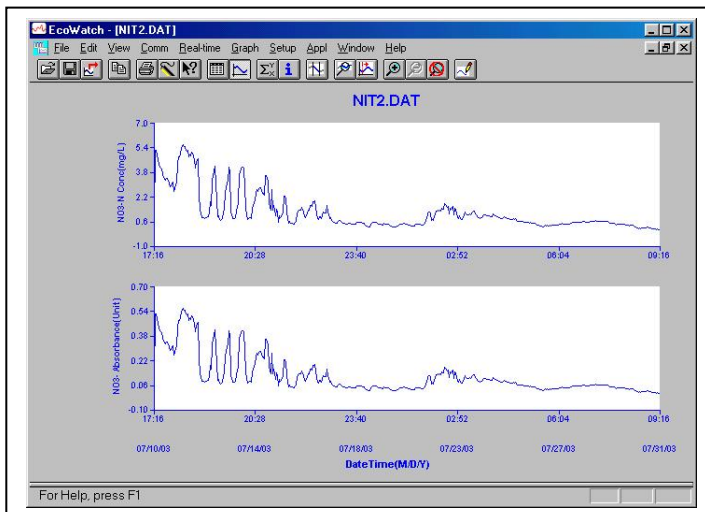
After uploading your 9600 data in .DAT format to a directory on your PC, run EcoWatch for Windows from the desktop icon or from the START|PROGRAM FILES selection. The following display will appear.



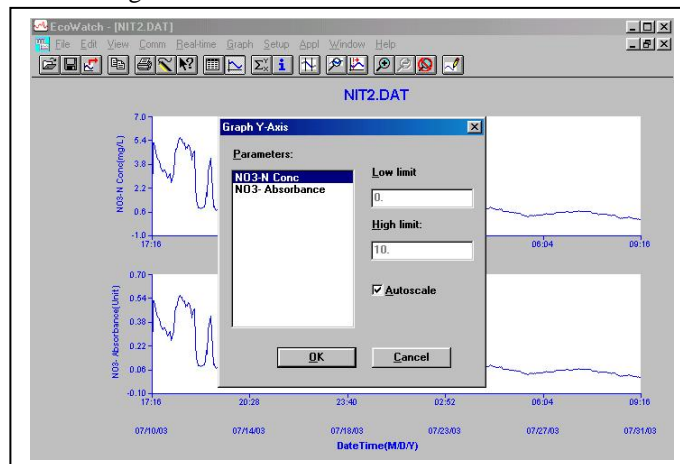
Click on the **File|Open** selection and then browse to the location of your 9600 data file (usually C:\PROGRAM FILES\NUVIEW\DATA) and then follow the instructions to open the file as shown below.



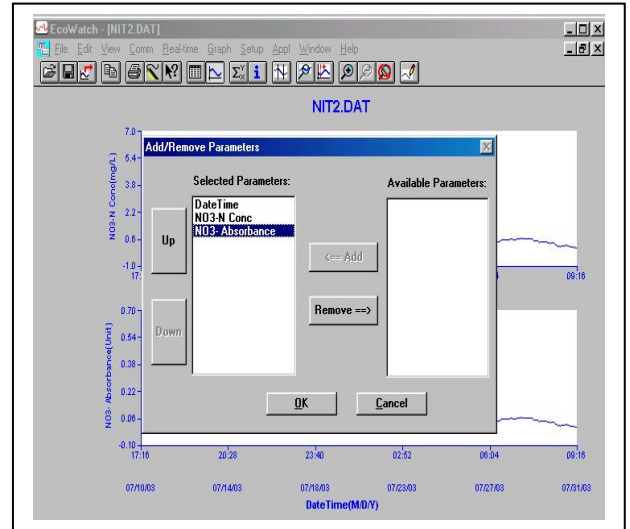
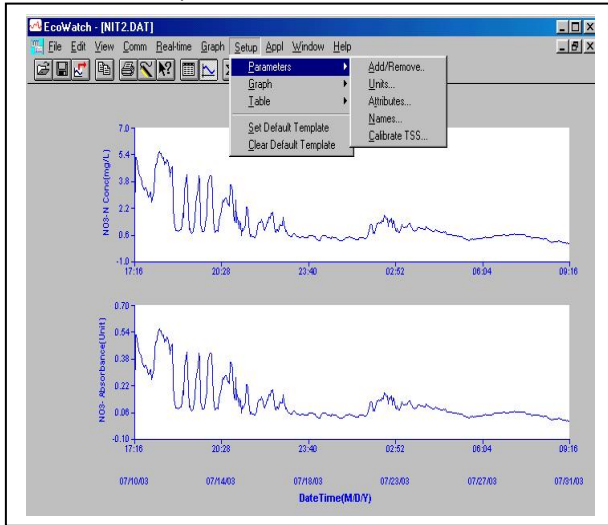
After Clicking OK, the following display will appear.



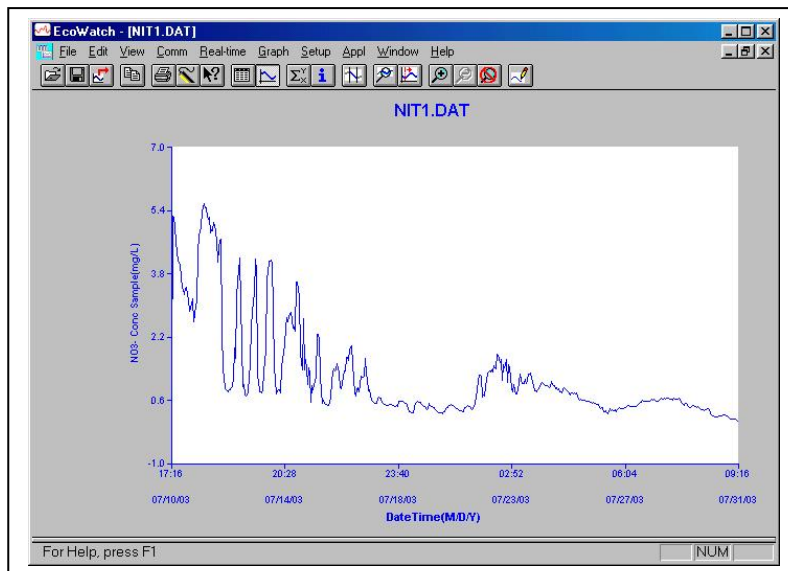
Note that you already have a graph in which the two uploaded 9600 parameters (nitrate-N concentration and sample absorbance) are presented. The data is presented with default y-axis scaling, but users can change the scaling presentation by double clicking on the y-axis of the desired parameter and entering the desired scaling values in the dialog box as shown below.




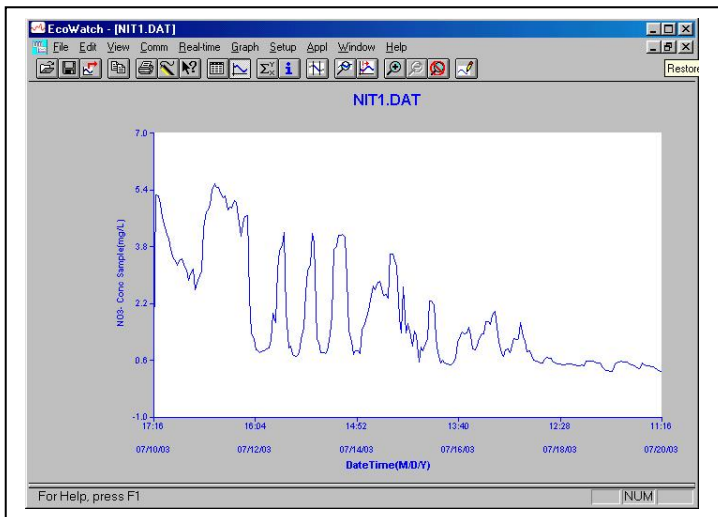
If you would like to view ONLY the nitrate concentration in your graph, the sample absorbance parameter can easily be removed. Click on the **Setup** selection in the upper menu bar and then select **Parameters|Add/Remove** as shown below.



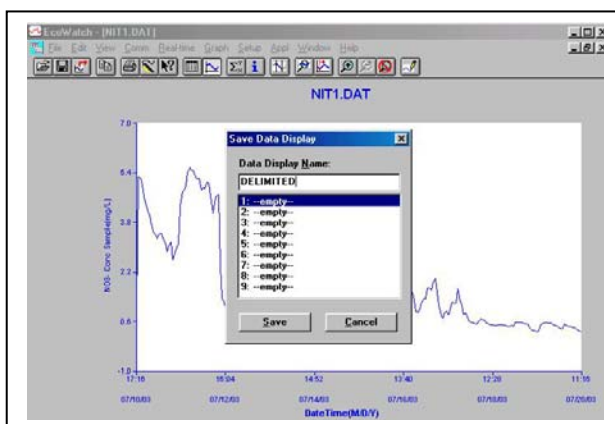
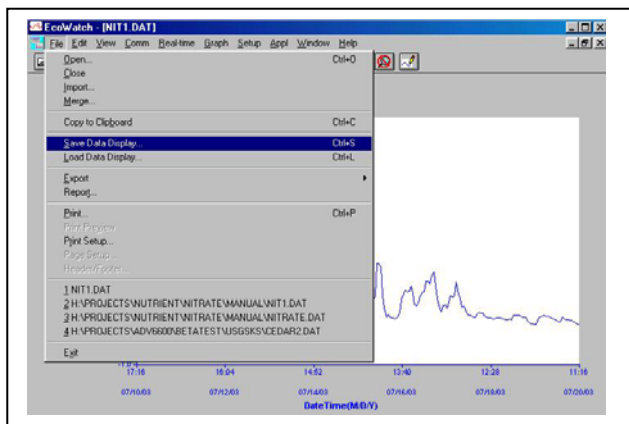
Highlight the Sample Absorb parameter on the left side of the box and then click the **Remove** selection. Note that you are NOT deleting this parameter – only moving it to a location where its data will no longer show in the graph or the data table. The Sample Absorb parameter can be included in future data displays simply by highlighting it and then clicking the **Add** button to move it back to the left (active) side of the display. After removal of the Sample Absorb parameter, the following display will appear.



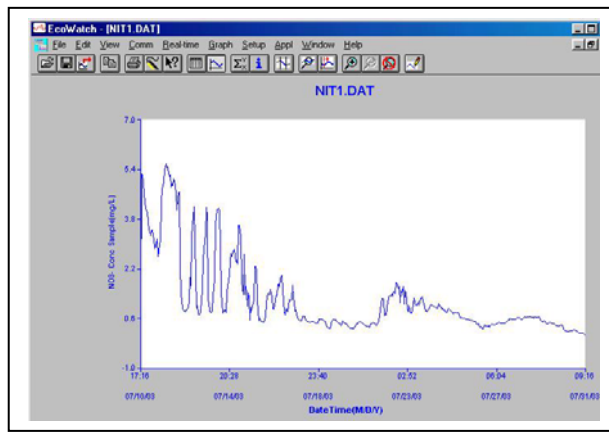
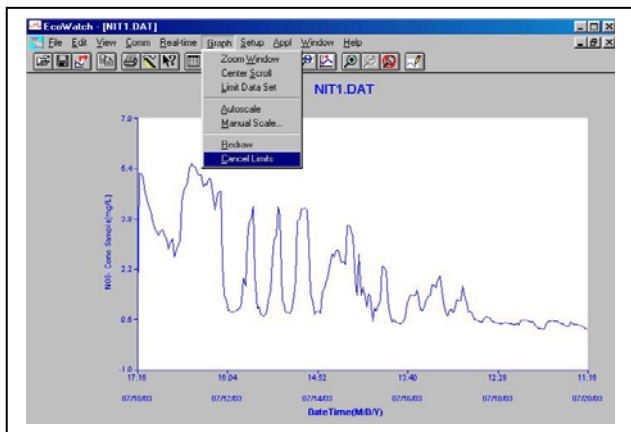
If you want to view only a part of the data displayed, use the **Limit Data Set**  icon which is found on the toolbar above the graph. To view only the first half of the data file, first click on the icon and then move the cursor to the beginning of the graph. Click once to generate the first “delimiting” x value. Then move the cursor to the halfway point on the x-axis and click again. The following “delimited” plot and table will be shown.



You might also want to Save this custom display of your data in a file for later retrieval. This can easily be done using the **File|Save Data Display** command as shown below left. Name the data presentation as desired (in this case DELIMITED) and click OK as shown below right.





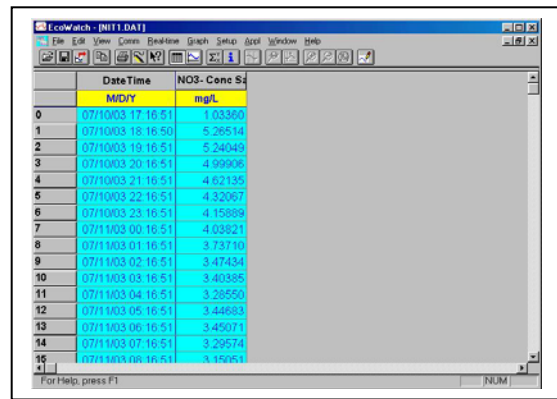
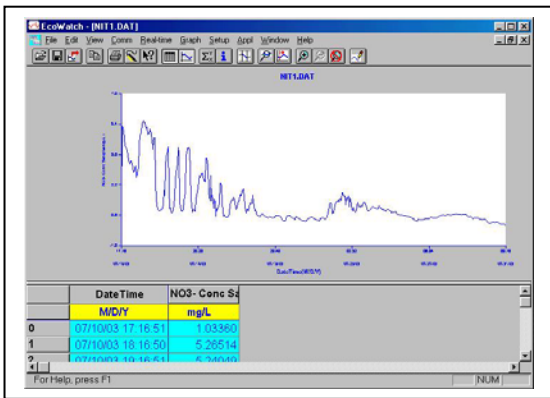
To return to a graph in which all data is displayed, click on the **Graph** selection in the Toolbar and choose **Cancel Limits** as shown below left. The data display will then return to its original format as shown below right.



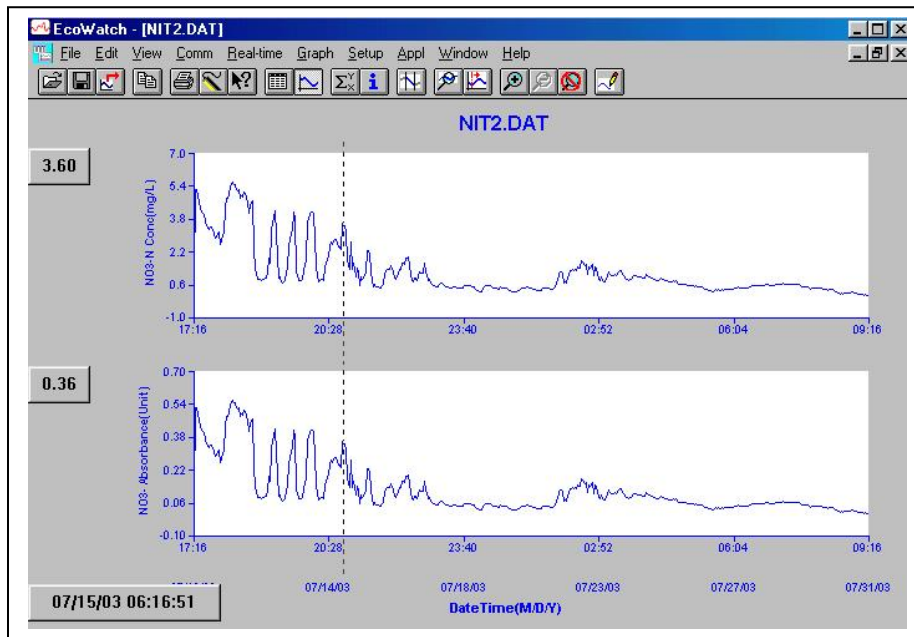
Now if you want to return to the data display in which only half the data is shown, use the **File|Open Data Display** command, select the DELIMITED designation, and click **OK**. The delimited data display will reappear.

You might want to export your custom data presentation to a file which can be imported into spreadsheet programs such as Excel. Use the **File|Export** selection and choose the desired format (usually CDF/WMF), name the file, and press **OK** to place the spreadsheet compatible file in the same subdirectory as your data file (usually C:\PROGRAM FILES\NUVIEW\DATA).

If you want to see the data from your study in table format, click on the “toggle data” icon  in the toolbar and the display will change to one in which both a graph and a table are present as shown below left. You can also use the “toggle graph”  to turn the graph completely off and show only the data table as shown below right.



Finally, you might want to view actual data readings at any time in the graph display. This can be carried out by placing the cursor on the plot and holding down the right mouse button while moving the cursor from left to right. As shown in the data display below, the values of all parameters at a particular time are shown in boxes at the left edge of the graph.



7.5 USING TOOLBAR SHORTCUTS

The EcoWatch toolbar includes buttons for some of the most common commands in EcoWatch, such as **File Open**. To display or hide the toolbar, open the **View** menu and click on the **Toolbar** command. A check mark appears next to the menu item when the toolbar is displayed.

The toolbar is displayed across the top of the application window, below the menu bar.



Click To:



Open an existing data file (.DAT). EcoWatch displays the **Open** dialog box, in which you can locate and open the desired file.



Save the working Data Display of the active data file. EcoWatch displays the **Save Data Display** dialog box in which you can overwrite existing Data Display or save to a new one.



Export data as a graph in Window Meta File (.WMF) format or as data in Comma Delimited (.CDF) format.



Copy the whole graph page or data from the selection on the table to the clipboard.



Print the active graph page or table page depending on which one is currently active.



Open a new terminal window to communicate with the sonde. **NOTE THAT THIS COMMAND CANNOT BE USED WITH THE MODEL 9600.**



Access context sensitive help (Shift+F1).



Toggle table window during file processing.



Toggle graph window during file processing.



Display study statistics.



Display study info.



Limit the data to be processed in a study.



Enlarge a selective portion of graph.



Center the graph under the cursor.



Enlarge graph or table 20%.



Reduce graph or table 20%.



Return graph or table to its normal state (unzoom)



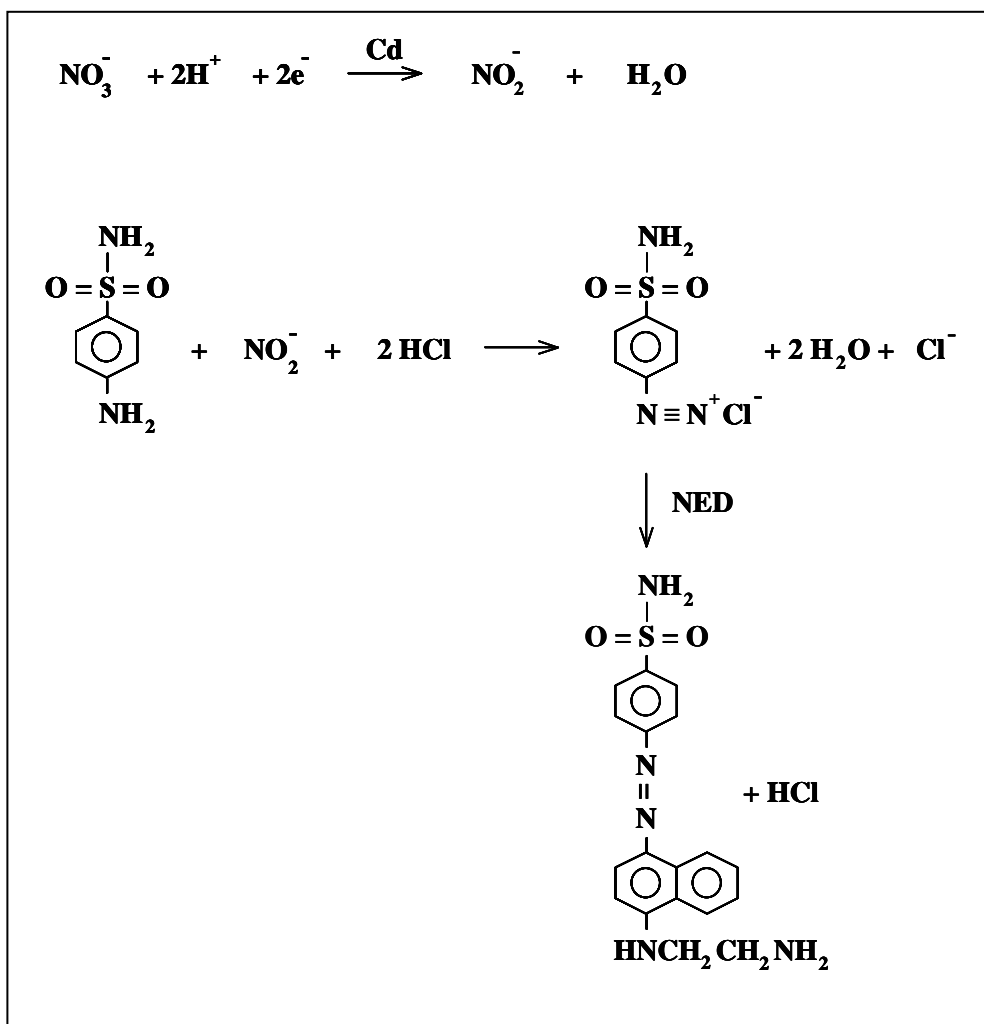
Redraw the graph.

Appendix A at the end of this manual provides information on all commands relevant to analysis of Model 9600 nitrate data and points out the commands which are not appropriate for use with the 9600. Note that the data files used as examples in this Appendix deal with parameters which come from YSI 6-series water quality sondes, but that the operations described are all compatible with Model 9600 data files in .DAT format.

SECTION 8 PRINCIPLES OF OPERATION

8.1 CHEMISTRY

The YSI 9600 uses a standard colorimetric method to measure combined nitrate and nitrite levels in natural water samples. Nitrate is converted to nitrite by cadmium reduction and the nitrite subsequently reacts with sulfanilamide and N-naphthyl ethylenediamine to form a colored species with a 540 nm absorption maximum as shown in the diagram below:



Efficient reduction of the nitrate ion by cadmium requires the use of “copper activated” cadmium. Cadmium metal is treated with a Cu^{+2} solution resulting in deposition of elemental copper on the cadmium. This results in what is believed to be a copper/cadmium galvanic cell with reduction occurring at copper (1).

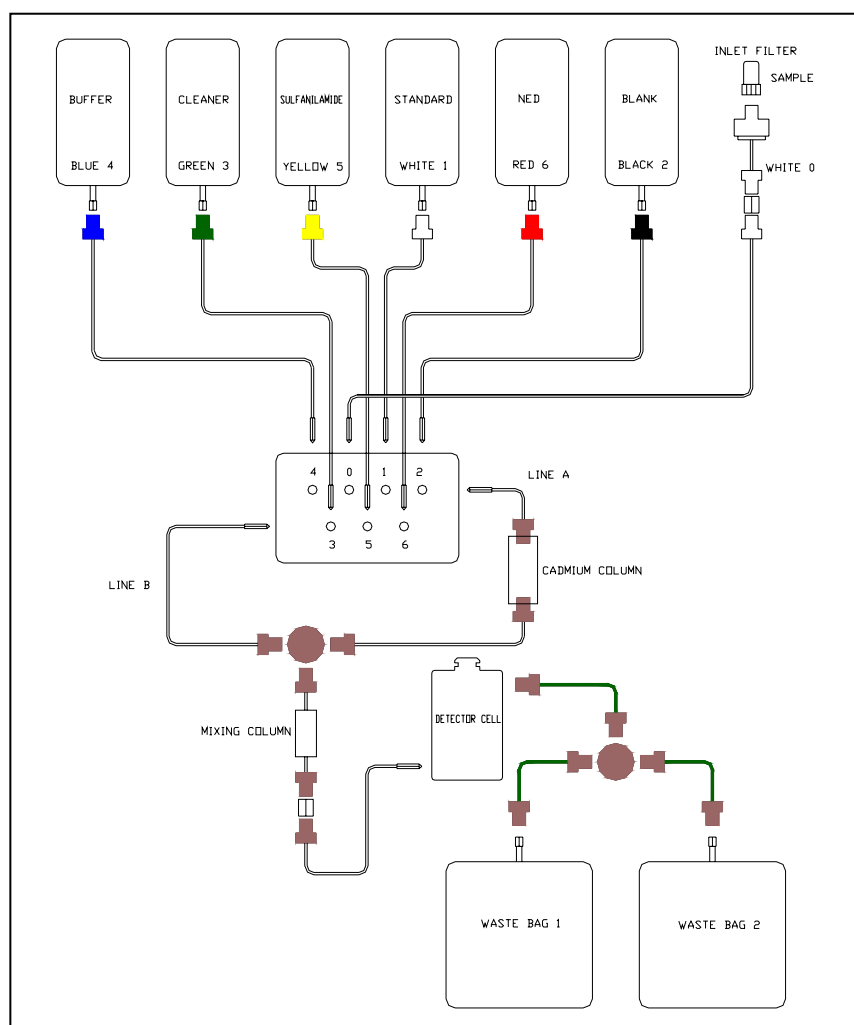
(1) Nydahl, F. *Talanta* **1976**, 23, 349-357.

8.2 EFFECT OF PH

The pH of the solution reacting with the copper activated Cd can have a major impact on reduction efficiency and the lifetime of the Cd/Cu particles. Hydrogen ions are required for the reduction of nitrate to nitrite, but if the hydrogen ion concentration is too high, additional reduction of the nitrite will occur. At the other extreme, if the pH is too high, cadmium hydroxide can precipitate in the column causing rapid degradation in performance (1). For natural water samples, YSI has observed the longest cadmium column life using the ammonium chloride solution (1.6 M) (not truly a buffer) which is characterized by a pH of 6. YSI has found higher pH solutions to significantly reduce column life for natural water samples.

8.3 FLOW SYSTEM DETAILS

The above chemistry is achieved using flow injection analysis. A manifold of 7 pumps delivers sample and reagents in sequences defined by preset schedules in the instrument as shown in the diagram below.



First, the environmental water sample is pumped to fill the entire system – the purpose of this is mainly to purge the inlet filter so that a representative sample resides at the inlet. Next, four pumps operate simultaneously until the reagents reach a steady-state concentration at the detector. Two pumps push sample and buffer through line A and the cadmium column while another two pumps push sulfanilamide

and NED through line B. The output of all four pumps meet at a T-connection and continue through a mixing coil and detector cell. After a steady state concentration is achieved in the detector flow cell, buffer is pumped into the cadmium column and then all pumps stop to allow the color forming reaction to reach completion. After this waiting period, two readings are taken in the detector: (1) the SAMPLE photodiode signal which measures the amount of light passing through the 2mm sample path and (2) the REFERENCE photodiode signal which is a measurement representative of the LED output. After the photodiode readings are logged, a wash solution is pumped through the mixing coil and detector to prevent staining in the system. YSI has found that the solution exiting the detector typically contains 60 ppm Cd^{+2} which is a product of the reduction of dissolved O_2 in the sample and reagents. For this reason, the effluent must be collected in waste bags for disposal in compliance with local and federal regulatory agencies.

8.4 PUMPING SEQUENCES

The 9600 software has two preset schedule routines which define the parameters described above. The routines are for normal (0-5 mg/L) or higher (5 mg/L and up) nitrate-N concentrations expected in the environment water samples. The two routines differ in only two ways – both a shorter color forming reaction time and longer wash cycle for higher nitrate concentrations – to minimize precipitation of the colored reaction product and prevent staining of the detector.

8.5 FLOW RESTRICTION PROBLEMS

The pumps used in the 9600 cannot function properly with (and can be damaged by) excess backpressure in the system. The cadmium column is the most likely source of this problem – and proper operation of the instrument requires use of the Model 9612 Cadmium Column Assembly which **MUST** be purchased from YSI. Also, excess air introduced into the system will cause cadmium column degradation and unacceptable increases in back pressure. **ANY** additional restriction to flow in the system can cause the above schedule routines to no longer be optimal with serious degradation of instrument performance.

8.6 CALIBRATION OF SAMPLE AND STANDARD PUMPS

The 9600 measures nitrate by comparing the absorbance reading from a standard to that from the environmental water after each has been processed by the system. These two solutions of nitrate (standard and sample) are introduced into the system by separate pumps which almost certainly pump slightly different volumes of fluid. Thus, without some correction for this effect, an error in the comparison of standard to sample would be introduced with a consequent compromise of system accuracy.

This potential problem is overcome in the 9600 during the Predeployment Check described in Section 4.3 above. During this test, the same solution (usually a 1 mg/L nitrate standard) is introduced into the system by both sample and standard pumps and the relative absorbances are determined after the chemical reaction sequence shown above in Section 8.1 has taken place. These relative values are then applied to the calibration sequences for all points in the study immediately following the Predeployment Check. For example, if the absorbance of the “standard” in the predeployment check is 10 % greater than that for the “sample”, then the fact that the standard pump is introducing more volume into the system is automatically accounted for in all subsequent calculations.

8.7 CALIBRATION DETAILS

The 9600 contains standard and blank solutions for periodic calibration. The standard solution concentration is typically 1 mg/L nitrate-N, but can be chosen by the user as described in Section 2.3.3.

The blank is typically purified water which has a salinity which is roughly that of the water at the site for brackish and oceanographic applications and simply deionized or distilled water for freshwater applications. The blank and standard solutions are analyzed in a manner identical to the samples described above. The blank photodiode readings are defined as P_o for determining absorbance values. The standard and sample photodiode readings are defined as P . To correct for temperature effects, the 9600 uses the following ratios (see details in section 8.8):

$$P_o = \text{blank signal (Hz)/reference signal (Hz)}$$

$$P = \text{sample signal (Hz)/reference signal (Hz)}$$

As shown in the equation below, Beer's law defines absorbance as directly proportional to concentration where a is absorptivity, b is path length, and c is concentration.

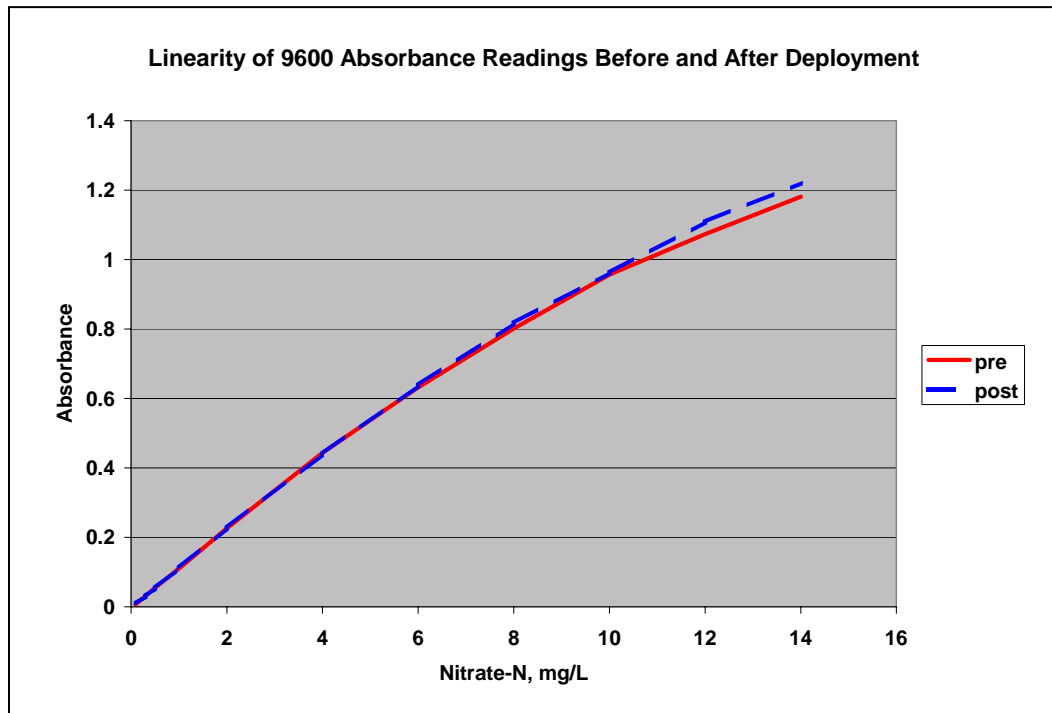
$$\text{Absorbance} = A = \log(P_o/P) = abc \quad \text{Beer's Law}$$

Periodic calibration of the instrument determines an absorbance value for the standard solution and linear interpolation between two standard readings results in a **corrected** standard absorbance value (A_{std}) used in the calculation of each sample nitrate-N concentration as shown in the equation below:

$$\text{Sample conc. (mg/L nitrate-N)} = (A_{\text{sample}}/A_{\text{std}}) \times \text{std conc. (mg/L nitrate-N)}$$

8.8 SYSTEM LINEARITY

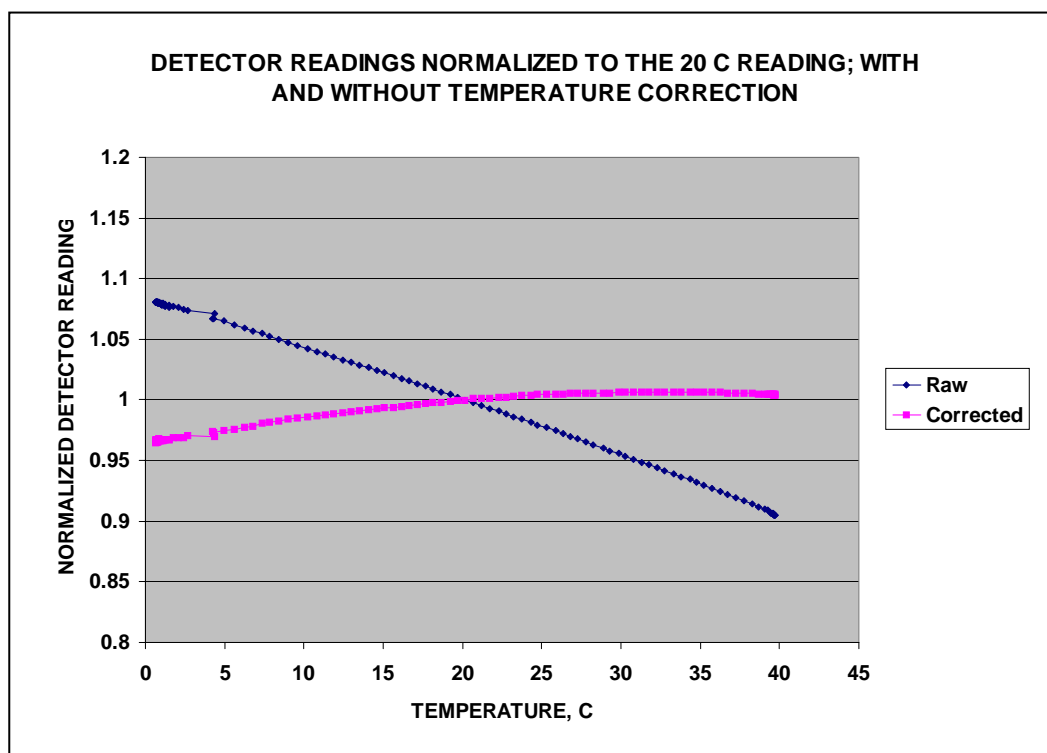
For the 2 mm detector, typical absorbance values range from 0-1 absorbance units for the range 1-10 mg/L nitrate-N. Deviation from linearity begins in the vicinity of 6 mg/L where the accuracy falls off to +/- 10%. Shown below are typical calibration curves before and after a 30 days field deployment.



8.9 TEMPERATURE EFFECTS

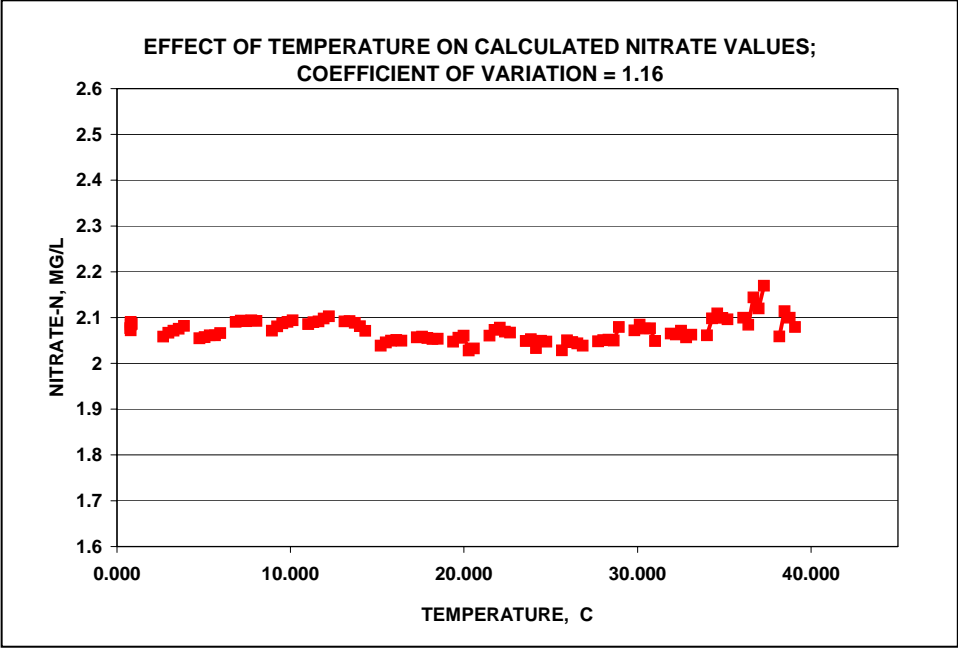
The effects of temperature on the performance of the 9600 fall into two categories. First, the output of the LED (the light source in the absorbance measurement) is temperature dependent. Second, the rate of the chemical reactions is highly dependent on temperature.

Absorbance measurements are based on the amount of light entering (P_o) and exiting (P) your sample flow cell. See Beer's law above. The 9600 uses a green LED as the light source and a light-to-frequency converter (a photodiode with a current-to-frequency converter) to measure P_o and P in units of Hz. The instrument corrects for temperature effects on the LED by use of an additional (reference) photodiode which takes a reading independent of the sample/blank/standard in the detector flow cell. This reference reading will display a temperature dependence identical to the temperature dependence of the sample/blank/standard photodiode readings. By simply ratioing all sample/blank/standard photodiode readings to a simultaneous reference reading, most of the effects of temperature are removed as shown below. Without ratioing, there could be a 19% difference in the photodiode reading across the temperature range; with ratioing this difference is reduced to less than 4% across the entire range and less than 2% from 10-40 °C. This effect is documented in the figure below.



It is important to note that the self calibration of the instrument (running of blanks and standards at least twice a day) will remove these residual temperature effects as shown below.

The effects of temperature on the chemical reaction rates can be ignored if the reaction is allowed to reach equilibrium. If this is the case, then the remaining temperature effects are thermodynamic, i.e. position of equilibrium may be temperature dependent. The figure below demonstrates empirically that temperature effects on the chemistry are minimal. Note that a coefficient of variation of only 1.16 % was seen over a wide temperature range (1 to 40 C) for analysis of a solution which was approximately 2 mg/L in nitrate-N.



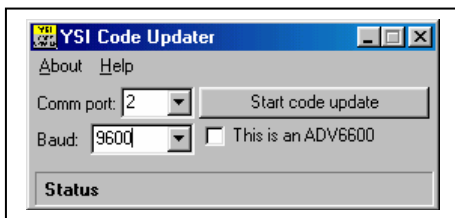
SECTION 9 UPGRADING 9600 FIRMWARE AND NUVIEW SOFTWARE

The 9600 is controlled by a combination of a firmware package which resides in the analyzer electronics and is designated “9600 Firmware” and a software package which resides on the user’s PC and is designated NUview. Both firmware and software can be upgraded by the user from the YSI World Wide Web page (www.ysi.com) with no need to send the instrument in to the YSI Service Center. Please follow the instructions below if you require these upgrades.

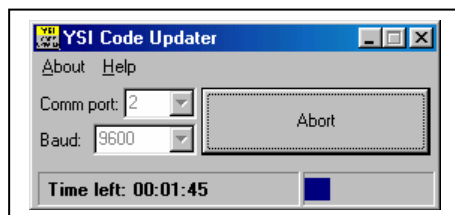
9.1 UPGRADING 9600 FIRMWARE

Follow the step-by-step instructions below to upgrade the 9600 Firmware which is resident in your Nitrate Monitor:

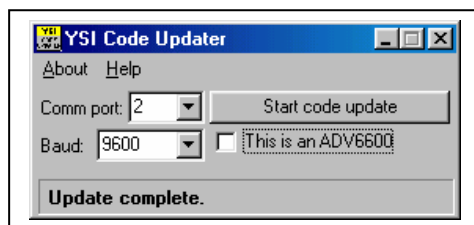
- Connect your 9600 to the serial port of a PC with access to the World Wide Web using the standard interface described above.
- Make sure that the 9600 is powered with either an internal battery pack or the Model 9689 power supply.
- Access the YSI Environmental Software Downloads page at www.ysi.com/edownloads and fill out the registration form.
- Click on the **YSI Instruments Software Updates** link (or scroll down until you see the **9600 Firmware icon**).
- Click on the file icon to the right of the **9600 Firmware** listing and save the file to a temporary directory on your computer.
- After the download is complete, run the file that you just downloaded and follow the on-screen instructions to install the YSI Code Updater on your computer. If you encounter difficulties, contact YSI customer service for advice. Refer to Section 13 of this manual, Warranty and Service Information.
- Run the YSI Code Updater software that you just installed on your computer. The following window will be displayed:



- Set the Comm port number to match the port to which you connected the 9600 cable and make sure that the “This is an ADV6600” selection is NOT checked. Then click on the **Start Code Update** button. An indicator bar will show the progress of the upgrade as shown below.



- When the update is finished (indicated on the PC screen as shown below), close the YSI Code Updater window (on the PC) by clicking on the "X" in the upper right corner of the window.



- Disconnect the Model 9600 from the computer.

9.2 UPGRADING NUVIEW PC SOFTWARE

Follow the step-by-step instructions below to upgrade the NUview software which is resident on the PC which is used to interface to your 9600.

- Access the YSI Environmental Software Downloads page at www.ysi.com/edownloads and fill out the registration form.
- Access the YSI Environmental Web Site at www.ysi.com/edownloads.
- Click on the NUview link (or scroll down until you see the NUview icon).
- Click on the NUview icon and save the file to a temporary directory on your computer.
- After the download is complete, run the NUview file (that you just downloaded) and follow the on screen instructions to install the software on your computer.

If you encounter difficulties in the download procedure, contact YSI Customer Service. See Section 13 of this manual, Warranty and Service Information. Alternatively, you may purchase the software on CD ROM (Model # 9675/Item # 609675) by contacting YSI Customer Service.

SECTION 10 TROUBLESHOOTING

The following section describes problems that you might encounter when using the 9600 Nitrate Monitor and provides suggestions that will allow the user to overcome the symptom without additional assistance. If you still encounter the symptom after trying the suggested actions, please contact YSI Technical Support.

PROBLEM	POSSIBLE SOLUTION
<p>Cannot communicate with 9600 when selecting features (File or Start Deployment) from the Main NUview display</p>	<p>Make sure that cable is attached securely to both the 9600 and the serial port of your PC.</p> <p>Make sure that power is supplied to the 9600 via an internal battery pack or an external power supply.</p> <p>If using internal battery pack, make sure that battery pack and 9600 cables are securely connected.</p> <p>If using internal battery pack, make sure that batteries are not expended. Check voltage with voltmeter or replace with new battery pack.</p>
<p>Error messages appear after the Predeployment Check routine.</p>	<p>Make certain that the second standard bag is attached to the inlet port and that the pinch clamp on the bag is “open”. If not, install the bag and/or open the pinch clamp and rerun the Predeployment Check.</p> <p>Make certain that the same concentration of nitrate standard is present in the internal standard bag and in the second standard bag that is attached to the inlet port.</p> <p>Rerun the Predeployment Check routine to make certain that all air has been purged from the system. If a error messages are observed after the second attempt, remove the carousel from the outer shell and make the following checks:</p> <ol style="list-style-type: none"> 1. Are all of the pinch clamps on the reagent and waste bags open? If not, open the pinch clamps and rerun the Predeployment Check. 2. Are there any pinch points in any of the reagent or waste lines? If so, realign the tubing to eliminate the pinch points and rerun the Predeployment Check. 3. Are all of the threaded fittings that connect the reagent and waste lines to the bags finger tight? If not, tighten the fittings and rerun the Predeployment Check. 4. Are the proper reagent lines attached to the proper bags as defined by the color-coding? If not, attach the lines properly and rerun the Predeployment Check.

	5. Are there any bubbles present in the reagent transfer lines? If so, make sure that all connections are finger tight, rerun the Predeployment Check and look again for bubbles.
PROBLEM	POSSIBLE SOLUTION
Cannot communicate in the field to upload or view data.	<p>Make sure that cable is attached securely to both the 9600 and the serial port of your PC.</p> <p>Internal battery pack could be expended. Replace battery pack and try again to communicate or use external power supply.</p>
When running the 9600 in the field from an auxiliary power source such as a car battery or data collection platform battery, no data is being acquired.	<p>Make certain that you are using a 96XX series cable with yellow overmolding on the connectors. Auxiliary power cannot be properly supplied when using a standard YSI 6-series cable with black overmolding.</p>
After uploading data in the field, data file cannot be located on the PC for viewing in EcoWatch for Windows.	<p>Data will be located in the C:\PROGRAM FILES\NUVIEW\DATA subdirectory. Browse to this location in the EcoWatch File Open selection.</p>
After uploading data in the field and viewing in EcoWatch, readings from deployment appear “smooth” but seem grossly incorrect in terms of absolute concentration values.	<p>Make certain that you have entered the correct value of the standard concentration into the Deployment Set-up Wizard. For example, you might have inadvertently entered “10” instead of “1.0”.</p> <p>Make certain that the standard has been prepared correctly. Be sure, for example, that you have not inadvertently prepared a 10 mg/L nitrate-N standard instead of the desired 1 mg/L standard. Check your dilutions and calculations.</p>
Data from deployment appears jumpy.	<p>Make certain that the inlet port is completely submerged at all water levels at your deployment site. For example, make sure that the inlet port remains submerged at low tide in an estuarine site.</p> <p>Inspect the inlet filter for extreme fouling. Wipe clean if heavy fouling is present.</p> <p>Remove the carousel from the outer shell and follow the instruction given above for Predeployment Check failure. If problems are found and corrected, attach second standard bag (with same nitrate concentration as internal standard bag) to inlet port. Stop the deployment and rerun the Predeployment Check in the field to purge the system.</p> <p>There might be excessive back-pressure within the system from either pinched tubing or a defective cadmium column. First remove the carousel from the outer shell and inspect the tubing for pinch points. If any are found, realign the tubing to eliminate the crimps and continue the study. If no pinch points are found, then stop the study, replace the cadmium column and rerun the Predeployment Check.</p>

SECTION 11 FERRITE BEAD INSTALLATION

As described in the Declaration of Conformity YSI Item # 699298), the YSI 9600 Nitrate Analyzer complies with the Residential, Commercial and Light Industrial Class B Limits for radio-frequency emissions specified in EN55011 (CISPR11) for Industrial, Scientific and Medical laboratory equipment with no qualifiers. However, if you are using your YSI 9600 Nitrate Monitor in a European Community (CE) country or in Australia or New Zealand, when communicating with the instrument you must attach a ferrite bead to the interface cable in order to comply with the industrial immunity specified in EN61326 for Industrial, Scientific and Medical laboratory equipment. The ferrite bead (YSI Item Number 699296) is NOT supplied as standard equipment with the 9600 and should be purchased as an accessory by customers requiring its use.


To install the bead, loop the cable through the ferrite bead assembly as close as possible to the 9600 connector, close the bead assembly and lock it with the integral tab. The picture below shows a properly installed ferrite bead assembly.



SECTION 12 9600 SAFETY CONSIDERATIONS

IMPORTANT SAFETY INSTRUCTIONS!

SAVE THESE INSTRUCTIONS!

 **CAUTION:** Operation of the YSI 9600 Nitrate Monitor requires the use of a variety of chemicals. With one exception (elemental cadmium), the user is required to purchase these chemicals from a vendor of their choice. Users should consult the Material Safety Data Sheets (MSDS) supplied by these vendors for all reagents before their use. Users should **ALWAYS** wear appropriate personal protective equipment including gloves and safety glasses with side shields when handling any of these chemicals.

For proper operation of the YSI 9600, cadmium metal **MUST** be purchased in packaged form as the YSI Model 9612 Cadmium Column Assembly. An MSDS for the material captured in the cadmium column is automatically supplied to the user by YSI. To protect against potential hazards associated with inhalation of cadmium dust, the cadmium column should be handled in a fume hood during activation. After the reducing capacity of the cadmium column has been exhausted, the entire sealed column should be disposed of in accordance with regulatory requirements, e.g. hazardous waste. Users should **NEVER** open the cadmium column in attempts at regeneration. If the cadmium is accidentally spilled, appropriate spill measures should be taken.

The waste generated from use of the YSI 9600 contains potentially toxic organic chemicals, but most importantly, contains Cd^{2+} that according to the USEPA is toxic and a probable human carcinogen. Users should **NEVER** discharge waste from the YSI 9600 into the environment, instead retaining it in the waste bags that are provided with the instrument. Likewise, unless specifically approved by the local wastewater authority, users should **NEVER** dispose of the reaction waste into a sanitary or storm sewer. The waste should be disposed of in accordance with regulatory requirements with an approved waste handler.

SUMMARY

- **ALWAYS** wear appropriate personal protective equipment including gloves and eye protection with side shields when handling any chemicals.
- Consult the MSDS for proper handling and disposal of all reagents
- **NEVER** dispose of waste solution which contains cadmium ions into a sanitary sewer without prior approval of local wastewater authorities. It is likely that you will be required that you use an approved waste handler for proper disposal of the waste solutions.
- **NEVER** dispose of used cadmium columns in your standard trash. Dispose of the used columns through an approved waste handler.
- **NEVER** attempt to open a cadmium column assembly.

SECTION 13 WARRANTY AND SERVICE INFORMATION

The YSI Model 9600 Nitrate Monitor is warranted for one year against defects in workmanship and materials when used for its intended purposes and maintained according to instructions. Damage due to accidents, misuse, tampering, or failure to perform prescribed maintenance is not covered. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, write or call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by (i) failure to install, operate or use the product in accordance with YSI's written instructions, (ii) abuse or misuse of the product, (iii) failure to maintain the product in accordance with YSI's written instructions or standard industry procedure, (iv) any improper repairs to the product, (v) use by you of defective or improper components or parts in servicing or repairing the product, or (vi) modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI'S LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

AUTHORIZED SERVICE CENTER

UNITED STATES AND INTERNATIONAL

YSI Incorporated • Repair Center • 1725 Brannum Lane • Yellow Springs, Ohio • 45387 • Phone: (937) 767-7241 or 800-765-4974 • E-Mail: environmental@ysi.com

CLEANING INSTRUCTIONS

NOTE: Before they can be serviced, equipment exposed to biological, radioactive, or toxic materials must be cleaned and disinfected. Biological contamination is presumed for any instrument, probe, or other device that has been used with body fluids or tissues, or with wastewater. Radioactive contamination is presumed for any instrument, probe or other device that has been used near any radioactive source.

If an instrument, probe, or other part is returned or presented for service without a Cleaning Certificate, and if in our opinion it represents a potential biological or radioactive hazard, our service personnel reserve the right to withhold service until appropriate cleaning, decontamination, and certification has been completed. We will contact the sender for instructions as to the disposition of the equipment. Disposition costs will be the responsibility of the sender.

When service is required, either at the user's facility or at YSI, the following steps must be taken to insure the safety of our service personnel.

- ☞ In a manner appropriate to each device, decontaminate all exposed surfaces, including any containers. 70% isopropyl alcohol is suitable for most disinfecting. Instruments used with wastewater may be disinfected with 0.5% Lysol if this is more convenient to the user.
- ☞ The user shall take normal precautions to prevent radioactive contamination and must use appropriate decontamination procedures should exposure occur.
- ☞ If exposure has occurred, the customer must certify that decontamination has been accomplished and that no radioactivity is detectable by survey equipment.
- ☞ Any product being returned to the YSI Repair Center, should be packed securely to prevent damage.
- ☞ Cleaning must be completed and certified on any product before returning it to YSI.

NOTE CAREFULLY: The following steps which are SPECIFIC TO THE 9600 must be performed prior to shipment of the 9600 to YSI. IF ANY CHEMICALS ARE PRESENT IN THE 9600 ASSEMBLY WHEN RECEIVED BY YSI, IT WILL IMMEDIATELY BE RETURNED AT THE USER'S EXPENSE.

- **Remove the carousel and place on a flat surface.**
- **Make sure that the pinch clamps on all reagent are closed. Then disconnect the reagent bags from the 9600 tubing, remove the bags from the monitor and set aside for further use. Do NOT return the bags with the analyzer. Leave the waste bags connected to the analyzer at this point.**

- **Disconnect the tubing from the cadmium column assembly and plug the ends with the two black plugs that were set aside during unpacking. Connect the two nuts that were removed from the cadmium column with the translucent coupling nut that was set aside during unpacking. Do NOT return the cadmium column assembly with the analyzer.**
- **Fill the second standard reagent bag with purified water and attach to the sample inlet fitting via the tubing assembly.**
- **Locate the six reagent lines (previously attached to reagent bags) and place them into a vessel that contains approximately 500 mL of purified water.**
- **Connect to the 9600 via a computer running NUview software and run the predeployment test to assure that the system is flushed thoroughly.**
- **Remove the second standard bag from the inlet port and replace with the inlet filter and its guard. Remove the reagent lines from the water vessel and allow to hang down into the lower compartment of the carousel.**
- **Close the pinch clamps on the waste bags and remove them from the carousel. Do NOT return the waste bags with the instrument.**
- **Reassemble the 9600 by placing the carousel into the outer shell and attaching the four assembly screws.**

PACKING INSTRUCTIONS

- ☞ Clean and decontaminate items to insure the safety of the handler.
- ☞ Complete and include the Cleaning Certificate.
- ☞ If possible, place the product in a plastic bag to keep out dirt and packing material.
- ☞ Use a large carton, preferably the original, and surround the product completely with packing material.
- ☞ Insure for the replacement value of the product.

Cleaning Certificate	
Organization _____	
Department _____	
Address _____	
City _____	State ___ Zip _____
Country _____	Phone _____
Model No. of Device _____	Lot Number _____
Contaminant (if known) _____	
Cleaning Agent(s) used _____	
Radioactive Decontamination Certified?	
(Answer only if there has been radioactive exposure) Yes _____	
No	
Cleaning Certified By _____	
Name	Date

SECTION 14 REQUIRED NOTICE

The Federal Communications Commission defines this product as a computing device and requires the following notice.

This equipment generates and uses radio frequency energy and if not installed and used properly, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A or Class B computing device in accordance with the specification in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional instructions. The user may find the following booklet, prepared by the Federal Communication, helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, and Stock No. 0004-000-00345-4.

SECTION 15 9600 SPECIFICATIONS

15.1 SENSOR SPECIFICATIONS

USING 2 MM PATHLENGTH DETECTOR CELL

Range: 0 to 10 mg/L Nitrate-N

Accuracy: 0-6 mg/L -- +/- 5 % of reading or 0.2 mg/L, whichever is greater.

Accuracy: 6-10 mg/L -- +/- 10 % of reading using a 6 mg/L Nitrate-N standard. Accuracy in the 0-6 mg/L range may be slightly compromised by the use of the 6 mg/L standard.

Detection Limit: 0.025 mg/L Nitrate-N

USING 10 MM PATHLENGTH DETECTOR CELL

Range: 0 to 2 mg/L Nitrate-N

Accuracy: +/- 5 % of reading or 0.02 mg/L, whichever is greater

Detection Limit: 0.005 mg/L

15.2 SYSTEM SPECIFICATIONS

Operating Temperature Range: 1 to 45 C

Operating Depth : < 200 feet (61 m) of water

Reagent Life: > 30 days at a 1 hour sample interval

Standard Battery Configuration: YSI 9611 Battery Pack with 14 Alkaline D Cells.

Battery Life: Approx. 70 days at a 1 hour sample interval at 20 C; approximately 30 days at a 1 hour sample interval at 5 C.

Dimensions: Cylindrical with a diameter of 13 inches and a height of 28 inches.

Weight With All Reagent Bags Full and Alkaline Battery Pack Installed: Approximately 40 lbs. (18.2 kg).

Communication Protocol:

RS-232 for communication to PC

SDI-12 for communication to Data Collection Platforms

SECTION 16 ACCESSORIES

ITEM/MODEL #	ACCESSORY
Model 6095	6095B Adapter, MS-8 to DB-9 w/ Power Port
Model 6096	6096 Adapter, MS-8 to Flying Leads, Use with DCPs
Model 6100	6100 External Power Connector, Attaches to 6095B adapter or 6067B cable
Model 6067	6067B Low Cost Calibration Cable, 10 ft., Dry Use Only
Model 9691	Field Cable with 18 AWG Wire, 25 ft
Model 9692	Field Cable with 18 AWG Wire, 50 ft
Model 9693	Field Cable with 18 AWG Wire, 100 ft
Model 9611	Replacement Battery Pack, Alkaline D Cells, 30 Ahr
Model 9612	Replacement Cadmium Column
Model 9613	Replacement Reagent Bag Kit, 6 1-liter bags and 2 5-liter bags
Model 9614	Replacement Tubing Kit
Model 9615	Replacement Syringe Kit
Model 9616	Maintenance Kit
Model 9617	Replacement Inlet Filter Kit
Model 9689	Power Supply, MS-4 to AC outlet
Model 3885	Nitrate Standard, 1.0 mg/L Nitrate-N, 500 mL
Item 063089	Replacement Pressure Cap for Comm Port
Item 699179	Replacement Assembly Screw
Item 699296	Ferrite Bead
Item 699298	Declaration of Conformity

SECTION 17 FREQUENTLY ASKED QUESTIONS

GENERAL

What is the Model 9600 designed to do?

The YSI 9600 Nitrate Monitor is a powerful instrument that allows the user to continuously record nitrate levels at a variable sample interval and thus provides a much greater capability to detect nutrient events than the spot sampling activities which have historically been carried out. The software associated with the system allows easy user set-up for most nitrate monitoring studies whether the nitrate at the site is expected to be typical (0-5 mg/L of nitrate-N) or high (5 mg/L and up of nitrate-N). The 9600 is not designed for spot sampling of nitrate since the minimal interval between samples is 15 minutes.

What are the key competitive features of the 9600?

- Works on standard cadmium reduction/diazotization principle. Standard Methods #4500-NO₃⁻ E.
- Can be custom configured relative to detector cell for most freshwater applications (2 mm) or for most estuarine and near coastal applications (10 mm).
- Easy-to-use software for simple set-up and deployment
- Easy access to reagent bags and internal battery pack for field replacement
- Good battery life (approx. 70 days at a 1 hour sample interval at 20 C) with internal D-cell battery pack. Also can be powered by 12 V car battery, AC adapter, or data collection platform for longer deployments
- SDI-12 and RS-232 interfaces standard for use with computers and data collection platforms
- Automatic calibration at user-selected interval. Calibration points do not affect data continuity for sample intervals of 30 minutes and greater
- Waste system included with instrument to avoid cadmium²⁺ discharge into the environment
- Minimal waste volume because of pump design

How does the 9600 measure nitrate?

To accurately measure nitrate, the 9600 uses flow injection technology combined with a chemical reaction sequence which is defined in literature from both the USEPA and Standard Methods for the Examination of Water and Wastewater. The intensity of the color produced by the chemical reaction sequence is determined by standard absorbance spectroscopy and compared to that of a standard of known concentration in order to quantify the amount of nitrate in an environmental sample. The use of flow injection technology minimizes the amount of reagents required and the amount of waste generated.

Do I have to make any configuration decisions when ordering the 9600?

You must specify which detector cell will be factory installed in your 9600. The 9600-02 uses a 2 mm detector cell while the 9600-10 uses a 10 mm cell.

How would I decide which detector cell to order?

Your choice should be based on the nitrate levels that normally exist in the water that you intend to monitor. For applications where typical nitrate levels are over 2 mg/L of nitrate-nitrogen, the 9600 should be configured with a 2 mm cell; for applications where typical nitrate levels are below 2 mg/L, the monitor should be equipped with a 10 mm detector cell. The 9600-02 and 9600-10 are designed primarily for freshwater and estuarine/near coastal applications, respectively, but there may be some cases where the greater range of the 9600-02 will be required for brackish water studies and some cases where freshwater nitrate levels are consistently low enough to require the greater accuracy of the 9600-10.

Can I order a 9600-02 and a separate 10 mm detector and switch the cells myself to fit the application?

No. Users cannot change the detector cell that was purchased with their particular 9600. While detector cells can be switched from 2 mm to 10 mm or vice versa, this action must be carried out by YSI personnel and requires a return of the 9600 monitor to the factory.

What is the detection limit for the 9600?

Laboratory studies show that typical detection limits for the 10 mm and 2 mm detector cells are 0.005 and 0.025 mg/L of nitrate-N, respectively. Note that YSI uses the term “detection limit” to identify the lowest level of typical reading change which can be quantified by the analyzer near a value of zero analyte. Thus, a 9600-10 can consistently show a difference in absorbance between a blank solution and one that has a concentration of 0.005 mg/L of nitrate-N. Note that the detection limit is different from the accuracy as defined in the next section.

What accuracy does the Model 9600 provide?

With a 2 mm pathlength cell, the instrument is accurate to 5 % of the reading or 0.2 mg/L nitrate-N, whichever is greater in the 0-6 mg/L range. In the 6-10 mg/L nitrate-N range, the 9600 is accurate within 10 % of the reading. With a 10 mm detector cell, the accuracy is increased to 5 % of the reading or 0.02 mg/L, whichever is greater, in the 0-2 mg/L range.

Do I have to write any software routines to control the mixing of chemicals in the instrument?

No. The instrument software comes with two control programs for two applications – typical nitrate levels (0-5 mg/L of nitrate-N) and high nitrate levels (5-10 mg/L of nitrate-N). All the user has to do is to select one of these choices and the instrument software does the rest. The set-up of the instrument is via a “Wizard” similar to that used in many Microsoft WindowsTM programs.

If I have a special application, can I generate unique flow injection sequences to serve my needs?

This feature is not available at the initial release of the product, but will be available in the future. Please contact YSI Technical Support to inquire as to whether the feature has been activated in the software.

Does the 9600 have CE approval?

Yes, the 9600 will bear the CE sticker and thus be compliant with all electromagnetic emission and immunity requirements in countries where these regulations are relevant as long as an optional ferrite bead is installed on the instrument cable as described in Section 11 of the manual.

Can I use the 9600 to measure nitrite (NO₂⁻)?

Yes. The 9600 will measure the nitrite in the water if the cadmium column is removed and its inlet and outlet ports are connected by a fitting that is provided with the instrument. In fact, with the cadmium column in place, the 9600 measures the sum of the nitrate AND nitrite in the water being monitored. Normally, however, because of nitrification, there is very little nitrite in most environmental water and therefore the 9600 reports its readings as nitrate. Users who are concerned that there is indeed a significant quantity of nitrite in the water at their monitoring sites should either carry out studies with the 9600 with no cadmium column in place or should collect water samples at the site and perform laboratory analyses for nitrite to confirm that its presence is having a significant effect on the overall accuracy of the measurement.

CHEMICALS AND SAFETY

What safety concerns need to be addressed when using the 9600?

There are three major areas of concern when using the 9600:

- Operation of the YSI 9600 Nitrate Monitor requires the use of a variety of chemicals and users must take care to handle them properly. With one exception (elemental cadmium), the user is required to purchase these chemicals from a vendor of their choice. Users should consult the Material Safety Data Sheets (MSDS) supplied by these vendors for all reagents before their use and should follow manufacturers' and/or MSDS recommendations with regard to their proper disposal. Users should ALWAYS wear appropriate protective equipment including safety glasses with side shields and gloves when handling any of these chemicals.
- For proper operation of the YSI 9600, cadmium metal MUST be purchased in packaged form as the YSI Model 9612 Cadmium Column Assembly. An MSDS for the material captured in the cadmium column is automatically supplied to the user by YSI. To protect against potential hazards associated with inhalation of cadmium dust, the cadmium column should be handled in a fume hood during activation. After the reducing capacity of the cadmium column has been exhausted, the entire sealed column should be disposed of in accordance with regulatory requirements, e.g. hazardous waste. Users should NEVER open the cadmium column in attempts at regeneration. If the cadmium is accidentally spilled, appropriate spill measures should be taken.
- The waste generated from use of the YSI 9600 contains potentially toxic organic chemicals, but most importantly, contains Cd²⁺ that according to the USEPA is toxic and a probable human carcinogen. Users should NEVER discharge waste from the YSI 9600 into the environment, instead retaining it in the waste bags that are provided with the instrument. Likewise, unless specifically approved by the local wastewater authority, users should NEVER dispose of the reaction waste into a sanitary or storm sewer. The waste should be disposed of in accordance with regulatory requirements with an approved waste handler.

While these concerns are significant, they basically involve commonly-used good laboratory practices that are used by many organizations already. While the cost of disposal of the waste through a certified waste handler will vary somewhat, it generally it is not so high as to be a major factor in the overall cost of monitoring nitrate with the 9600. The key is that you WILL have to handle chemicals if you use a 9600 and you should have a plan in place to do so before you purchase the instrument.

Where do I get the chemicals to use with the 9600?

The sources used for the various reagents that have been used in YSI development studies on the 9600 are provided in detail in the 9600 manual. However, other than cadmium, users can purchase reagents from

any source of their choosing as long as the chemicals are (a) identical in formulation and (b) equivalent in purity – ACS Reagent Grade or better. An appropriate quantity of the reagents should be purchased based on the frequency of deployment of your 9600. The cadmium used in the system MUST be purchased from YSI in the form of a packaged column assembly.

What equipment do I need to make up the solutions for the 9600?

The following equipment should be available to users of the 9600. YSI does not supply this equipment, but will help users in recommending a source for its purchase.

- Graduated Plastic Bottles with 2 L capacity (at least 6)
- Volumetric Flask for 1000 mL (at least 1) of solution.
- Adjustable pipetter for 0-1 mL volumes (at least 1)
- Glass pipets of various denominations (depending on standard concentrations required)
- Laboratory balance with weighing accuracy of 0.01 g

CALIBRATION OF THE 9600

How is the 9600 calibrated?

Part of the reagent package of the 9600 is a standard (usually 1 or 2 mg/L in nitrate-N) and a blank (purified water with no nitrate present). These reagents are run through the system periodically during a deployment providing on-board calibration that compensates for any instrument drift. These calibration points are used to convert the optical readings from actual samples into nitrate values in mg/L nitrate-N. This calibration protocol is transparent to the user.

How often are the calibration standards run as part of a field study?

The frequency of calibration is a user-selectable parameter. YSI generally recommends that calibration be carried out at least once every 24 hours and preferably every 12 hours.

Do the calibration points displace actual data points?

Generally not. For sample intervals of 30 minutes or greater, the calibration is run between data points and no readings are displaced. For a sample interval of 15 minutes, each calibration routine (standard and blank) displaces one data point.

What concentration of calibration standard should I use for my field studies?

For your initial deployment, YSI recommends using a standard that is 1mg/L in nitrate-nitrogen (nitrate-N). This standard will assure readings that are accurate to 5 % of the reading or 0.2 mg/L whichever is greater, for the nitrate concentrations in most environmental water (0-6 mg/L of nitrate-N). If the water at your site is known to consistently contain concentrations of nitrate higher than 6 mg/L, then you can either accept a lower accuracy using the 1 mg/L nitrate-N standard or use a higher standard concentration such as 6 mg/L nitrate-N which will assure accuracy of +/- 10 % of the reading in the higher range.

USING THE 9600 IN FIELD STUDIES

How do I interact with the 9600 to set it up and deploy it?

To interface to the 9600 you must use a PC (laptop or desktop) which is running the YSI software that is designed for use with the nitrate analyzer. This software is called NUview™ and is supplied as a standard item with each 9600. The software provides an easy to use, Windows-based interface which allows you to:

- Configure your instrument for a deployment
- Start a deployment
- Interact with the 9600 during deployments to upload and view data
- Stop a deployment

Can I use my YSI 650 to interact with the 9600?

No. The 650 will not interface properly to the 9600.

Is the 9600 difficult to set up for nitrate monitoring?

The set-up is simple, but does require some time. For example, the preparation of chemicals for use with the 9600 and their installation in the monitor is not difficult, but could take a couple of hours depending on the familiarity of the user with this procedure. The diagnostic routine used before each deployment is very simple to activate with the instrument software, but does take approximately 1 hour to complete. In general, you should probably count on spending about 4 hours total in the set-up of the 9600 for a long-term monitoring study. Thus, you could set up the instrument for a deployment in the morning and deploy in the afternoon.

Do I have to take a laptop computer to the field to deploy the 9600?

Not if you don't want to. You can easily program a delay in the time of deployment during laboratory set-up of the 9600 which will allow you to simply take the instrument to the field and place it in the water at your site before any readings are taken.

Can the 9600 be used with data collection platforms?

Yes. The 9600 provides a standard SDI-12 interface which is ideal for use with most data collection platforms. Note, however, that the minimum sample interval for SDI12 applications is 30 minutes.

What is a typical sample interval for field studies?

Our experience is that usually a 1 hour sample interval will “catch” any changes in nitrate during a typical deployment. However, there may be isolated cases where nitrate events are more transitory and lower sample intervals will have to be employed to quantify them. If users are concerned about the potential for transitory nitrate events at their sites, then they should err on the side of caution in their initial studies, i.e., use a greater sampling frequency to gain knowledge of the typical rate of change of the nitrate levels at a particular location. Naturally, you will want to sample at the longest sample interval which “catches” all nitrate changes in order to conserve reagents and battery power.

What is the physical size of the 9600?

The 9600 is fairly large and must be so to provide space for the chemical reagent bags and the waste storage bags. When assembled, it is cylindrical in shape and is approximately 13 inches in diameter by 28 inches tall. When equipped with chemicals for a deployment, it weighs about 40 pounds.

What length of deployment can I expect from a 9600?

The deployment length is limited by two factors – battery life (as described above) and reagent life – and, with a fully charged battery pack the true limiting factor is usually reagent life. For a study involving a 1 hour sample interval, the reagents will last approximately 35 days. For longer sample intervals, the increase in reagent life is linearly proportional; for example, the reagents will last approximately 70 days with a 2 hour sample interval.

How long can I expect my cadmium column to last?

Our experience is that some degradation of the column will be observed after approximately 1000 samples – equivalent to about 36 days with a 1 hour sample interval. However, the loss of reducing capacity will be dependent on the overall characteristics of the water at a particular site and therefore it is possible that the column may function acceptably for longer periods of time. Unacceptably high back-pressure is the most common problem that develops as the cadmium column degrades or ages. Only by gaining experience with your particular applications will you be able to estimate the longevity of your cadmium column.

Can I regenerate my cadmium column by following the activation procedure outlined in the manual?

Our experience is that cadmium used in environmental water monitoring undergoes changes that will not allow for regeneration. Therefore, YSI strongly recommends that the cadmium column be REPLACED after function is compromised.

What depth of water is required for deploying the 9600?

Ideally, the 9600 will be deployed in an “upright” position and under these conditions approximately 3 feet of water is required for the top-mounted inlet filter to be submersed at all times. However, the 9600 can be deployed on its side if necessary with the required depth under these conditions being reduced to approximately 18 inches. Note that the entire monitor should be immersed – not just the inlet filter – so that all reagents are maintained at a constant environmental temperature.

How deep can the 9600 be deployed?

The 9600 will function properly at depths up to 200 feet of water.

What power sources can be used with the 9600?

The 9600 can be powered in three basic ways:

- An internal battery pack that contains 14 alkaline D cells with an output voltage of approximately 10.5 volts. One of these packs is supplied with each nitrate monitor and replacements are available from YSI as Model Number 9611.

- A new power supply (Model Number 9689) which will automatically convert line voltages of 90 to 264 VAC to 12 VDC and allows for the use of line input cords from most countries world-wide. The Model 9689 is supplied with an American/Canadian cord. Note that, while physically compatible with the 9600 cables (see below), other YSI power supplies such as the 6037, 6038, and 6123 should NOT be used with the 9600 since they do not supply enough power to operate the pumps correctly.
- An auxiliary power source with a voltage range of 10 to 20 volts and supplying a current of at least 2 amperes. A typical application in this area would be a lead acid battery alone or one that is being powered by solar cells as part of a data collection platform package.

What is the life of the alkaline D cell internal battery pack?

The life will depend on two key factors: (1) the frequency at which samples are run and (2) the temperature of water which is being monitored. For a 1 hour sample interval at 20 C, a battery pack will last approximately 70 days. If the sample interval is increased to 2 hours, the battery life will increase to approximately 130 days. If the temperature of the water is decreased to 5 C, the battery life at a 1 hour sample interval will decrease very significantly – to approximately 30 days.

Can the user purchase individual alkaline D-cells and make them into a battery pack?

No. Users must purchase the battery pack assemblies from YSI.

What type of cable will I need for setting up and deploying the 9600?

Depending on your applications, several YSI cables can be used to interface your 9600 to a computer as described below:

- 6067B -- If your applications involve the remote deployment of the 9600 where the instrument is powered on internal batteries and then recovered for data upload, then the relatively-inexpensive 6067B is probably the ideal cable interface to your 9600. The cable can be used in the laboratory to set up the instrument for deployments to upload data in the laboratory or in the field when no provision for a water tight connection to the 9600 is required. However, users should note that (a) the connection between the 6067B cable and the 9600 is NOT watertight and (b) the nitrate monitor CANNOT be powered by auxiliary devices such as the 9689 power supply, car batteries, or data collection platforms during deployments using this cable because its connection to the 9600 is not watertight.
- Standard YSI Field Cables -- Users of the 9600 who also have YSI 6-series field cables, such as the Models 6090, 6091, 6092, or 6093, can utilize these cables for interface to the 9600 under limited conditions. When using these cables to interface to the 9600, the optional YSI 6095B MS-8 to DB-9 adapter must be connected to the MS-8 end of the cable. However, users with existing 6-series field cables should be aware that the 9600 CANNOT be powered by auxiliary devices such as the 9689 power supply, car batteries, or data collection platforms during deployments using this cable. The current draw when the 9600 is actually making measurements is too great for the wires in the cable.
- 9600 Field Cables -- As noted in Sections 3.2.1 and 3.2.2 above, the major limitation of the use of existing YSI cables with the 9600 is that the nitrate monitor CANNOT be powered externally through these cables during deployments using the 9689 power supply, auxiliary batteries, or data collection platforms. However, special field cables such as the 9691, 9692, and 9693 are available for use with the 9600 under these conditions. These cables utilize heavier gauge wires than the standard YSI cables such that the 9600 can be remotely powered for distances of up to 100 feet between the power supply and the nitrate monitor. As for standard YSI field cables, users must utilize a 6095B adapter with the 96XX cables in order to interface to a computer.

How do I acquire the data from my 9600?

To extract nitrate data from the memory of the 9600, you will need to connect the nitrate monitor to a computer running NUview software and simply click the File selection in the initial screen. Then choose the Upload button and select the file type that you wish to upload to your computer.

The raw data found in the memory of the 9600 can be uploaded in two formats as described below:

- YSI Data Format (.DAT extension) – This data format will probably be preferred by most users and is compatible with the proven YSI data analysis software EcoWatch for Windows™. This software will allow custom reporting and plotting of the data from the 9600 and will allow the interconversion between concentration units of mg/L of nitrate-N and uM (micromolar) nitrate. Most importantly, nitrate-N data uploaded in .DAT format will be processed to take into account the periodic calibration of the 9600, automatically compensating the data for any drift. When you upload in .DAT format, only three parameters are available for display in EcoWatch for Windows – nitrate concentration, the optical absorbances associated with each point, and the battery voltage. Note that the optical absorbance has NOT been compensated for calibration drift.
- Comma Separated Values (.CSV extension) -- Uploading data from the 9600 in this data format will allow users to obtain the raw data parameters that are used to calculate the nitrate values uploaded in the YSI Data Format. Files of this type can readily be opened in spreadsheets such as Excel for advanced data analysis and troubleshooting if required by the user. The following parameters are found in the file:
 - The raw signal photodiode response for all samples, blanks, and standards in sequential listing.
 - The raw reference photodiode response logged at the time of each sample, blank and standard reading.
 - The battery voltage.
 - A date and time stamp for each sample, blank, and standard reading.

In general, users will always want to upload their data in YSI Data Format; they may or may not want to upload in .CSV format, depending on their level of interest in the processing of the raw data. In particular, the .CSV file will be of great help to YSI Technical Support personnel in troubleshooting.

Can I just view the data in the field without plotting it to assure that the instrument is functioning properly?

Yes. You can use the Quick View feature in the software to view the last 10 sample points, blank, and standard points and assure that they are consistent with good 9600 performance

Does the study stop when I upload or view my data in the field?

No. The current study will continue even if you carry out the upload or Quick View operation while a sample is being taken. There will be no need to restart the study while viewing or uploading data.

APPENDIX A ECOWATCH FOR WINDOWS COMMANDS

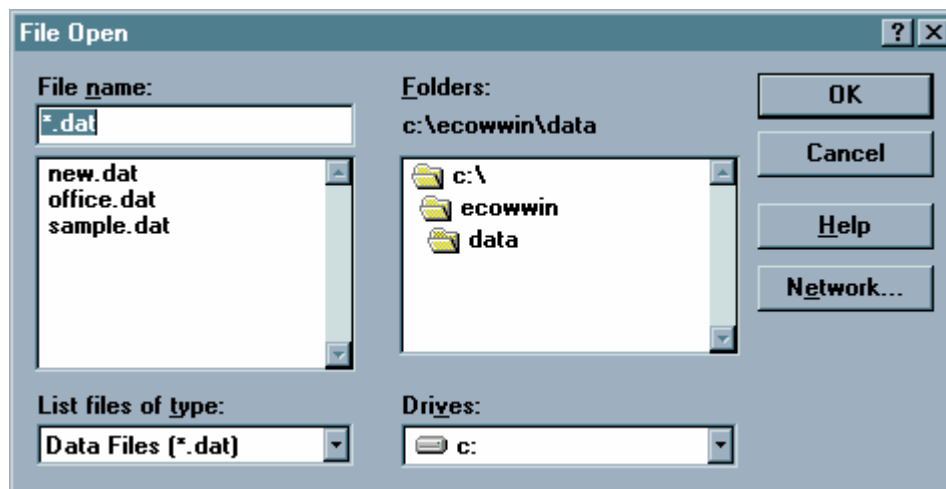
The following section provides a description of all EcoWatch functions. Examples shown in the discussion use water quality parameters from 6-series sondes rather than nitrate data from a Model 9600, but the functionality of the commands is identical for both applications. As noted above, several of the commands in EcoWatch are used to communicate to 6-series sondes and these commands are not relevant for use with the 9600.

7.6.1 FILE

The **File** menu offers the following list of commands. Some commands are available only when a file is open.

OPEN

Use this to open sonde or 9600 data file (.DAT).



File Name Type or select the filename you want to open. This box lists files with the extensions you select in the **List Files of Type** box.

List of Files of Type Select the type of file that you want to open.

- *.dat Sonde or 9600 binary data file
- *.txt, *.prn ASCII text file
- *.cdf, *.csv, *.sdf Comma delimited file
- *.rt Real-time file
- *.cr1 CR10 file

Drives Select the drive where the YSI Data Format file resides.

Directories Select the directory where the YSI Data Format file resides.

Network... Choose this button to connect to a network location, assigning it a new drive letter. This button is hidden if your computer is not connected to a network. The screen above has the network button hidden.

CLOSE

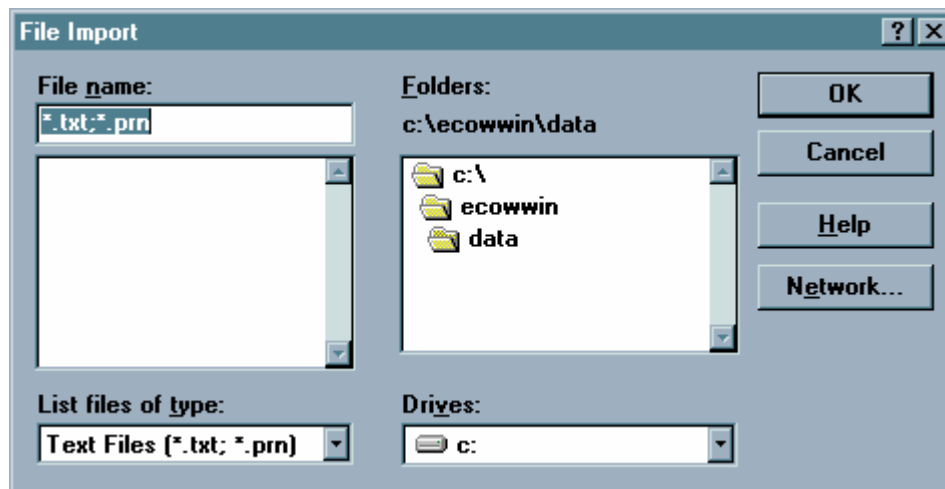
Use this command to close all windows containing the active document. EcoWatch automatically saves any changes before the file is closed.

You can also close a document by using the **Close** icon on the document's window, as shown below:



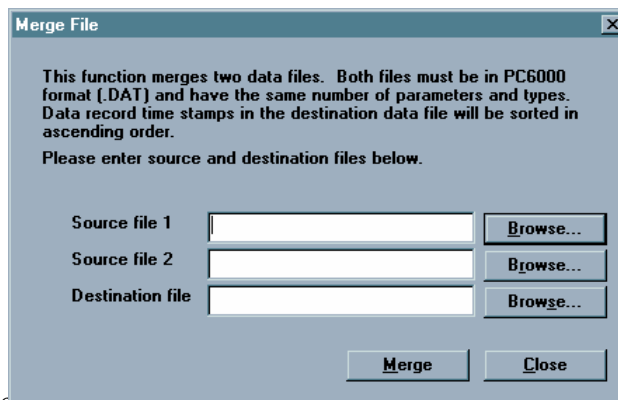
IMPORT

With this command, you can import common ASCII files into EcoWatch. The file will be converted into YSI Data Format and again with a .DAT extension.



MERGE

This function takes two existing data files and merges them into one new file. Both files must be in YSI Data Format (.DAT), have the same number of parameters, and the same parameter types (the parameter set-up must be identical). Data record time-stamps in the destination data file will be stored in ascending



order.

COPY TO CLIPBOARD

If a graph or table is active, then choosing this command will send its contents to the Windows clipboard so that it can be pasted into other programs. This is a normal method of transfer data between different Windows programs.

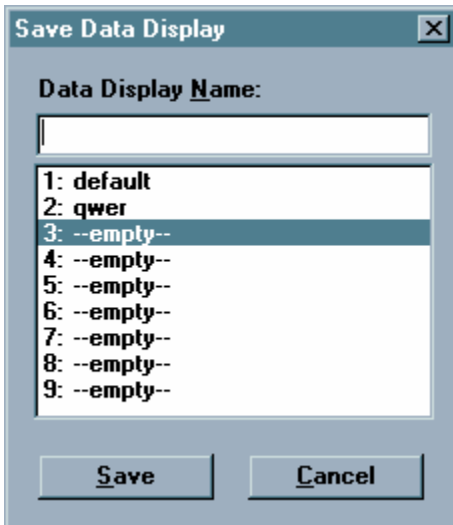
Shortcuts

Toolbar: 
Keys: CTRL+C

SAVE DATA DISPLAY

When opening a data file, you will probably want to look at the data in graph form. You may also want to rearrange the default graph by selecting or reordering parameters, zooming in to a portion of the graph, or even changing colors or changing fonts. You may sometimes choose to look at the data or a portion of it in table form. All of this work is done in the Data Display window.

This command allows you to save the settings and content of the Data Display window so that you can load it at another time and have it look exactly the same as when you saved it. This saved display is associated with the data file. Up to 9 data displays can be saved per data file. When you save a display you will be asked to give it a name in the following dialog box.



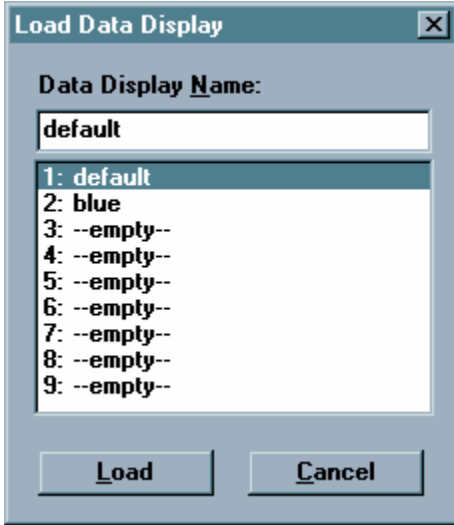
There must be an open data file for this command to be available. See also **Load Data Display**.

Shortcuts

Keys: CTRL+S

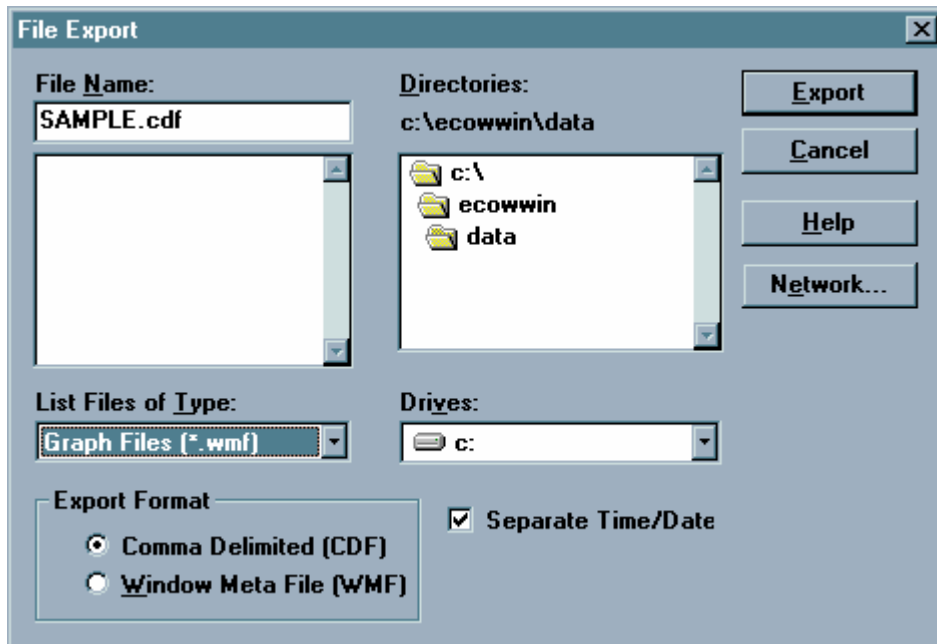
LOAD DATA DISPLAY

This command is only available when a data file is open. If you have previously used the **Save Data Display** command for the open data file, then you can load the saved display and have it look exactly the same as when you saved it. Saved displays are associated with the data file. You can have as many as nine saved displays for each data file. When loading a display you will be asked to choose from among the names of saved displays.



EXPORT

Use this command to send the current data to a file. Typically, some other program will read the file. You will see the following dialog box.




You may export the file in either of two forms: a WMF file, or a .CDF file.

WMF stands for Windows MetaFile and is a format that describes any image in a way that is independent of the program that generated the image. For example, you can generate a graph in EcoWatch, export it as a .WMF file and then import it into another Windows program.

CDF stands for Comma Delimited, sometimes referred to as a Comma and Quote Delimited File. This format is commonly used by spreadsheet and database programs. In this type of file, commas separate individual data entries, quotation marks surround any text and no formatting or marking is performed on numbers. EcoWatch can also open files in CDF formats.

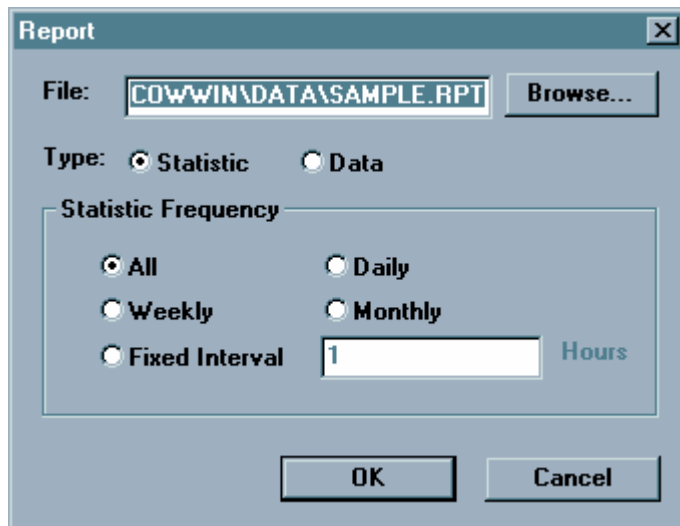
When the exported file is to be imported into a spreadsheet, it is sometimes convenient to reduce the number of data. Averaging them can easily do this. See **Change Parameter Attributes** for more information.

Shortcuts

Toolbar: 

REPORT

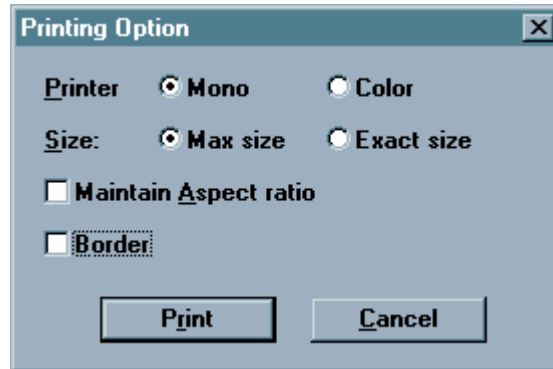
Use this command to send data or statistics to an ASCII text file. The information is easy to read in this format. When choosing this command the following dialog box will appear.



- You must enter a filename (under **File**; use the **Browse** button if needed). If you want to simply have a report Type listing the data, then click **Data**. If you want **Statistics** (minimum, maximum, average, and standard deviation), then the statistics frequency button applies.
- If you want to have **Daily** statistics, keep in mind that every day actually starts at midnight. It would be likely then that the first and last days would have very different statistics because they would only be partial days. **Daily**, **Weekly** and **Monthly** statistics behave similarly.
- When you click **OK**, EcoWatch will send the report to the specified file and open Windows Notepad where you can view and/or print the report. Note: Notepad can only open report files that are 64K or less in size. You can use the Windows Wordpad to open reports that are larger than 64K. Unless you change it, the report file will have the same location as your data file (.DAT) and has the same name with a .RPT file extension.

PRINT

Use this command to print a document. If a graph is selected, this command presents a Print Option dialog box with the options below. When a table is selected, a standard print window is presented.



Shortcut

Toolbar:
Keys:



CTRL + P

Printer

If you have a color printer, you can choose to print in Color. Otherwise you should choose Mono (black and white).

Size

If you choose Max size, then the program will size the graph so that it fits on one page. If you choose Exact size, then program will print the graph as close as possible to the size that is displayed.

Maintain Aspect Ratio

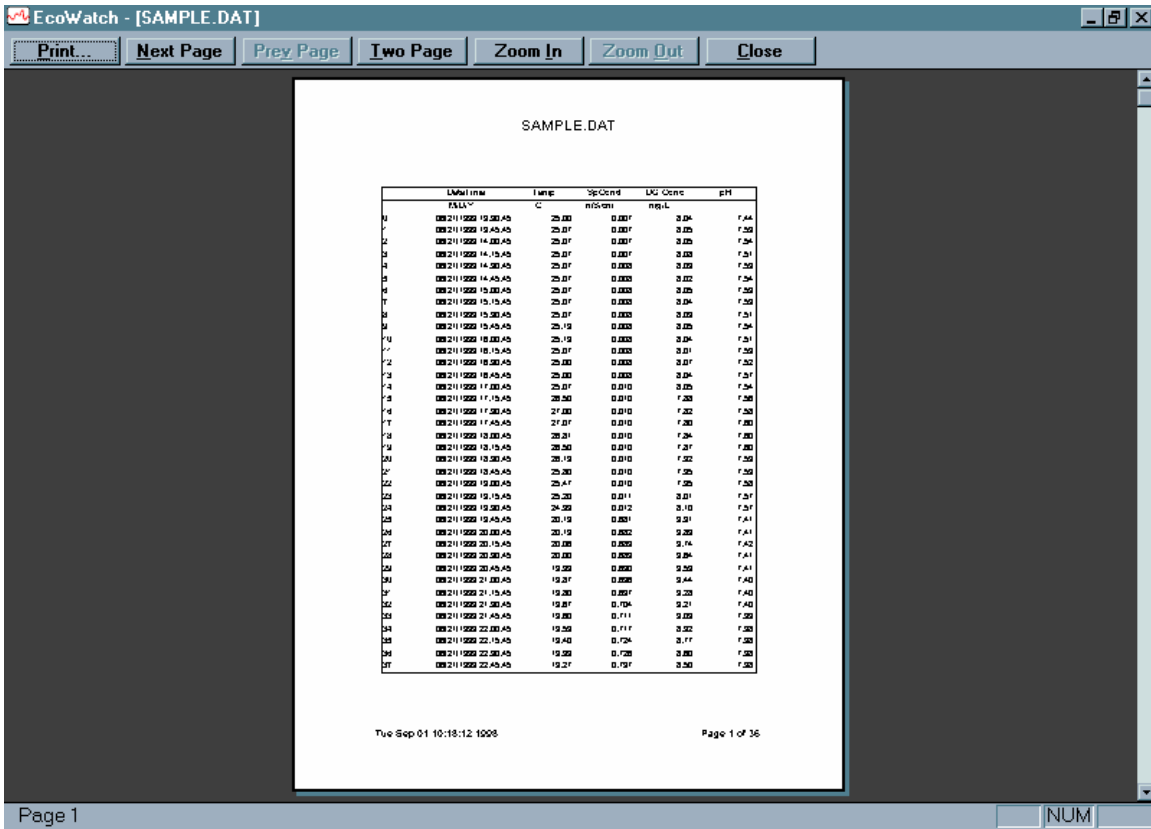
If you choose to maintain the aspect ratio, then the program will size the graph until either the height or the width is maximized and then leave the graph in the same height width ratio that is displayed.

Border

You can also choose whether or not to print a border.

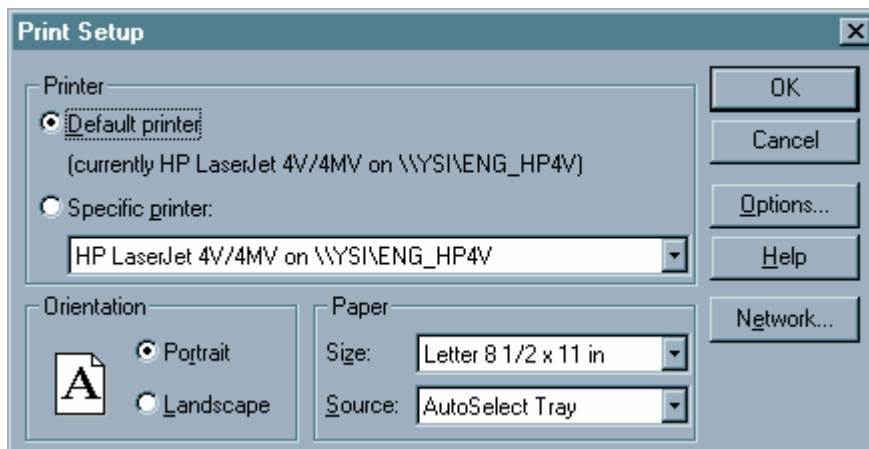
PRINT PREVIEW

This command allows the user to preview how the document will appear when it is printed. This command only works for data that is displayed in a table format, not when the data is in graph format.



PRINT SETUP

Use this command to select a printer and a printer connection. This command presents the **Print Setup** dialog box. The following options allow you to select the destination printer and its connection.



Printer

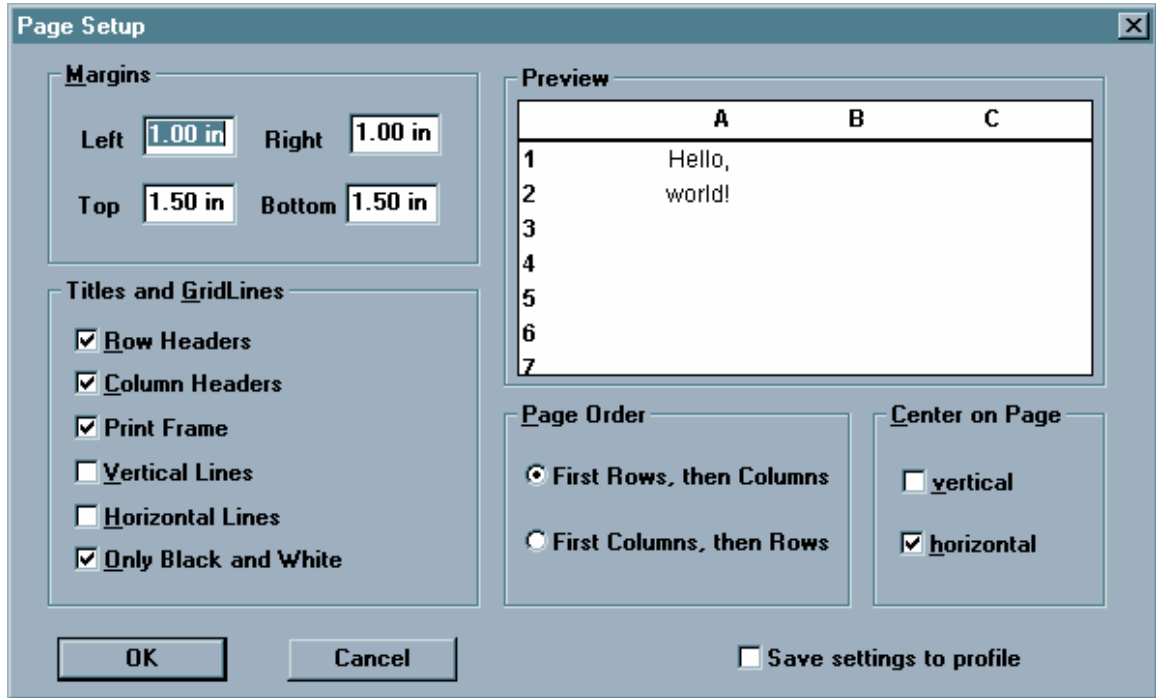
Select the printer you want to use. Choose the **Default Printer**; or choose the **Specific Printer** option and select one of the current installed printers shown in

the box. You install printers and configure ports using the Windows Control Panel.

- Orientation** Choose **Portrait** or **Landscape**.
- Paper Size** Select the size of paper that the document is to be printed on.
- Paper Source** Some printers offer multiple trays for different paper sources. Specify the tray here.
- Options** Displays a dialog box where you can make additional choices about printing, specific to the type of printer you have selected.
- Network** Displays a dialog box that allows you to choose a printer if you are on a network.

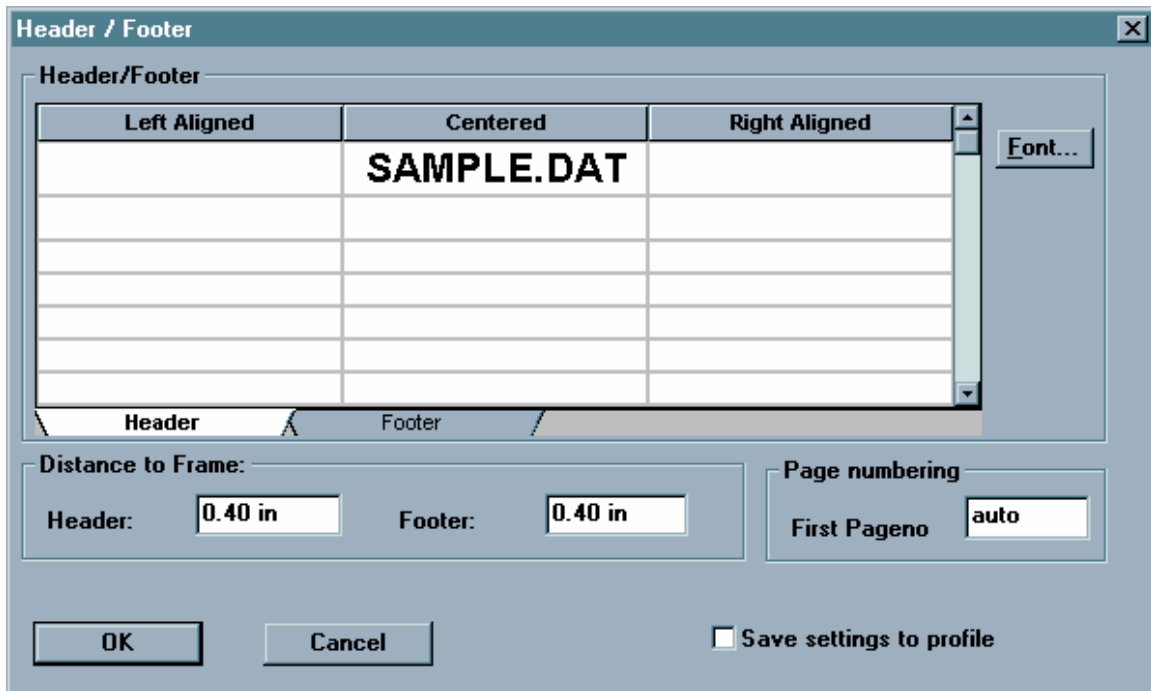
PAGE SETUP

Layout options for printable data tables may be specified. Page margins, table set-up, page orientation, and page order are adjustable.



HEADER/FOOTER

Page headers and footers can be customized with respect to font and placement. Both the header and footer have separate tabs as shown below. Once the desired profile is created, it can be saved for use every time the particular data file is opened.



7.6.2 EDIT


The edit menu appears whenever a data file is opened in EcoWatch. It allows you to locate, format, and manage data.

COPY

Copies the selection to the clipboard. If a graph or table is active, then choosing this command will send its contents to the Windows clipboard so that it can be pasted into other programs. This is a normal method of transfer data between different Window programs.

Copying data to the clipboard replaces the contents previously stored there.

Shortcuts

Toolbar: 
 Keys: CTRL+C

PASTE

This command does not function in this version of EcoWatch.

REMOVE PARAMETERS

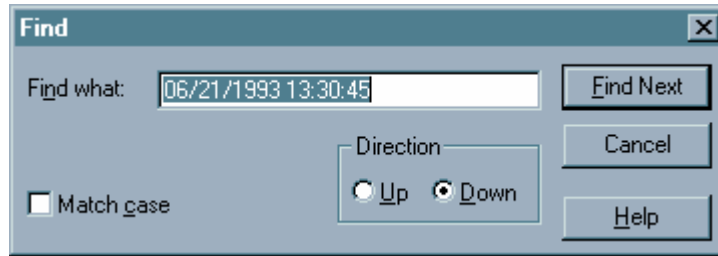
When entire column(s) of data is selected, including the heading(s), this command will remove the parameter(s) from both the data table and graph.

INSERT PARAMETER

Adds an additional parameter to the data table and graph. All available parameters that can be added are shown on a list.

FIND

Locates text within the selected parameter. Only one parameter may be searched at a time. A system beep indicates that there are no more occurrences of the desired text.



FIND AGAIN

Locates the text that was most recently searched for within the selected parameter. Only one parameter may be searched at a time.

7.6.3 VIEW

The **View** menu offers the following commands:

TOOLBAR

Use this command to display and hide the Toolbar, which includes buttons for some of the most common commands in EcoWatch, such as **File|Open**. A check mark appears next to the menu item when the Toolbar is displayed.



Shortcut: To hide or display the Toolbar, choose **Toolbar** from the **View** menu.

See **Section 4.2.6, Using the Toolbar**, for a list of the toolbar icons and their functions.

STATUS BAR

Use this command to display and hide the **Status Bar**, which describes the action to be executed by the selected menu item or statuses of keyboard latch state. A check mark appears next to the menu item when the **Status Bar** is displayed.



The right areas of the status bar indicate which of the following keys are latched down:

CAP	The Caps Lock key is latched down.
NUM	The Num Lock key is latched down.
SCRL	The Scroll Lock key is latched down

4-DIGIT YEAR

Use this command to toggle between a date with a two or four digit year on the graph and table.

GRAPH

Use this command to display and hide the **Graph** page when viewing a file. The graph page contains plots of data.


Shortcuts

Toolbar: 

TABLE

Use this command to display and hide the **Table** page while viewing a data file.

Shortcuts

Toolbar: 

GRID

Turns on or off the gridlines on graphs.

MARKERS

Turns on or off data point markers on the graphs. For graphs with more than a few data points we recommend that **Markers** be left off.

STATISTIC

This command will display statistics for the current study. It will show the minimum, maximum, mean, and standard deviation for each of the current parameters. If you click on any minimum or maximum value, then a small box will appear showing the date and time when the minimum or maximum point occurred.

Statistic				
4315 Samples				
From (06/08/94 15:52) To (07/23/94 14:22)				
	Min	Max	Mean	Std
Temp (C)	19.85	32.05	25.67	2.459
Sp Cond (mS/cm)	0.01	1.02	0.86	0.057
DO Conc (mg/L)	0.16	15.14	3.07	3.286
pH ()	6.79	7.77	7.27	0.127
Depth (ft)	0.93	2.84	2.32	0.236

Shortcuts


Toolbar: 

STUDY INFO

This command will display a dialog box describing the study. It will show the sonde type and serial number that was used to collect the data, the parameters available, the logging interval, and the beginning and ending times of the sample.

Study Info	
Instrument Model: <input type="text" value="6000-UPG1"/> ID: <input type="text" value="<None>"/> Revision: <input type="text" value="2.00"/>	Sample Total samples: <input type="text" value="4315"/> First sample: <input type="text" value="06/08/94 15:52:50"/> Last sample: <input type="text" value="07/23/94 14:22:50"/>
Parameters Battery Cond Depth DO% pH Temp	Logging Site Name: <input type="text" value="jones2"/> Rate: <input type="text" value="15 Mins"/> Duration: <input type="text" value="44 Days, 22 Hrs, 30 Mins"/>


Shortcuts

Toolbar: 

ZOOM IN

Enlarges graph or data table (whichever is currently active) by 20%.


Shortcuts

Toolbar: 

ZOOM OUT

Reduces graph or data table (whichever is currently active) by 20%. If the graph already extends to both ends of the **Study Limits**, then it is not possible to zoom out any farther and this command will be dimmed.

Shortcuts

Toolbar: 


UNZOOM

Displays the graph all the way to both ends of the **Study Limit** if a graph is selected. Displays the data table in default size, if a data table is selected.

Shortcuts

Toolbar: 

7.6.4 COMM(UNICATION)

NOTE CAREFULLY: None of the selections under the COMM selection are relevant for use with the Model 9600 Nitrate Monitor. In addition, the Toolbar sonde icon:  also cannot be used with the 9600

7.6.5 REAL-TIME

NOTE CAREFULLY: The REAL-TIME selection cannot be used with the Model 9600 Nitrate Monitor.

7.6.6 GRAPH

ZOOM WINDOW

Enlarges a section of the graph. The pointer will change to a magnifying glass and then you can click and drag on the graph to indicate the section you want to view. This command stays active until you execute it again.

Shortcuts

Toolbar: 

CENTER SCROLL

Centers graph at the mouse cursor. The pointer will change to a bullseye. Clicking anywhere on the graph will cause that point to be moved to the center. This command stays active until you execute it again.

Shortcuts

Toolbar: 

LIMIT DATA SET

This command limits the amount of data being processed. If you are not presently interested in portions of the graph or table at the beginning or end of the study, you may want to use this command to indicate only that portion that you are interested in. The program will have fewer data points to handle and will respond to your commands quicker. Executing this command when modifying a graph will change the pointer to a vertical arrow. Click once on the left end of that part of the graph that you want and then click again at the right end. This command stays active until you execute it again.

To limit the data in a table, move the pointer to the far left of the table into the row numbers area and highlight from the desired cutoff point to the beginning or end of the data set, whichever is desired. Then select the **Limit Data Set** option from the graph menu or use the toolbar shortcut.

To undo the limits choose **Cancel Limits** below. Alternately, you may remove the limits on a graph by executing this command backwards. That is, click anywhere on the right side of the graph first, and then click anywhere on the left side. The limits will be moved to the ends of the file.

Shortcuts

Toolbar: 

AUTOSCALE

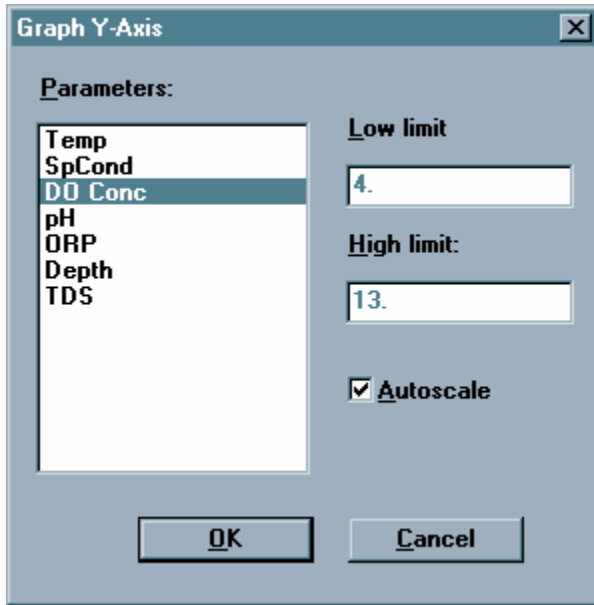
Sets the scale of each parameter so that the minimum and maximum points fit comfortably on the graph.

MANUAL SCALE

Takes you to the **Graph Y-Axis** dialog box where you can set the scale for each parameter.

Graph Y-axis dialog box

To manually scale a graph, double click on its Y-axis labels. A dialog will come up where you can set the scale. Note that you can manually set the scale for some parameters and autoscale others. When the autoscale box is checked, the high and low limits will be dimmed. See also the **Autoscale** command in the **Graph** menu.



REDRAW

If part of a graph is not displayed it could be because your window is sized too small to display it or because you have just returned to EcoWatch from some other application. Maximizing the window and choosing this command should display your graph correctly

Shortcuts

Toolbar: 

CANCEL LIMITS

Choose this command to cancel the limits set by the **Limit Data Set** command.

7.6.7 SETUP

PARAMETER

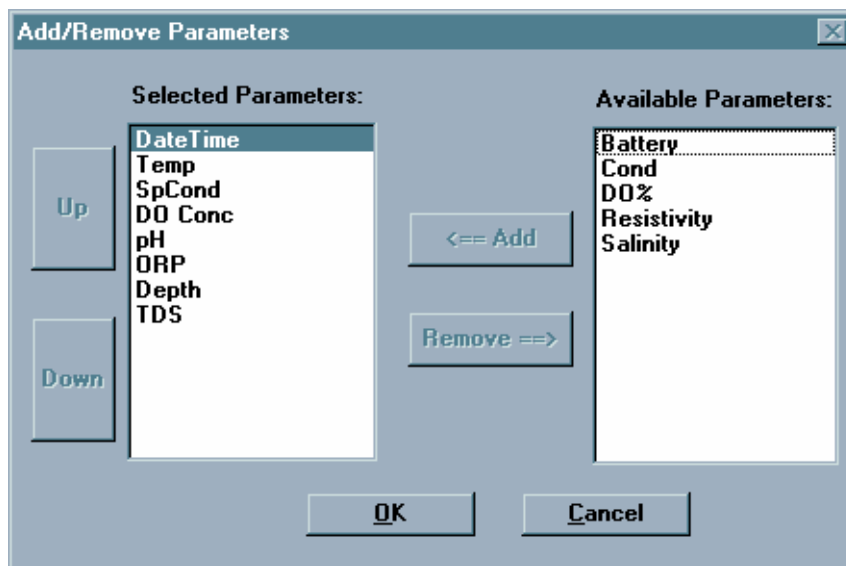
Lets you select which parameters you want to analyze and how they will appear.

Add/Remove

There are two lists, **Selected Parameters** and **Available Parameters**. If, for example, you wish to graph another parameter, you must highlight it on the **Available Parameter** list and then click the Add button to move it over to the **Selected Parameters** list.

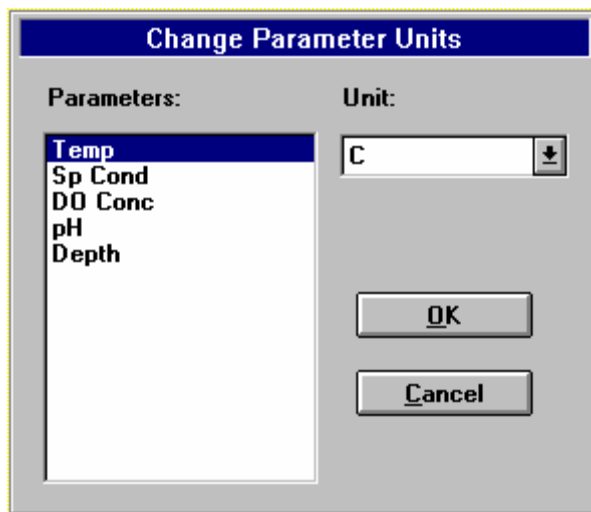
This is also where you decide the order in which the parameters will appear in both the table and the graphs. If you choose to have two traces per graph, then the first graph will have the first and second parameters on this list, the second graph will have the third and fourth parameters and so forth. The parameters will appear in the **Selected Parameters** list in the order that they were added. To rearrange the order, highlight the parameter you wish to move and then use the up and down buttons to move it to the desired spot in the order.

The **TSS parameter** (only available if your sonde has a Turbidity sensor) is a parameter that is not part of your original collected data. TSS is calculated by EcoWatch, which uses the Turbidity data and a set of correlation points that you enter. When you add TSS, a TSS calibration window will pop up and prompt you for a set of correlation points. For more information see **Calibrate TSS**.



Units

Select the units for any parameter. It will take you to the **Change Parameter Units** dialog box. You may choose the units for each of the selected parameters. Many parameters have only one possible choice of units. DO concentration, for example; can only be expressed in mg/L. pH has no units at all.

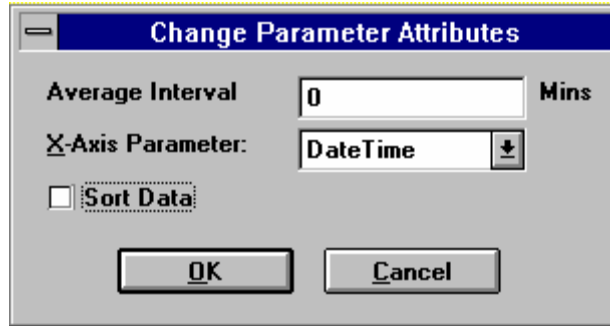


Attributes

This command takes you to the **Change Parameter Attributes** dialog box where you have access to two powerful features. You can choose to display an average of your data, or graph the data with some parameter other than time for the x-axis. The most common use for this latter feature is to graph temperature and DO versus depth. Other combinations are possible. You may choose to average the data before it is graphed. An interval of 0 will cause there to be no averaging at all. The larger the averaging interval, the more points will be used in each average. For example, if

you acquired data every 15 minutes and you set the average interval to 60 minutes, each set of four points will be averaged and then plotted as a single point. This feature will not only smooth a graph, but will also reduce the amount of data exported. This is sometimes convenient when exporting to a spreadsheet.

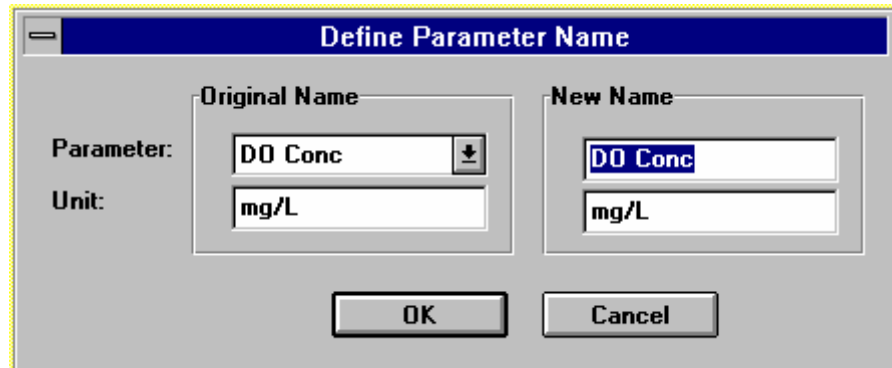
The x-axis parameter is normally **Time**, but you can choose any parameter you like. By default, data files are sorted by increasing time. If you have chosen another parameter for the x-axis, then you may want to have the data sorted before graphing it.



Change name

This command takes you to the **Define Parameter Name** dialog box where you may change the default names of the parameters.

This dialog is intended to make changes like "degrees Celsius" to "degrees C". If you change "degrees Celsius" to "degrees Fahrenheit", then the data displayed will be in degrees Celsius even though the graph says "degrees Fahrenheit." To change the units for that parameter, use the **Change Parameter Units** dialog box.

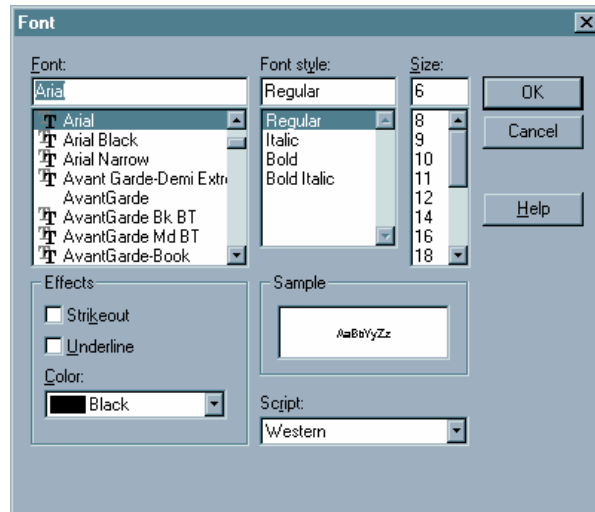


GRAPH

In the **Setup** menu, the **Graph** submenu has the following commands:

Font/Color

Goes to the **Font Dialog Box** where you can change the font and color of text that appears in the graph.



- **Font**
Type or select a font name. EcoWatch lists the fonts available with the current printer driver and additional fonts installed in your system.
- **Font Style**
Select a font style. To use the default type style for a given font, select Regular.
- **Size**
Type or select a font size. The sizes available depend on the printer and the selected font. If the size you type is not available on the current printer, EcoWatch chooses the closest available size.
- **Effects**
Choosing **Strikeout** will draw a line through all text in the table. Choosing underline will underline the text.
- **Color**
Type or select one of the 16 predefined colors. To display color, you must have a color monitor; to print color, you must have a color plotter or a color printer.
- **Sample**
Shows the effects of the formatting you specify before you apply it to the document.

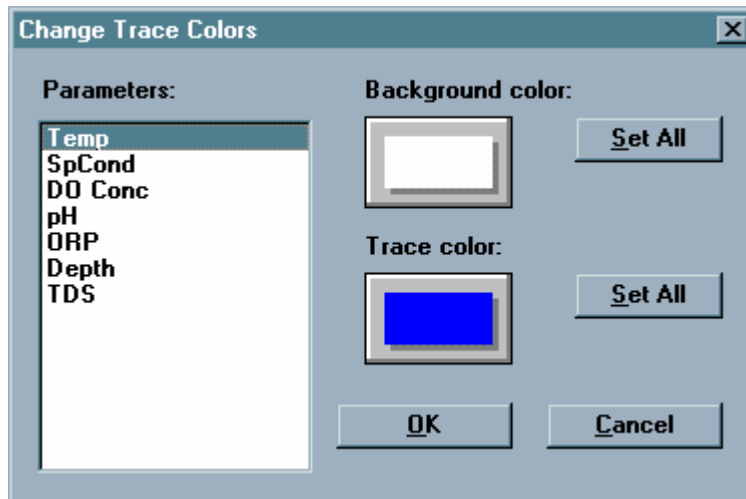
Page Color

Goes to the **Color Dialog Box** where you can change the color of the graph page. This is the background for all of the graphs rather than the background for each individual graph that is set with the next command.



Trace Color

Goes to the **Change Trace Color** dialog box where you can change the color of the trace and the background for each of the individual graphs. For setting the background color for all graphs, see the previous command.

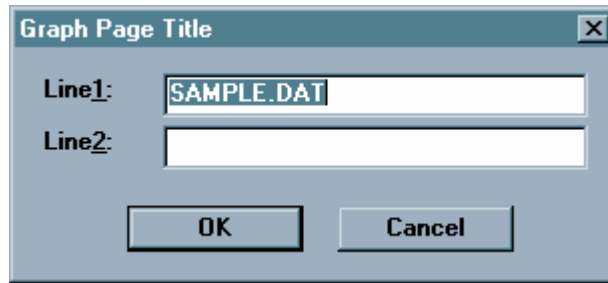


Note that there are two color buttons, one for the trace color and the other for the background color. Clicking on either of these buttons will take you to the **Color** dialog box where you can change the color.

Use the **Set All buttons** to quickly set all traces or backgrounds to the same color.

Page Title

This is where you can enter a title for the graph. The title may have one or two lines.



1 Trace per Graph

Choose this to have just one parameter on each graph.

2 Traces per Graph

Choose this to have two parameters on each graph.

TABLE

If there is no table, then the commands on this submenu will be unavailable. The Table submenu offers the following commands:

Font/Color

Goes to the Font Dialog Box where you can change the font and color of text that appears in the table.

Page Color

Goes to the Color Dialog Box where you can change the color of the table background color. That is the part of the table where the readings appear.

Highlight Color

Goes to the Color Dialog Box where you can change the color of the table highlight color. That is the part of the table where the reading units appear.

SET DEFAULT TEMPLATE

This option allows you to select display parameters for your data when you initially open a file in EcoWatch. Display parameters include background and trace colors on your graph, which parameters are displayed, parameter ordering, parameter units, and scaling of those parameters (either manual or automatic). The first time you use EcoWatch with a data file, graphing will proceed according to the default settings present in EcoWatch. For example, graph backgrounds will all be black, traces will be plotted each with a different color, all parameters will be auto-scaled, and if your sonde measures conductivity and dissolved oxygen, EcoWatch will display specific conductance in mS/cm and dissolved oxygen in mg/L. You can change the default settings by using **Set Default Template**.

1 - Open a data file and observe the presentation of the data in graphic and tabular form.

2 - You can change the background and trace colors by going into the **Graph** and/or **Table** submenus of the **Setup Menu**.

3 - You can add or remove parameters by going into the **Parameter** submenu of the **Setup Menu**.

- 4 - You can change the units of the displayed parameters by going into the **Parameter** submenu of the **Setup Menu**.
- 5 - You can change the order of the parameters by going into the **Add/Remove Parameters** dialog box in the **Parameter** submenu of the **Setup Menu**.
- 6 - You can set the scaling options for your data by double-clicking on the Y-axis of the graph and using the **Graph Y-Axis** dialog box to set the scales.
- 7 - After setting the display parameters enter the **Setup Menu** and choose **Set Default Template**. Now every data file that you initially open will use the display parameters that you have chosen. If you want to delete your template, enter the **Setup Menu** and choose **Clear Default Template**.

CLEAR DEFAULT TEMPLATE

This command will eliminate a default template that has been saved. With no default template, all new EcoWatch files open in whatever form they were saved in.

7.6.8 APPL(ICATIONS)

NOTE CAREFULLY: The **APPL** selection cannot be used with the Model 9600 Nitrate Monitor.

7.6.9 WINDOW

The Window menu offers the following commands that enable you to arrange multiple views of multiple documents in the application window:

CASCADE

Use this command to arrange multiple opened windows in an overlapped fashion

TILE HORIZONTAL

Use this command to vertically arrange multiple opened windows in non-overlapped horizontal tiles.

TILE VERTICAL

Use this command to arrange multiple opened windows side by side.

ARRANGE ICONS

Use this command to arrange the icons for minimized windows at the bottom of the main EcoWatch window. If there is an open document window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this document window.

WINDOW 1, 2...

EcoWatch displays a list of currently open document windows at the bottom of the Window menu. A check mark appears in front of the document name of the active window. Choose a document from this list to make its window active.

7.6.10 HELP

The Help menu offers the following commands, which provide you assistance with this application:

CONTENTS

Offers you a list of the available **Help** topics.

USING HELP

Use this command for instructions about using Help.

TECHNICAL SUPPORT

YSI Technical support phone number.

ABOUT

Displays the version number of this application.

YSI incorporated



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