# *Operator Manual*

## ANATEL A643a TOC ANALYZER


HACH ULTRA™

EXCELLENCE IN PROCESS ANALYTICS

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# Manual Overview

## About This Manual

The information in this manual has been carefully checked and is believed to be accurate. However, Hach Ultra assumes no responsibility for any inaccuracies that may be contained in this manual. In no event will Hach Ultra be liable for direct, indirect, special, incidental, or consequential damages resulting from any defect or omission in this manual, even if advised of the possibility of such damages. In the interest of continued product development, Hach Ultra reserves the right to make improvements in this manual and the products it describes at any time, without notice or obligation.

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## Safety Conventions

**WARNING**

*A warning is used to indicate a condition which, if not met, could cause serious personal injury and/or death. Do not move beyond a warning until all conditions have been met.*

**CAUTION:**

*A caution is used to indicate a condition which, if not met, could cause damage to the equipment. Do not move beyond a caution until all conditions have been met.*

**Note:**

*A note is used to indicate important information or instructions that should be considered before operating the equipment.*

## General Safety Considerations

- Read the *Anatel A643a TOC Analyzer Operator Manual* thoroughly before installing or operating the instrument. Although the A643a is designed for rugged use, it is still an instrument that should be cared for and maintained as described in this manual. Following proper safety and handling instructions will promote accident free operation and prolong product life.
- For any questions regarding the Anatel A643a, contact Hach Ultra at 800-866-7889 or +1-541-472-6500.
- All service procedures should be conducted by properly trained service personnel.
- Make sure the A643a TOC Analyzer is properly installed and all connections are correctly installed before operation. All safety guidelines should be observed.
- Follow all procedures in “Return Procedures” on page 189 before shipping a unit to a service center for repair or re-calibration.

### WARNING

*Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.*

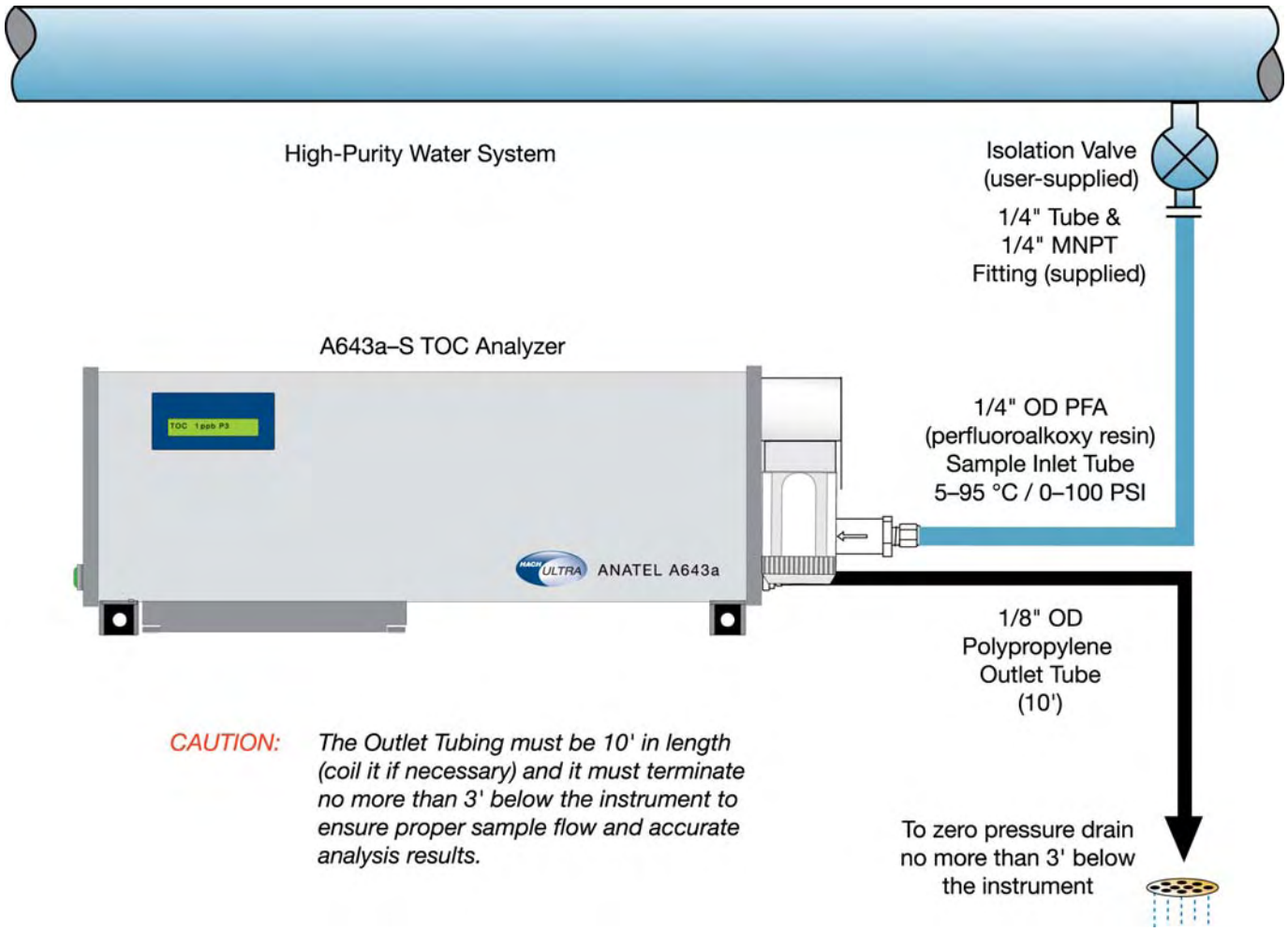
### WARNING

*Only factory certified personnel should perform service of the* A643a*. Attempts by untrained personnel to disassemble, alter, modify or adjust the electronics and/or hydraulics may result in personal injury and damage to the* A643a*.*

## A643a TOC Analyzer Warnings and Cautions

### CAUTION:

*It is extremely important that the A643a TOC Analyzer be plumbed correctly to ensure proper sample flow through the instrument and, consequently, accurate analysis results. The Outlet Tubing* ***must be 10 feet in length and cannot terminate more than 3 feet below the Analyzer****. For this reason, use the section of polypropylene tubing that is supplied with the instrument. Coil and tie the tubing if necessary to keep it out of the way,* ***but do not cut it****.*



This instrument has been tested and found to be in conformity with the following EU Directive:

- EMC Directive 89/336/EEC Low Voltage Directive 73/23/EEC

This instrument is in conformity with the relevant sections of the following EC Technical Standards and other normative documents:

- Safety: EN 61010-1:1993 + A2:1995
- EMC: EN 61326:1998
  EN 55011:1999
  EN 61000-3-2:1995 + A14:2000
  EN 61000-3-3:1997
  EN 61000-4-2:2001
  EN 61000-4-3:2001
  EN 61000-4-4:2001
  EN 61000-4-5:2001
  EN 61000-4-6:2001
  EN 61000-4-11:2001

**Note:**
*The CE Marking applies only to 230 VAC instruments and has been affixed on the devices according to the EU Directives noted above.*

The A643a TOC Analyzer complies with those parts of 21 CFR, Part 11 concerning the collection, retention, access and retrieval of data as electronic records. The instrument uses no electronic signature(s), thus those parts of the rule referring to electronic signature(s) are not applicable. Extensively documented and verifiable tests have been conducted to establish 21 CFR, Part 11 compliance.

The A643a TOC Analyzer System is comprised of a line of precision instruments which meet or exceed the following international requirements and standards of compliance:

**EN61010–1**
Electrical Equipment for Laboratory Use,
Part 1: General Requirements

**CAN/CSA–C22.2 No. 1010.1–92**
Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements

Customer satisfaction through continuous quality improvements.

In addition, the following international symbols are found on the instruments and throughout the *A643a TOC Analyzer Operator Manual:*

**High Voltage**
*Reference Document: ISO 3864, No. B.3.6*

**Standby**
*Reference Document: IEC 417–5009*

**Earth Ground**
*Reference Document: IEC 417–5017*

**Protective Earth Ground**
*Reference Document: IEC 417–5019*

**WARNING**

*The UV lamp used for oxidation by the Anatel A643a emits ultraviolet radiation and contains small amounts of mercury vapor. When replacing it, dispose of the expired UV lamp in accordance with applicable local regulations. Hach Ultra accepts used lamps for proper disposal. Refer to* "Return Procedures" on page 189 *for guidelines.*

**WARNING**

*The Anatel A643a contains high voltage electronics. Always physically disconnect power from the instrument before performing maintenance procedures to avoid potential electrostatic discharge resulting in possible shock or damage to instrument components. Although the instrument's electronics and analysis modules are physically separated and the enclosure is NEMA 12-compliant, components are not completely protected against external conditions. Do not subject the Anatel A643a to direct water streams or other adverse environmental elements.*

**WARNING**

*The calibration and validation processes employed by the Anatel A643a use chemicals and a photooxidation technology which produces hazardous waste byproducts. The effluent is potentially dangerous both personally and environmentally. Analyzer wastes generated during calibration and validation procedures must be disposed of in accordance with all applicable local regulations.*

**WARNING**

*The A643a TOC Analyzer's onboard lithium battery presents a potential fire, explosion and burn hazard. Properly dispose of expired batteriesódo not attempt to incinerate, recharge or disassemble.*

**WARNING**

*The A643a TOC Analyzer's fittings and sample vessel may become hot during operation if the sample water is hot, thereby creating a potential burn hazard. Make sure parts and surfaces are cool to the touch before proceeding with procedures.*

**WARNING**

*Use extreme care when installing and removing the Anatel A643a Analyzer's sample vessel and vials. Contact with the exposed needle could cause injury.*

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**CAUTION:**
*When replacing the battery, ensure that the positive (+) indicator on the battery is inserted at the positive end of battery holder.*

**CAUTION:**
*Use the grounded power cord provided and do not clip the ground pin.*

## Warranty

Hach Ultra warrants that this instrument will be free of defects in materials and workmanship for a period of one (1) year from the shipping date. If any instrument covered under this warranty proves defective during this period, Hach Ultra will, at its option, either repair the defective product without charge for parts and labor, or provide an equivalent replacement in exchange for the defective product.

To obtain service under this warranty, the customer must notify the nearest Hach Ultra service support center on or before the expiration of the warranty period and follow their instructions for return of the defective instrument. The customer is responsible for all costs associated with packaging and transporting the defective unit to the service support center, and must prepay all shipping charges. Hach Ultra will pay for return shipping if the shipment is to a location within the same country as the service support center.

This warranty shall not apply to any defect failure or damage caused by improper use or maintenance or by inadequate maintenance or care. This warranty shall not apply to damage resulting from attempts by personnel other than Hach Ultra representatives, or factory-authorized and trained personnel, to install, repair or service the instrument; to damage resulting from improper use or connection to incompatible equipment; or to instruments that have been modified or integrated with other products when the effect of such modification or integration materially increases the time or difficulty of servicing the instrument.

THIS WARRANTY IS GIVEN BY HACH ULTRA ANALYTICS, INC. WITH RESPECT TO THIS INSTRUMENT IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED. HACH ULTRA ANALYTICS, INC. AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR NON-CONTRACTUAL PURPOSE. HACH ULTRA ANALYTICS, INC.' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. HACH ULTRA ANALYTICS, INC. AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES EVEN IF HACH ULTRA ANALYTICS, INC. OR ITS VENDORS HAS BEEN GIVEN ADVANCED NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

## Patents

Apparatus and products are manufactured and sold by Hach Ultra Analytics, Inc. under one or more of the following U.S. patents: 4,626,413; 4,666,860; 4,683,435; 4,868,127; 5,047,212; 5,260,663; 5,275,957; 5,334,940; 5,677,190 and equivalents in other countries where issued. Purchaser is granted a paid-up, non-exclusive license to practice under these patents for the useful life of this apparatus or product.

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## Revision History

- Edition 1, July 1998, Anatel Corporation
- Edition 2, October 1998, Anatel Corporation
- Edition 3, January 1999, Anatel Corporation
- Edition 4, August 1999, Anatel Corporation
- Edition 5, April 2000, Anatel Corporation
- Edition 6, August 1997, Anatel Corporation
- Edition 7, July 2001, Anatel Corporation
- Edition 8, November 2001, Anatel Corporation
- Edition 9, December 2002, Anatel Corporation
- Edition 10, March 2003, Anatel Corporation
- Edition 11, November 2006, Anatel Corporation
- Edition 12, June 2007, Hach Ultra Analytics, Inc.

## Acknowledgements



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# 1 Introduction

The Anatel A643a TOC Analyzer, a recent generation of on-line instrumentation, are designed to specifically address pharmaceutical industry needs. Building on the proven success of Hach Ultra's line of TOC Analyzers, the Anatel A643a–S and Anatel A643a–P Analyzers offer measurement capabilities which meet the requirements of the United States Pharmacopeia (USP). Typical Anatel A643a applications include on-line organic contamination detection in pharmaceutical water systems as well as the convenience of being able to perform TOC analyses in the laboratory.

The Anatel A643a Analyzer System integrates analytical Sensors with managing Controllers in a wide range of configurations that afford maximum flexibility to address a wide range of process requirements. Multiple Anatel A643a Analyzers can be associated with a single C80 Controller to observe several process points from one location. Alternatively, multiple Controllers can be networked to display Anatel A643a readings at several locations.


*Fig 1-1 :* The Anatel A643a–P Portable TOC Analyzer

## 1.1 The Anatel A643a TOC Analysis System

The Anatel A643a TOC Analysis System is comprised of the following components:

### Anatel A643a–S (Stationary) Analyzer

This permanently mounted instrument is the standard Anatel A643a analysis device. Its 1-line by 16-character display visually reports the instrument's current values. In conjunction with a C80 Controller, it can be networked with other Analyzers to perform multiple TOC measurements. Or, a single Anatel A643a–S Analyzer can be linked to as many as eight C80 Controllers to offer data display and operational control from multiple remote sites.

### Anatel A643a–P (Portable) Analyzer

The Anatel A643a–P combines the attributes of the Anatel A643a–S Analyzer with an integral C80 Controller and 40-column thermal printer to provide total instrument portability with point-of-use reporting capabilities. The Anatel A643a–P is designed for maximum flexibility by furnishing spot TOC measurements in addition to providing local printouts as the data are reported.


### C80 Controller

The C80 Controller is the control/display device for the Anatel A643a Analyzer. The C80 allows operational and reporting parameters for as many as eight associated Analyzers to be programmed independently. Its 4-line by 16-character display communicates such analysis information as current TOC in ppb, trend, conductivity (or resistivity), temperature and current operational mode. The alarm status of each active Analyzer is reported via a corresponding Channel LED.

### Printer

A stand-alone version of the thermal printer that is part of the Anatel A643a–P Analyzer can be connected to any Anatel A643a–S to provide local printouts.


### Heat Exchanger

The Anatel CX-20 Heat Exchanger reduces the temperature of sample waters that are over 65 °C to an acceptable level for TOC analysis. Under most operating conditions, sample water of up to 65 °C can be routed directly to the Anatel A643a for TOC analysis. For sample water temperatures greater than 65 °C, a heat exchanger is required for analysis. The CX-20 cools the sample using a stainless steel tube-fin to provide superior heat transfer with no possibility for sample contamination.

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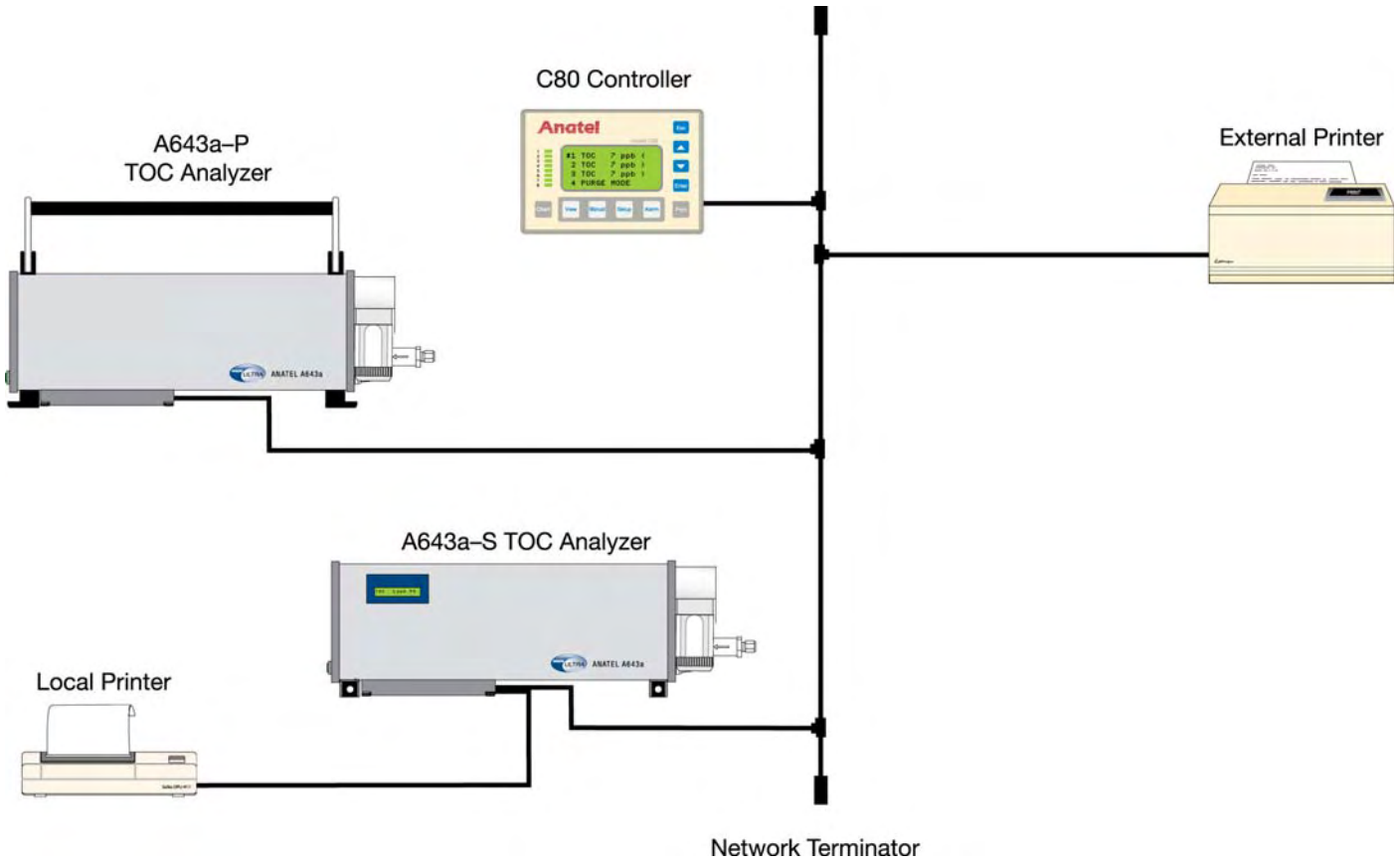


*Fig 1-2 :* A-Net RS-485 Local Area Network

## 1.2 Anatel A643a Analyzer Features

Anatel A643a TOC Analyzers offer several unique advantages in the monitoring of ultrapure water systems:

| | |
|---|---|
| **Calibration and Validation** | The Anatel A643a Analyzer can be calibrated with from one to three TOC standards using Anatel's pre-packaged Calibration Standards. Calibration and instrument performance can be validated on-line using Anatel's Validation Kit. |
| **USP Compliance for Conductivity and System Suitability** | The Anatel A643a's limit response and response efficiency are calculated on-line automatically to determine compliance with USP TOC Method <643>. Meter accuracy and cell constant also can be verified on-line to comply with USP Conductivity Method <645>. |
| **Hot Water Application** | The Anatel A643a is fully compatible with water temperatures up to 65 °C. For water temperatures from 65 °C to 95 °C, a heat exchanger is required. The only wetted part in the Anatel Heat Exchanger is 316 stainless steel tubing. |

| | |
|---|---|
| **UV Detect™ Technology** | UV Detect is an optional feature. Analyzers with UV Detect can be identified by a UV Detect label on the analyzer housing and a -UV in the catalog number. UV Detect provides an additional level of diagnostics to the Anatel A643a analyzer, by continuously monitoring the level of the ultraviolet (UV) output by the analyzer lamp. When a marginal level of UV light or failed output is detected diagnostic messages are provided from the instrument. This feature ensures the TOC output value is always representative of a sample oxidized with the proper level of UV. |
| **Individual Alarm Monitoring** | TOC levels may be monitored for all connected Anatel A643a Analyzers and compared to user-defined alarm limits for each instrument. The user is alerted to any limit excursions by the C80 Controller which flashes its LCD display as well as the Sensor's corresponding LED. An audible beep or usersupplied external alarm may be enabled for additional warning. The Anatel A643a also can be set to alarm at USP recommended uncompensated conductivity levels. |
| **Local Area Networking (LAN) Capability** | The ability to link as many as eight Anatel A643a Analyzers to a single C80 Controller provides timely readings of TOC levels even at the most distant and crucial areas of the water system. The C80 Controller can be mounted wherever convenient to make the TOC levels at several key locations immediately available on a single display. Analog, Digital I/O, Serial and 12 VDC Bias connections allow quick and easy connection to any external device to further enhance system capabilities. |

## 1.3 Operational Overview

The Anatel A643a Analyzers employ a patented photocatalytic method which measures the conductivity of the sample before and after its oxidation by ultraviolet (UV) light. The water sample is isolated from the ambient environment to eliminate external contamination and the TOC concentration is determined using an algorithm that measures the change in the sample's conductivity. The change in conductivity is a direct function of the amount of organic carbon present and its oxidation to carbon dioxide ($CO_2$), allowing the TOC content of the sample water to be calculated.

The results of each sample analysis are digitally displayed on the front panel of the corresponding Sensor, and its supervisory C80 Controller, as a concentration of TOC in ppb. Additionally, conductivity (in µS/cm) or resistivity (in MΩ–cm), uncompensated for temperature or corrected to 25°C, and sample temperature are measured then displayed. A selection of data printouts is available.

An integral alarm scheme reports any abnormalities detected during Analyzer operation. A TOC limit (or uncompensated conductivity limit) excursion is automatically output to a printer and logged for display on associated C80 Controllers.

Anatel A643a Analyzers also perform ongoing TOC trend analyses to facilitate water quality management. Each instrument measures the change in TOC over the past hour and reports its directional trend. By further examining the exact TOC values on a printout, the user can determine if the trend is critical and respond accordingly.

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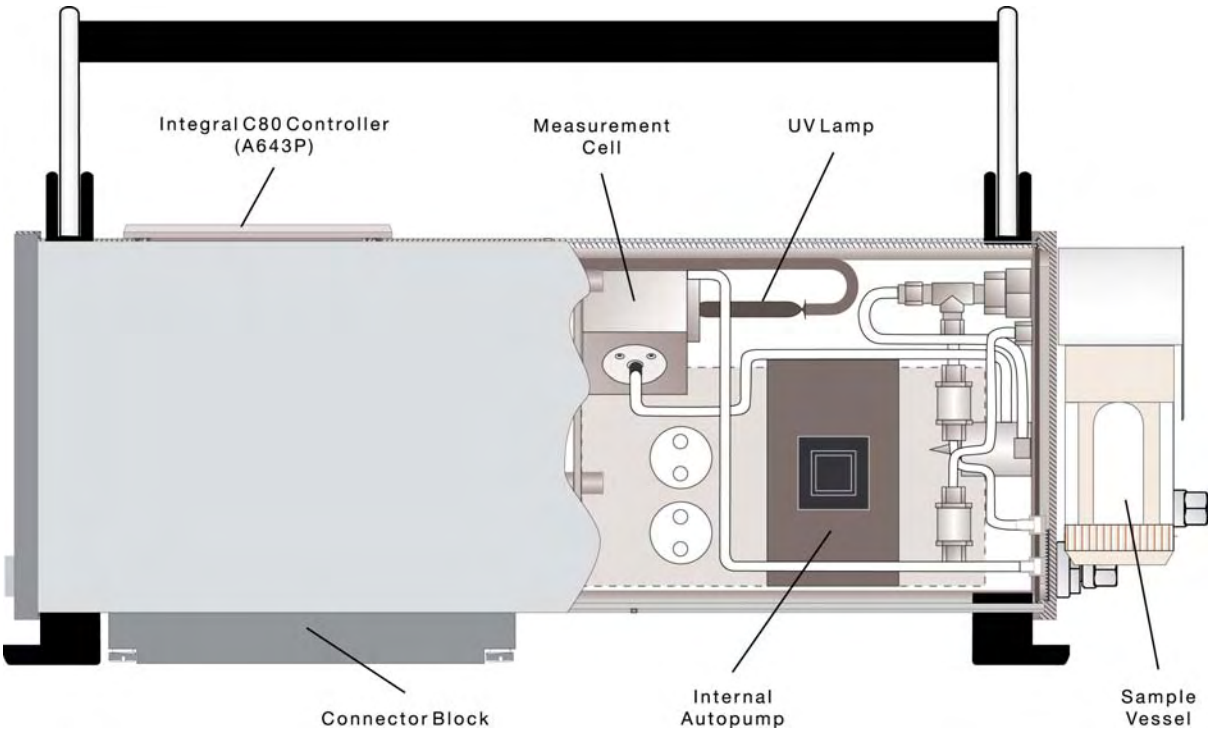


*Fig 1-3 :* Anatel A643a–P TOC Analyzer Components

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# 2 Instrument Installation

## 2.1 General Information

All models of the Anatel A643a Analyzer are designed to provide a flexible method of monitoring ultrapure water systems. The basic Anatel A643a–S configuration consists of an Analyzer and a C80 Controller. These two components are combined with a printer on the Anatel A643a–P to form a portable analysis system. Additional Analyzers and Controllers can be integrated to create a local area network (see “Network Installation” on page 39).

This configuration flexibility necessarily affects installation of the Anatel A643a System. Each Analyzer is furnished with an Installation Kit (Anatel A643a–S: P/N FG2041101; Anatel A643a–P: P/N FG2041201) and must consider these preparatory and installation issues:

*Table 2-1 :* Preparatory and installation issues

| Procedure | C80 | Anatel A643a–S | Anatel A643a–P |
|---|---|---|---|
| Inspection | X | X | X |
| Verification | X | X | X |
| System Time | X | — | X |
| Sensor Name | — | X | X |
| Mounting | X | X | — |
| Plumbing | — | X | X |
| External Communications | X | X | — |
| Auxiliary I/Os | — | X | X |
| Power | X | X | X |
| Self-Cleaning | — | X | X |

Note that these procedures are common to most, but not all, Anatel A643a components. The C80 Controller, for example, is built into the portable Anatel A643a–P Analyzer and, consequently, does not require external communications connections. Conversely, a **Sensor Name** cannot be assigned to a stand-alone C80 Controller because it is not integral to the Anatel A643a–S Analyzer.

## 2.2 Pre-Installation Procedures

Preliminary setup procedures should be conducted on the Anatel A643a components prior to installing them on the water system to help assure their proper operation. Verification also is easier at this stage than when the components have been mounted and cabling has been run. Suggested pre-installation procedures are:

- Unpacking, visually inspecting the equipment and verifying the packing list.
- Powering up the Analyzer to verify that all the components are operational (refer to “Specifications and Accessories” on page 191 for the specific power requirements of each component).
- Setting up the operational software by entering the System Time and naming the Analyzer.

**Note:**
*The terms “*Anatel A643a*” and “Analyzer” refer generally to all A643a TOC Analyzer models.*

### 2.2.1 Unpacking & Inspection

Upon receiving the Anatel A643a Analyzer, inspect the shipping container(s) for any signs of external damage before unpacking the components. Carefully remove the equipment, verify the enclosed packing list and check once again for obvious damage.

Each Anatel A643a Installation Kit contains:

- Power Cord
- Network “Tee” & Terminator
- 15 Micron Inlet Filter
- 5’ 1/4” OD Sample Tubing
- 10’ 1/8” OD Drain Tubing
- 1/4” Tube x 1/4” MNPT Fitting
- Operator Manual and Standard Operating Procedures (SOPs)

If damage is apparent, notify the freight carrier immediately: Claims must be filed by the customer. Also notify Hach Ultra or your distributor of any such problems. Include the Serial Number of the damaged unit(s) and your purchase order number with all factory communications.

### 2.2.2 Operational Verification

The next pre-installation step is to establish communication connections between the C80 Controller and its associated Anatel A643a–S Analyzer (these connections are internal to the Anatel A643a–P).

Each Anatel A643a–S Analyzer and C80 Controller is supplied with a 3-foot local cable, a twin BNC “tee” connector, and a passive terminator. The C80 Controller also includes a 10-foot trunk cable to facilitate communications connections.

**Note:**
*Additional twin-axial trunk cable, pre-wired with BNC plugs at each end, is available from Hach Ultra in 10-, 25-, 50-, 100-foot and custom lengths.*

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To connect the Controller to its associated Analyzer:

1) Grasp the end of the 3-foot local cable attached to the C80 Controller and, noting the alignment of its internal pins, gently push it onto the middle coupling of the tee connector. Twist the cable onto the connector until it “locks” on the coupling.
2) Similarly fasten the Analyzer to its tee connector.
3) Link the two tees using the 10-foot section of twin-axial trunk cable provided.
4) Complete communications connections by placing a passive terminator on the open couplings at each end of the configuration. Proper termination is crucial for reliable communications.

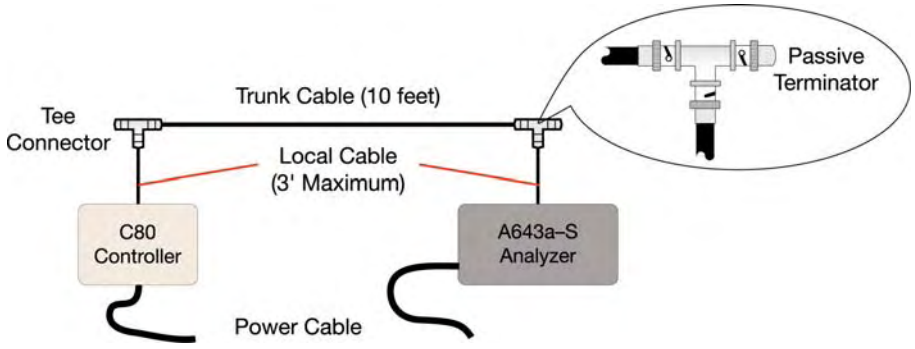


*Fig 2-1 :* Passive Terminator

5) Plug both components into an AC power source. A power cord is integral to Anatel A643a Analyzers; power is supplied to the C80 Controller through a 9 VDC wall mounted transformer that attaches similar to the communications connections.
6) Turn the Analyzer **ON**. Verify that the displays on both instruments illuminate and are functional.

The Controller display reports that it is establishing communications with the Analyzer. If **Sensor Head not communicating** is displayed or either instrument fails to operate, check the connections. Contact Hach Ultra Customer Service at 800-866-7889 or +1 541.472.6500 if these problems persist.

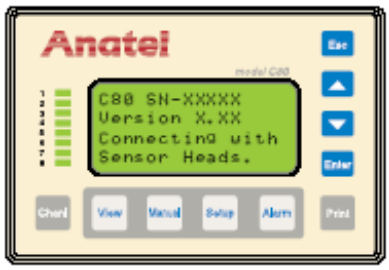


*Fig 2-2 :* C80 Logon Screen

### 2.2.3 Software Setup

**Note:**
*The following setup procedures are performed through the C80 Controller. Refer to* "C80 Controller Setup" on page 45 *if necessary for a description of this control device and its keyboard interface.*

With communications established, define the **System Time** on the C80 Controller and give the Anatel A643a–S a **Sensor Name**. The same programming should be performed on stand-alone Anatel A643a–P Analyzers to assure that they are operating properly.

#### 2.2.3.1 System Time

Each Analyzer's onboard clock is set at the factory during testing. It should be checked, however, and altered if necessary to display local time.

To set the Controller's clock/calendar:

1) Press the **Setup Key** to display the **Setup Menu**.

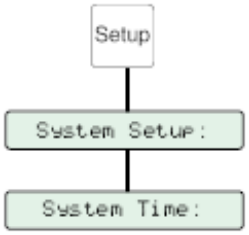


*Fig 2-3 :* System Time

2) Use the **Up** and **Down Keys** to specify System Setup.

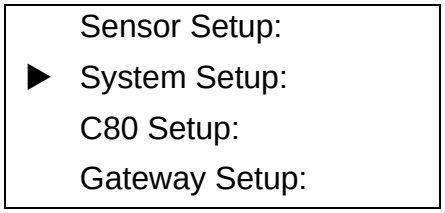


*Fig 2-4 :* Sensor Setup Selections

3) Press **Enter** to access its submenu.

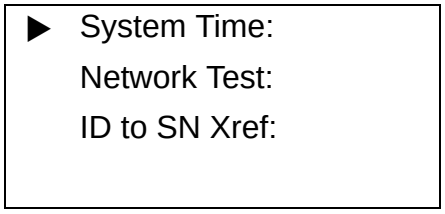


*Fig 2-5 :* System Time Submenu

4) Specify **System Time** and press **Enter** to display that parameter screen. The programmed Date is displayed numerically in a month/day/year format; the **Time** in an hour:minute format. A block cursor begins flashing to highlight the initial interval of the date.

**Note:**
*Although only the right digit of each of the* **Date** *and* **Time** *parameters is highlighted, the entire interval is selected.*

5) Modify the month, or use the **Up** and **Down Keys** to move the flashing cursor left or right, respectively, to highlight the division of the **Date/Time** display that is to be changed, such as the day.


*Fig 2-6 :* System Time Screen

6) Press **Enter** to enable the Controller's Edit Mode. The flashing cursor becomes an underscore and the key functions change.

System Date/Time
01/01/00 00:00
Esc selects char
▲/▼ to change

*Fig 2-7 :* Controller Edit Selections

7) Use the **Up** and **Down Keys** to scroll the digit to display the current day numerically.

System Date/Time
01/05/00 00:00
Esc selects char
▲/▼ to change

*Fig 2-8 :* Current Day Display

8) Press **Enter** to retain the day setting and advance the block cursor to the year division of the clock/calendar setting.

9) Repeat the editing process to alter the other settings as necessary. The hour and minute are displayed in a 24-hour format; for example, 3:15 P.M. would be entered as **15:15**.

System Date/Time
01/05/00 15:15
Esc selects char
▲/▼ to change

*Fig 2-9 :* Current Time Display

10) With the System's date and time properly set, press etwice to return to the **System Setup Menu**. The supervisory Controller transmits the new date and time to its associated Analyzer so that its report functions are now synchronized to the clock/ calendar setting.

▶ Sensor Setup:
System Setup:
C80 Setup:
Gateway Setup:

*Fig 2-10 :* Sensor Setup Selections

### 2.2.3.2 Analyzer Name

**Note:**
*Default: Serial Number*

The first step in setting up an Anatel A643a Analyzer is to name it so that it can be identified on displays and printouts. Up to 13 alphanumeric characters may be assigned to name the instrument. It is suggested that the Analyzer's **Sensor Name** be chosen based on its location, function or other relevant designation.

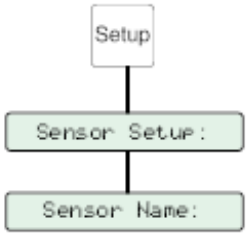


*Fig 2-11 :* Analyzer Name

To name an Anatel A643a Analyzer:

1) With **Sensor Setup** highlighted on the Setup Menu, press **Enter**.

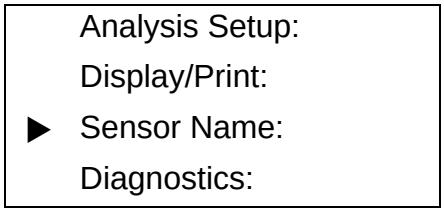


*Fig 2-12 :* Analysis Setup Selections

2) Specify **Sensor Name** and press **Enter** to display that parameter screen. The first line of the display identifies the chosen Analyzer by its Channel ID Number. The second line presents its default name (its Serial Number) with the block cursor flashing on the first character.

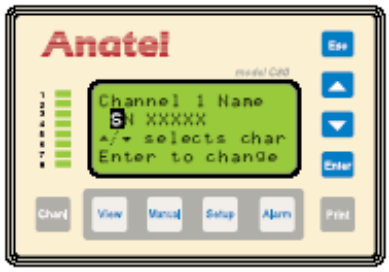


*Fig 2-13 :* Sensor Name Screen

3) Use the **Up** and **Down Keys** to move the cursor and highlight the character that is to be changed.
4) Press **Enter** to enable the Controller's Edit Mode and the flashing block becomes an underscore.

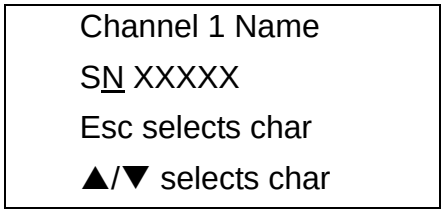


*Fig 2-14 :* Controller Edit Mode

5) Press the **Up** and **Down Keys** to step through the alphabet (upper- then lowercase), followed by a blank space and numeric values (0–9) until the desired character is displayed.

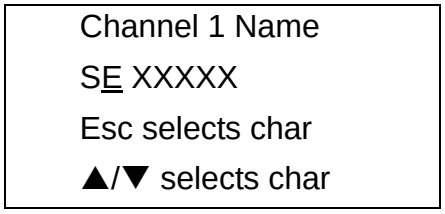


*Fig 2-15 :* Change Character

6) Press **Enter** to save the new character and advance the cursor to the next position.
7) Again scroll through the display using the **Up** and **Down Keys** until the desired character is displayed.
8) Press **Enter** to save the altered character.
9) Repeat the procedure until the desired **Sensor Name** has been entered into the display, then press **Enter** twice to exit this function and return to the normal display.

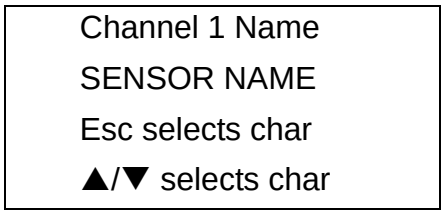


*Fig 2-16 :* Sensor Name Change

**Note:**
*It is possible for more than one Analyzer to have the same Name. Duplicate* **Sensor Names** *may cause confusion when reviewing printed reports.*

## 2.3 Hardware Installation

Once the Anatel A643a hardware components have been checked and initial software parameters setup, the Analyzer can be installed. Installation consists of:

- Mounting the components.
- Providing the required plumbing, communications and power connections.

### 2.3.1 Mounting

The C80 Controller and the Anatel A643a–S Analyzer are the only system components that require stationary mounting. The Anatel A643a–P Analyzer is designed to stand vertically on its feet, allowing these portable instruments to move to different locations easily and perform spot analyses. They must, however, be oriented properly.

### 2.3.1.1 C80 Controller

The C80 Controller can be positioned wherever it is convenient. The stand-alone unit is desk-mounted or wall-mounted in an aluminum enclosure that is sealed against moisture and is splash-resistant. The wall-mount Controller is secured in place with a steel mounting bracket. A 3/4" nut clamp accommodates the adjustable panel thickness, which can range in depth from 1/8" to 1/2" (3.17 mm to 12.70 mm). Controller mounting dimensions are shown below.

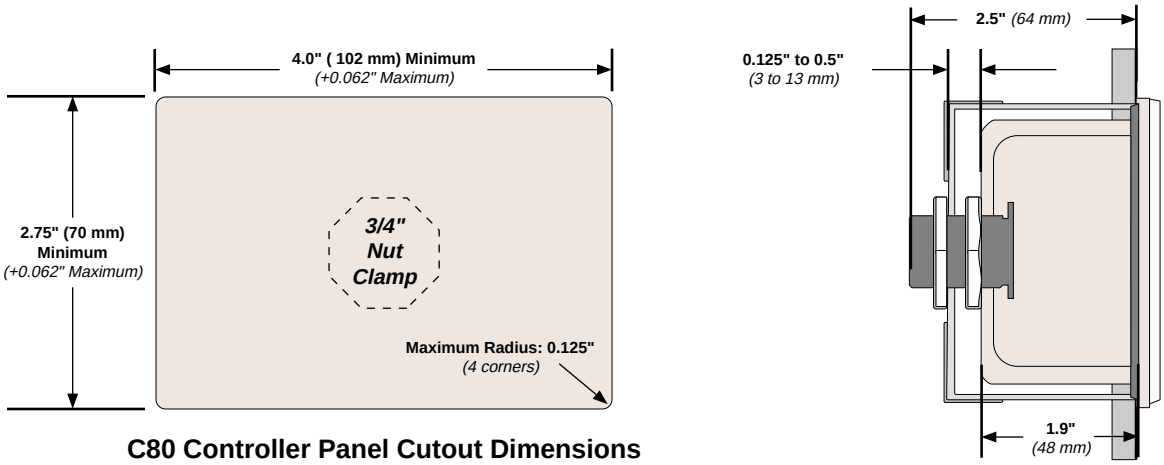


*Fig 2-17 :* Controller Mounting Dimensions

### 2.3.1.2 Anatel A643a–S Analyzer

The Anatel A643a–S Analyzer is a wall-mount unit. The standard instrument and Controller are NEMA 12-compliant. They are splash-resistant but not waterproof and therefore should be installed in a dry and relatively dust-free environment (an optional NEMA 4 case is available). The air is filtered through an intake located on the bottom of the Analyzer. Do not allow the air flow through the intake or outlet filters on the bottom of the instrument to be obstructed or to get wet. If mounting the Anatel A643a–S outside, place it inside a water-tight enclosure and away from direct sunlight. Ambient air temperature should not exceed 40 °C (104 °F) and venting the enclosure may be necessary.

**CAUTION:**

*Do not expose the* Anatel A643a *Analyzer to a caustic atmosphere, as may be present in a DI regeneration area or near an acid waste sump; exposure will corrode electronic circuitry and damage analysis components. If an Analyzer must be installed in a hazardous area, it must be protected by a suitable enclosure which complies with all instrument operating specifications (see* “Specifications and Accessories” on page 191*).*

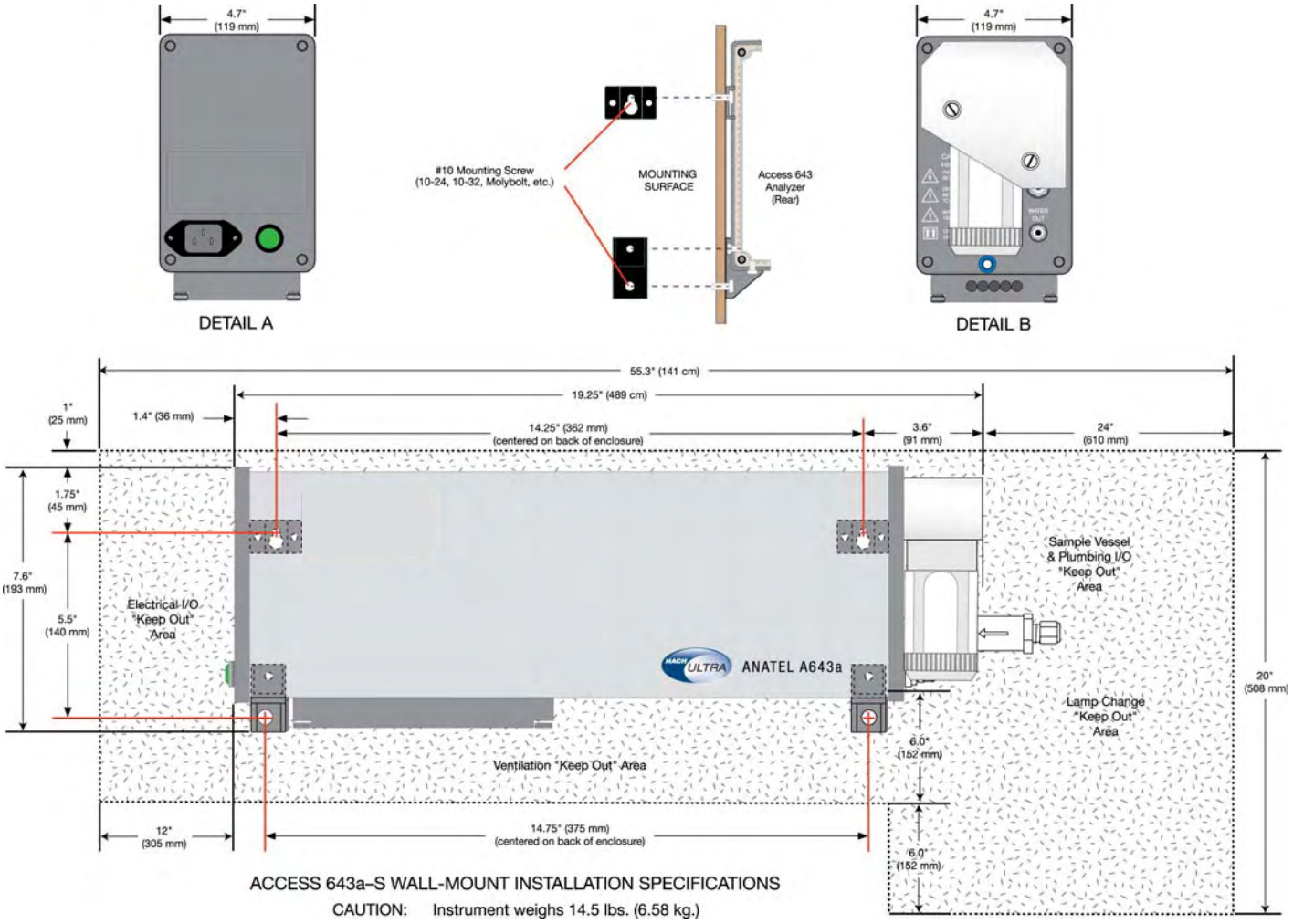


*Fig 2-18 :* Anatel A643a–S Mounting Template

The Anatel A643a–S Analyzer is secured using two 1/4" mounting brackets located on the rear of the instrument in conjunction with two 1/4" tie-down tabs positioned along its bottom. The mounting dimensions for the Analyzer are shown below.

Anatel A643a–S Analyzers combine the measurement cell, requisite electronics and power supply into a single compact package that is designed to be splashproof and water-resistant. All cases are constructed of lightweight aluminum.

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#### 2.3.1.3 Anatel A643a–P Analyzer

The ambient air temperature should not exceed 35°C (95°F) wherever the portable Anatel A643a–P Analyzer is positioned. Orientation also is important when locating the instrument. It must be maintained in an upright position with the integral Controller's panel facing upwards. This precaution assures that the measurement cell is flushed completely between analysis cycles, thereby ensuring reliable and accurate analysis results.

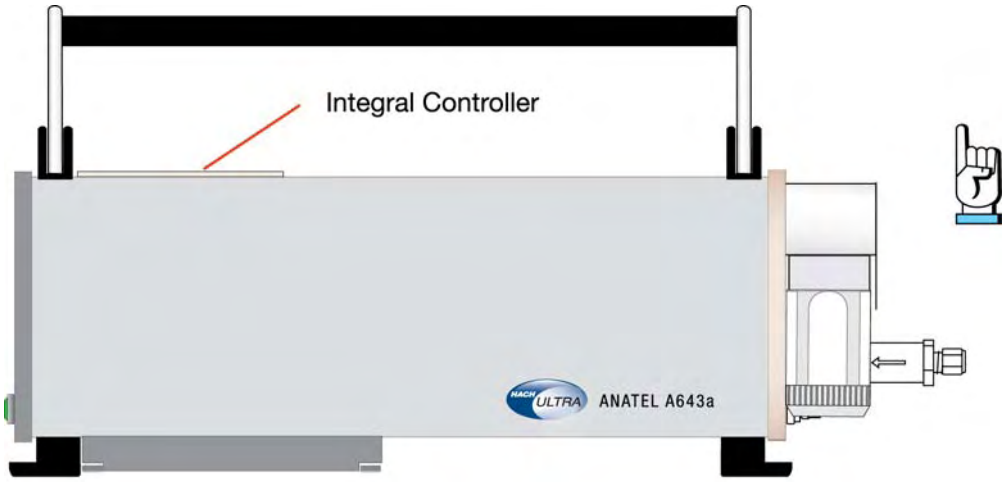


*Fig 2-19 :* Anatel A643a–P Orientation

The following plumbing, communications and power connections are identical for the Anatel A643a–S and Anatel A643a–P Analyzers.

**Note:**
*The terms "Anatel A643a" and "Analyzer" in th following instructions refer generally to all A643a TOC Analyzer models.*

### 2.3.2 Plumbing Connections

Sample connections are made through a 1/4" inlet (**WATER IN**) and a 1/8" outlet (**WATER OUT**) 316 stainless steel compression fitting located at the Water I/O end of the Analyzer enclosure. The sample inlet is fitted with a prefilter to minimize the potential for contamination. Plumbing the Analyzer consists of making these two connections and optionally installing an upstream isolation valve to permit control of sample flow to the instrument.

### 2.3.2.1 Isolation Valve

Anatel A643a Analyzers should be connected to the sample supply through an upstream isolation valve in order to allow manual control of the input flow. The isolation valve must be supplied by the customer. Hach Ultra provides a 1/4” tube x 1/4” MNPT stainless steel compression fitting that can be inserted in the valve to assist in connection to the Analyzer.

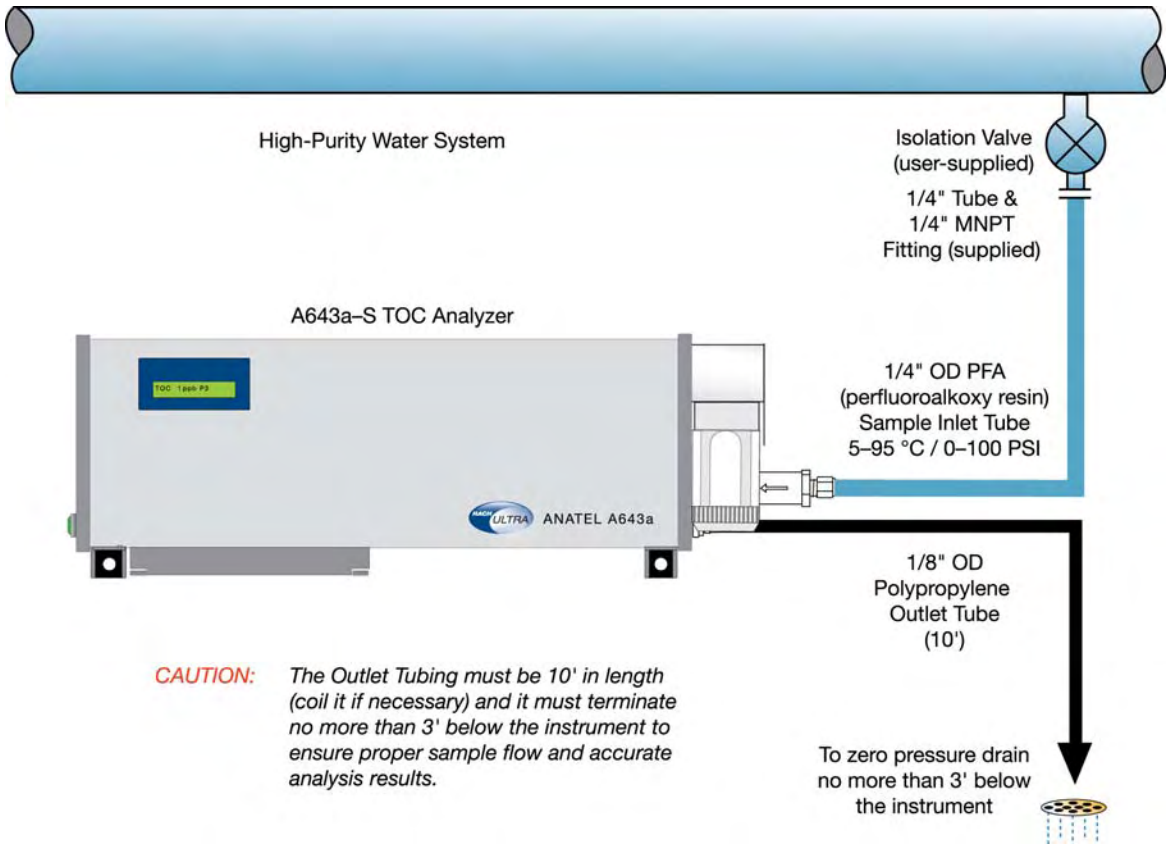


*Fig 2-20 :* High-Purity Water System

### 2.3.2.2 Water I/O Tubing

A length of 1/4” PFA (perfluoroalkoxy resin) sample tubing and a length of 1/8” OD polypropylene drain tubing are supplied with each Anatel A643a Analyzer. The suitability of any sample tube to the sample temperature and pressure should be determined prior to plumbing the instrument. The PFA tubing provided is not recommended for installations where:

- The water temperature exceeds 75 °C (167 °F) and the pressure exceeds 90 psig (620 kPa).
- The water temperature exceeds 85 °C (185 °F) and the pressure exceeds 80 psig (550 kPa).
- The water temperature exceeds 90 °C (194 °F) and pressure exceeds 70 psig (480 kPa).

Under these flow conditions, or in any application where the use of PFA is a concern, use of a high-grade 1/4” (OD) PTFE, FEP, PVDF or 316 stainless steel sample tube is recommended.

**CAUTION:**
*Install the 15 Micron Filter on the* **Inlet Port** *prior to making water I/O connections.*

A 7/16” and 9/16” wrench are needed to install the tube fittings. Connections are made as follows:

1) Flush the (customer provided) isolation valve by opening and closing it *fully* several times before connecting the Analyzer in order to avoid introducing debris through the inlet plumbing.
2) Noting its flow direction, connect the 15 micron inlet filter to the **WATER IN** port of the Analyzer.
3) Push one end of the PFA inlet tubing into the rear of the inlet filter assembly until it cannot be inserted any farther. Be careful not to crimp or damage the tubing.
4) Hand-tighten the compression nut taking care not to pull on the tubing.
5) Mark both the compression nut and the **WATER IN** connector as a reference for tightening the nut.
6) Tighten the compression nut 1-1/4 turns to secure the connection.

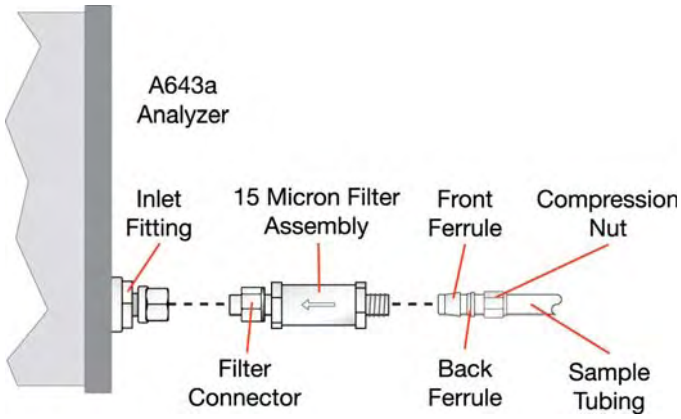


*Fig 2-21 :* Anatel A643a Analyzer


*Fig 2-22 :* Anatel A643a Water I/O Connections

7) Repeat step 2 through step 5 to attach the 10-foot 1/8” OD polypropylene drain tubing to the **WATER OUT** port. Run the open end to a gravity feed drain.

**CAUTION:**
*The drain must be open (without suction or pressure) and the end of the 10-foot drain tube should extend no more than 3 feet below the instrument. **Do not cut the drain tubing** or instrument performance may be adversely affected.*

8) Make sure the sample vessel is installed and securely tightened on the calibration assembly.
9) Leak test the connections by slowly opening the upstream isolation valve to introduce water into the instrument. Pulse the valve several times by opening and closing it, then recheck the fittings.
10) If necessary, slowly tighten the compression fittings to stop any leaks.

**CAUTION:**
*Once a new ferrule has been “swaged” by tightening it 1-1/4 turns, it should be tightened only another 1/8- to 1/4-turn to seal the connection: overtightening the fittings may damage or crush the ferrules and cause leaks.*

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### 2.3.3 Communications Connections

Communications are established by making the necessary connections between an Anatel A643a Analyzer and its associated C80 Controller. Because the Controller is an integral component on the Anatel A643a–P, communications are internal to that model.

The 3-foot local cables, twin BNC tee connectors, passive terminators and 10-foot trunk cable were all checked during the verification procedure and should only have to be reconnected in order to establish communications. The cable's twist-lock fittings facilitate the quick and easy connection and disconnection of any Anatel A643a system component for installation, relocation or repair.

The C80–Anatel A643a–S interface must be configured as a single trunk line with local cabling no longer than three feet in length, although the trunk line can extend a total of 3000 feet (not including local cable drops). If electrical interference may be a problem, the interface cable should be installed in conduit which is free from other wiring or AC buses. Active (AC-powered) termination is required for trunk lines longer than 500 feet in order to control noise and help ensure a clean communications signal.

To establish interface communications between the C80 Controller and Anatel A643a Analyzer:

1) Grasp the end of the 3-foot local cable attached to the C80 Controller and, noting the alignment of its internal pins, gently push it onto the middle coupling of the tee connector. Twist the cable onto the connector until it "locks" on the coupling.
2) Similarly fasten the Analyzer to its tee connector.
3) Link the two tee connectors using the section of trunk cable.
4) The passive terminators (P/N FG2005901) provided with each System component should be fastened to the open coupling at each end of the trunk cable.

**Note:**
*Trunk cabling longer than 500 feet requires active termination. In these longer installations, an AC-powered terminator (PN FG2006501 – 120VAC, FG2006601 – 230VAC) must be connected to the open coupling at one end of the cable, then plugged into an appropriate AC source. A passive terminator should be installed on the other end of the trunk cable.*

#### 2.3.3.1 Auxiliary Inputs & Outputs

All of the Analyzer's auxiliary input and output connections are made on its integral I/O Connector Block. This standardized Connector Block provides a consistent and flexible means of interfacing Anatel A643a Analyzers with a variety of other devices. External wiring connections are made by removing the entire I/O Connector Block from the bottom of the Analyzer and wiring each I/O cable to the appropriate screw terminals. The connector type and gender of the other end of the cable is determined by the auxiliary device to which it is attached.


*Fig 2-23 :* Anatel A643a Analyzer (Bottom View)

I/O connections require a Phillips-head and a small flathead screwdriver and are made as follows:

1) Make sure the Analyzer is turned **OFF** and disconnected from its power source.
2) Remove the I/O Connector Block from the bottom of the Anatel A643a analyzer by loosening the four retaining screws. A medium flat blade screwdriver may be required.
3) Loosen and remove the two screws that secure the metal strain relief plate.
4) Feed the device wiring through one of the holes at the end of the I/O Connector Block cover and along the corresponding slot in the foam padding.

5) Make the connections to the appropriate terminals. Refer to the following Sections for detailed information on the specific interface:
   - “Printer Output” on page 111
   - “Analog Outputs” on page 121
   - “Digital Inputs & Outputs” on page 139
   - “12 VDC Bias Output” on page 145
   - “Serial Communications” on page 147
6) Replace the metal strain relief plate.
7) Replace the I/O Connector Block on the bottom of the Analyzer, taking care not to pinch any wires, and secure it in place by tightening the screws.

The I/O Connector Block offers the following Anatel A643a input and output connections:

- A DB-25 Connector Block provides connections between the Analyzer’s electronics and the I/O Connector Block.

*Table 2-2 :* Isolated I/O Connections

| These connections are optically isolated from ground and the Analyzer’s internal power to avoid potential problems. | |
|---|---|
| **NET** | is used for Anatel A643a Network connections via the twinaxial BNC cable. The C80 Controller and the Anatel A643a–S are supplied with a 3-foot length of local A-Net cable; cable for the Anatel A643a–P Analyzers is provided in their installation kits. |
| **AUX** | is reserved for Hach Ultra use. |
| **4-20mA** | furnishes a 4-20 or 0-20 mA output proportional to the Analyzer’s TOC reading for external analog devices. |
| **INPUTS** | is a digital connection allowing limited supervisory control of the Analyzer by a remote device or switch. Connecting to the “IN1*” terminal allows external initiation of a TOC analysis cycle; “IN2*” determines whether the Analyzer is in the Auto TOC or the Purge Mode. |
| **OUTPUTS** | provides a corresponding digital output for devices such as a remote alarm indicator or a PLC (Programmable Logic Controller). Connecting to the “OUT1*” terminal reports on whether the Analyzer’s TOC level is above or below the user-specified limit; “OUT2*” reports whether its sample valve is opened or closed. Alternatively, “OUT2*” can be set to report the status of the Uncompensated Conductivity Alarm. |

*Table 2-3 :* Non-Isolated I/O Connections

| | |
|---|---|
| **DATA ACQUISITION** | is a bidirectional RS-232C interface that permits the Analyzer to interface with serial devices such as a host computer. |
| **PRINTER** | outputs data to a local thermal or serial printer to generate hardcopy reports. |
| **DIAGNOSTICS** | is a secondary RS-232C port for reporting resistivity and temperature in a 4-20 mA format via an external DAC (Digital-to-Analog Conversion) Module. This interface also may be used by Anatel Service Department personnel, eliminating the need to disconnect other wiring in order to perform field service procedures. |
| **BIAS** | furnishes 12 VDC, 0.5 Amp power for biasing digital inputs and outputs to drive external devices like the auxiliary External DAC Modules. |

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### 2.3.4 Power Connections

AC Power for each Anatel A643a Analyzer is provided via its IEC 320 power receptacle and molded power cord. The cord plugs into a standard AC power source (see "Specifications and Accessories" on page 191 for specific requirements). The Analyzer's internal electronics are self-adjusting to accommodate a 100 VAC to 240 VAC supply. The C80 Controller receives its 9 VDC power through an Hach Ultra-supplied transformer that connects to a 120 VAC adapter. A 230 VAC version of the adapter also is available.

**CAUTION:**
*Use the grounded power cord provided—do not clip the ground pin.*

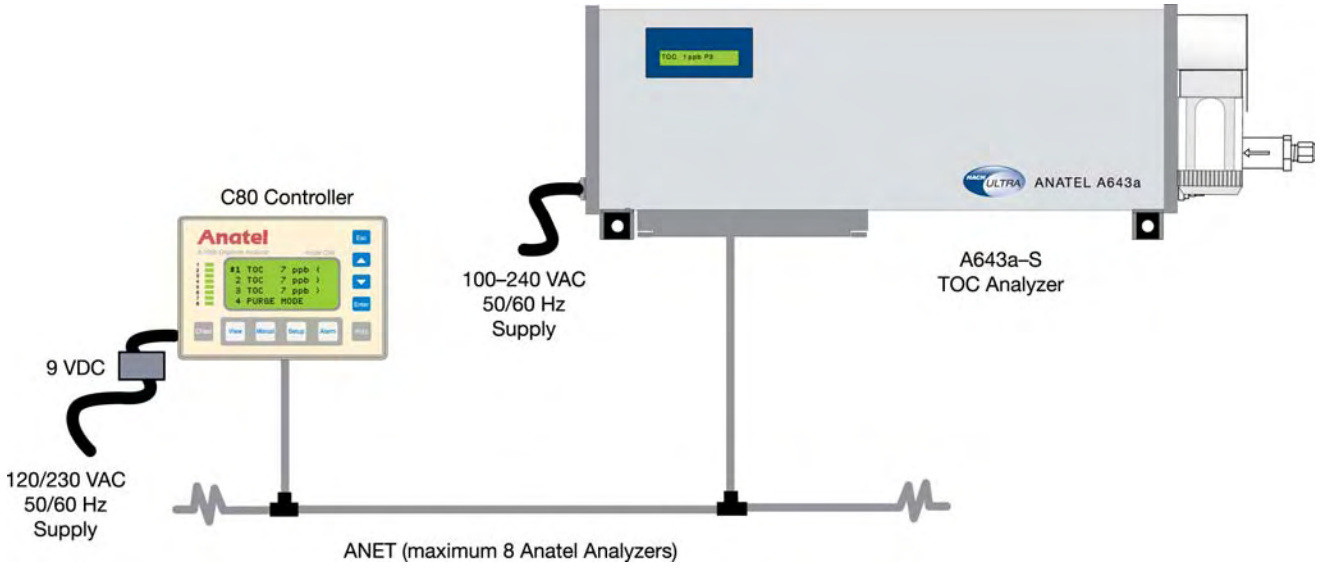


*Fig 2-24 :* A-Net (maximum 8 Anatel Analyzers)

## 2.4 Analyzer Initialization

With the plumbing, communications and power connections properly established, the Anatel A643a Analyzer can be initialized and placed into operation. Because the cleanliness of commercially available tubing varies (particularly stainless steel), it is suggested that the Analyzer's plumbing be thoroughly flushed. This is accomplished by placing the instrument in the Self-Clean Mode for several hours.

To initialize the Anatel A643a Analyzer:

1) Open the optional isolation valve to initiate flow to the Analyzer.
2) Turn the Analyzer and any attached printer **ON**. The instrument initially conducts a series of self-diagnostic routines, shown by a green Controller LED, to verify that it is operating properly. The LED flashes red while the Controller establishes communications with its associated Analyzer.

The Controller reports if it is unable to establish communications with the Analyzer and suggests checking the wiring connections. Once the Controller has established communications, any other faults detected during the power-up diagnostics may be examined by pressing the **Alarm Key**. Summaries of any problems encountered are displayed and output to the printer (refer to "Alarm Codes" on page 175 for information on reported Alarm Codes and their possible indications). When its self-diagnostics have been completed successfully, sample flow begins and the Analyzer initiates an automatic analysis cycle based on factory default parameters. If there is no flow through the instrument, check the isolation valve and the **Flow Adjust** control (see step 7 below).

3) Press the **Manual Key** in order to access the Analyzer's **Manual Menu**.

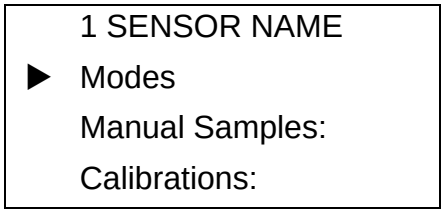


*Fig 2-25 :* Manual Menu

4) Select **Modes**, then press **Enter** to access its submenu.

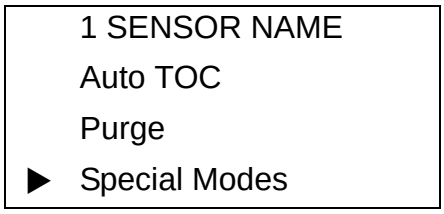


*Fig 2-26 :* Modes Menu

5) Specify **Special Modes** and press **Enter** to display the available options.

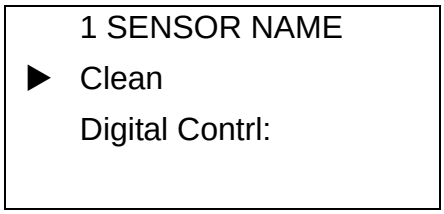


*Fig 2-27 :* Special Modes Menu

6) Use the **Up** and **Down Keys** to specify **Clean**.

7) Press **Enter** to place the Anatel A643a in its Self-Clean Mode of operation, then press **Esc** twice to return to the normal display.

**CLEAN MODE** is displayed on the Controller's LCD for the Anatel A643a. In this mode, the Analyzer's UV lamp is turned on to oxidize any contaminants inside its measurement cell and sample water flows through the instrument to flush away impurities. Allow the Analyzer to run in this state for 3 to 4 hours, longer if the sample tube is lengthy or if the sample point is at low pressure, such as a gravity-feed tube. Monitor the drain tube to verify that there is a sample flow of at least 60 mL/minute. The sample flow rate is increased or decreased by turning the **Flow Adjust** knob located on

the Water I/O end of the instrument to a maximum of 300 mL/min. The sample flow rate can be measured at the drain tube using a stopwatch or timepiece with a second hand and a graduated cylinder.

8) With the Anatel A643a sufficiently cleaned, automatic TOC analysis can be initiated. Press the **Menu Key** to access its Manual Mode.
9) Specify Modes once again and press **Enter**.

**Note:**
*To ensure accurate results after initial installation or long-term storage, allow the instrument to complete several analyses before accepting the reported data as valid.*

10) Specify **Auto TOC** and press **Enter** to initiate automatic analysis based on the factory default parameter settings.
11) Press **Esc** repeatedly to return to the top-level Controller display.
12) With the instrument selected, press **Print** to access its submenu.

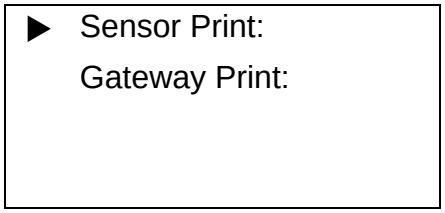


*Fig 2-28 :* Print Menu

13) Specify **Sensor Print** and press **Enter**.
14) Select **Printouts** and press **Enter** once again.

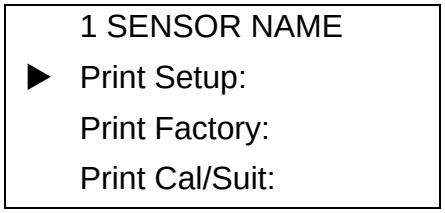


*Fig 2-29 :* Printouts Menu

15) Specify **Print Setup** then press **Enter** to generate a hard copy record of the instrument's current operational parameters.
16) Press **Esc** repeatedly to exit this function and return to the normal display.

# 3 Network Installation

## 3.1 General Information

As many as eight sensors and eight controllers can be networked together in any configuration to create a diverse system. One C80 controller, for example, can oversee as many as seven additional A643a analyzers, or a single A643a may be linked to eight controllers. Regardless of the instrument combination, an A-Net network must consist of at least one C80 Controller and one A643a analyzer.

## 3.2 Software Setup

Each component must have its own unique address to identify it on the Network. Analyzers are assigned Channel ID Numbers that correspond to the LEDs on the faceplate of their associated Controller. C80 Controllers are assigned Network addresses.

It is recommended these assignments be made during Operational Verification as described in “Operational Verification” on page 20 before performing hardware installation of the Network. This process avoids conflicts and assures all of the components on the Network are uniquely identified and functioning properly.

### 3.2.1 ID to S/N Cross Reference

**Note:**
*Default: Channel 1*

The ID to Serial Number Cross-Reference associates each Sensor’s Channel ID with its designated Serial Number. A Channel ID Number (1-8) is used to identify each Sensor for display and reporting purposes, as well as serving as its Network address. The attached Controller determines these ID–S/N relationships when it first scans the A-Net. These ID–SN assignments may be altered, but duplicate Channel IDs are not permitted on the Network.

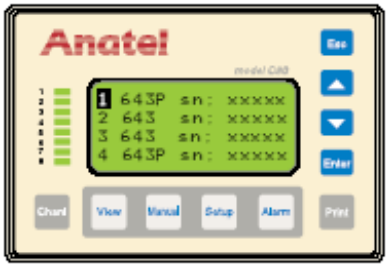


*Fig 3-1 :* ID to Serial number Cross-Reference Screen

To make Channel ID–Serial Number assignments:

1) With any Sensor specified, press the **Setup Key** to display its menu selections.

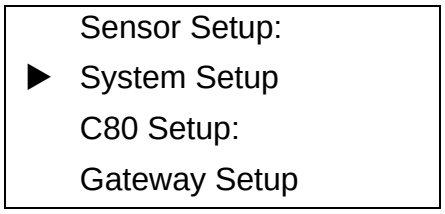


*Fig 3-2 :* Sensor Setup Selections

2) Use the **Up** and **Down Keys** to specify **System Setup**.
3) Specify **ID to SN Xref** and press **Enter** to view its parameter screen. The Channel ID–Serial Number assignments are presented and Channel #1 flashes to indicate that it is the current selection.
4) Accept this ID-S/N cross-reference, or press **Enter** to access the Controller's Edit Mode. The flashing block cursor becomes an underscore.

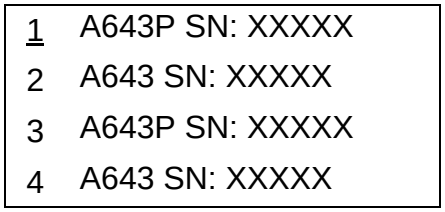


*Fig 3-3 :* Controller Edit Mode

5) Use the **Up** and **Down Keys** once again to select the Channel ID Number that corresponds to the associated Sensor's Serial Number. Note that duplicate Channel IDs are permitted while in the Edit Mode, but they cannot be saved.
6) Press **Enter** to retain the new ID Number and advance the cursor to the next Sensor.
7) Repeat the procedure to reassign other Channel IDs as necessary. The **Up** and **Down Keys** are used to access other Channel IDs that are not presently visible in the display.
8) With all of the Channel ID–Serial Number crossreference assignments established, press **Esc**. A message is posted indicating that the Network will be reset in order to implement the changes. If duplicate Channel IDs exist, a message is displayed indicating this condition is not permitted and that the ID–S/N conflict must be resolved before the screen can be exited.
9) Press **Enter** to continue and the Controller resets the Network. The Channel LEDs and displays reflect the new ID to S/N assignments.

### 3.2.2 Controller Address

**Note:**
*Default: Address 9*

Like A643a Analyzers, each C80 Controller also must have its own unique address on the Network for identification and reporting functions. The Sensor address is pre-configured at the factory to a default of "9," but may have to be changed in order to avoid a Network conflict.

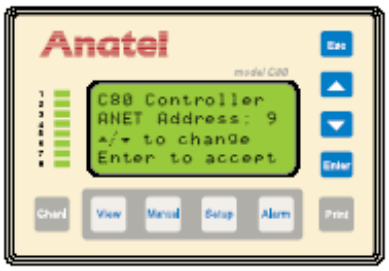


*Fig 3-4 :* Controller Address Screen

To change the Controller's A-Net address:

1) While holding the **Setup Key** down, cycle the Controller's power by removing, then restoring, its power connection (on an A643aS or A643aP, simply turn the Sensor **OFF** and then back **ON**). The Controller displays its current address.
2) Use the **Up** and **Down Keys** in order to scroll the Controller's **A-Net Address** to the desired setting (9–16).
3) Press **Enter** to retain the displayed setting and return to normal operation.

## 3.3 Network Setup

The A-Net Network is configured by making the necessary communications connections between multiple Sensors and their managing Controller(s) using the shielded twin-axial cabling. The cable's BNC twist-lock fittings allow quick and easy connection and disconnection of any component without disrupting overall Network operation.

The A-Net Network must be configured as a single trunk line with each component connected through an individual tee connector using a local cable no longer than 3 feet. The A-Net trunk line can extend a total of 3000 feet not including these local cable lengths. If the trunk line exceeds 500 feet, its cable should be installed in conduit which is free from other cables or AC buses to prevent the potential for electrical interference.

To establish A-Net communications:

1) Grasp the end of the 3-foot local cable attached to a C80 Controller and, noting the alignment of its internal pins, gently push it onto the middle coupling of the tee connector. Twist the cable onto the connector until it "locks" on the coupling.
2) Similarly fasten the local cable that extends from the other network components to their respective tee connectors.
3) Link the various tee connectors using sections of twin-axial trunk cable.
4) Both ends of the Network must be terminated to control noise and help ensure a clean signal. The passive terminators *(P/N FG 2005901)* provided with each system component should be fastened to the open jack connector at each end of the A-Net Network with a total trunk length less than 500 feet.

*Table 3-1 :* Potential A-Net Configurations

| C80 Controller | A643a-S Analyzers | A643a-P Analyzers |
|---|---|---|
| 8 | 8 | 0 |
| 0 | 0 | 8 |
| 1 | 1 | 7 |
| 1 | 2 | 6 |
| : | : | : |
| : | : | : |
| • Maximum of eight C80 Controllers<br>• Maximum of eight A643a Sensors | | |

**Note:**
*It is recommended that once the Network communications have been established with all instruments, the System Time be again set as described in* "System Time" on page 22*. The date and time are then broadcast to the connected Sensors, thereby assuring that all of the instruments on the Network are synchronized to the same clock setting.*

A-Net Networks longer than 500 feet require active termination. In these installations, an AC-powered terminator *(P/N FG2006501: 120 VAC, 60 Hz; FG2006601: 230 VAC, 50 Hz)* must be connected to the open coupling at each end of the Network and then plugged into an appropriate AC supply to ensure a clean signal. More Sensors may be added to an existing A-Net configuration by positioning them along the trunk line and then attaching them as described above using the twin-axial cable and the tee connector provided.

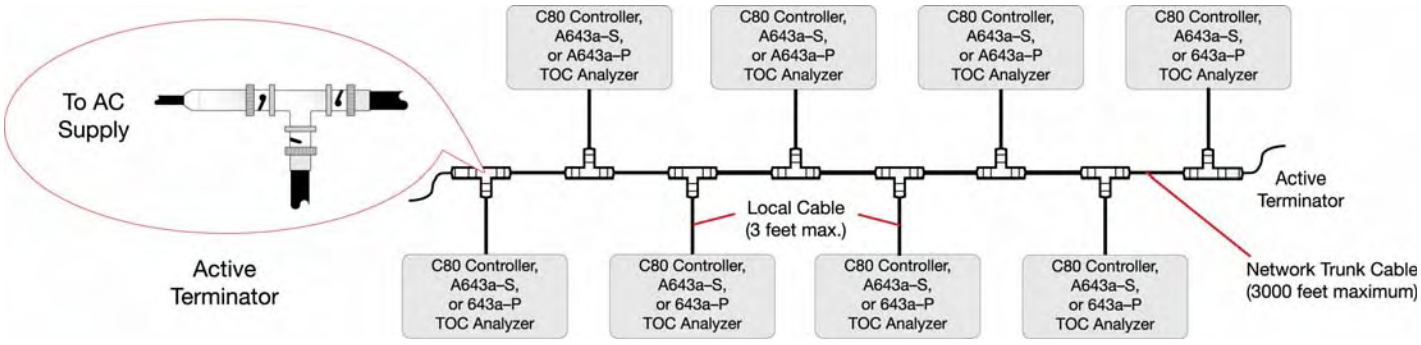


*Fig 3-5 :* A-Net Communications Connections

### 3.3.1 Network Connections

The local cable must be attached to an analyzer when connecting it to the network. This 3-foot communications cable is provided with each portable Sensor and can be found in its installation kit.

**Note:**
*The stationary A643a-S Analyzer is shipped with the local cable already installed.*

**Note:**
*Always disconnect the instrument from its power source before attempting to access internal components.*

Network connections are made to the NET Port on the Sensor's I/O Connector Block as follows:

1) Turn the Sensor **OFF** and disconnect the power cord from its source.
2) Remove the I/O Connector Block from the bottom of the Sensor by loosening the four thumbscrews.
3) Loosen and remove the two Phillips-head screws that secure the metal strain relief plate.
4) Feed the interface wiring through one of the five holes at the end of the Connector Block cover and along the corresponding slot in the foam padding.
5) Make the necessary connections to the Sensor's **NET** port as shown.

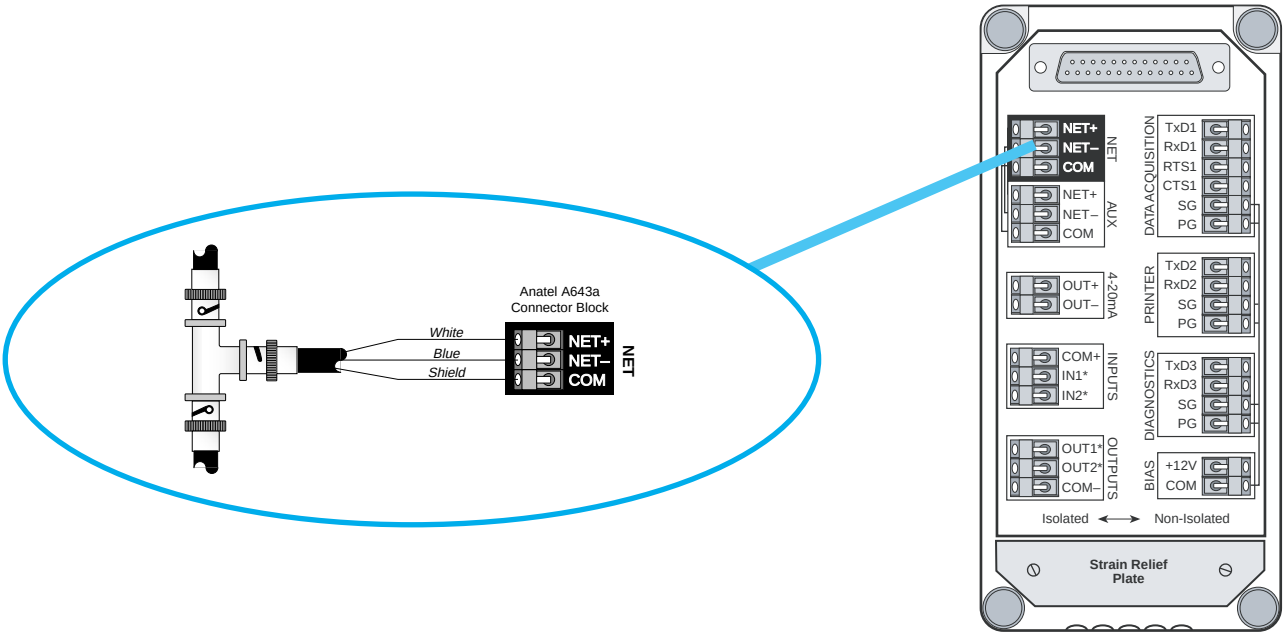


*Fig 3-6 :* Sensor NET Port Connections

6) Replace the metal strain relief plate.
7) Replace the I/O Connector Block on the bottom of the Sensor, taking care not to pinch any wires, and secure it in place by tightening the thumbscrews.
8) Reconnect the power cord and turn the Sensor **ON**.

**Note:**
*The I/O Connector Block must be reinstalled correctly to conform to emissions specifications.*

# 4 C80 Controller Setup

## 4.1 General Information

The C80 Controller provides the user interface with the various Analyzers, furnishing data displays and access to individual Anatel A643a parameters. The Controller is a stand-alone unit or an integral component of the Anatel A643a–P Analyzer.

User interaction with the C80 Controller is through a consistent interface. Its 4-line by 16-character display affords full functionality for interacting with its associated Anatel A643a Analyzers, allowing the user to manage their operation individually.

## 4.2 C80 Controller

The C80 Controller display simultaneously provides data from multiple Analyzers. The Controller's faceplate also contains a set of Channel ID LEDs which reflect the operational status of each connected Analyzer and ten membrane keys for user interaction.

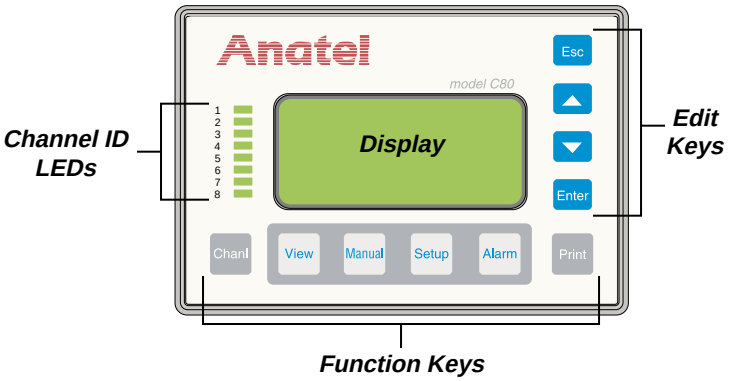


*Fig 4-1 :* C80 Controller Display

The C80 Controller's Edit Keys perform the following operations:

| | |
|---|---|
| **Esc** | exits the current screen or mode and returns to the previous one—any changes are saved. |
| **Up** and **Down** | scrolls to specify menu items and parameter values for selection. The "Up" arrow key moves the cursor up or left within the display and increments numbers while the "Down" arrow moves the cursor down or right and decrements numbers. |
| **Enter** | chooses the indicated menu selection, saves a modified value, accesses the Edit Mode or moves the Edit Cursor to the next selection. |

The Controller's Function Keys may be pressed at any time to access the designated Anatel A643a Analyzer's operations:

| | |
|---|---|
| **Chnl** | displays identification and status information on the selected Analyzer. |
| **View** | toggles between a Multichannel and a Single Channel View. |
| **Manual** | accesses the operational Mode options for the chosen Analyzer. |
| **Setup** | accesses global variables for the entire Anatel A643a System as well as operational parameters for individual Analyzers. |
| **Alarm** | acknowledges and displays any Anatel A643a Analyzer excursions or System alarms. |
| **Print** | allows on-demand printouts to be generated in several formats. |

## 4.3 Operational

Each Analyzer's parameter values and operational settings are accessed through menu selections. The Multichannel and Single Channel Views represent the highest level Controller screens; a parameter screen is the lowest level display. It presents the current value for the particular variable, allowing it to be edited.

There are a few general rules that govern the C80 Controller interface:

- The **Up** and **Down Keys** are used to specify a menu item: it then is selected by pressing the **Enter Key**. A menu item that is followed by a colon (:) indicates that a subordinate screen exists.
- An arrow ("▶") indicates the currently selected menu item; a check ("✓") preceding an item indicates that it is the currently active menu selection.
- An "X" in instrument display and printout examples represents any number or character.
- While an Edit Mode is employed to change Anatel A643a parameter values, there is no temporary screen. All parameter changes are made in real time and the displayed values are those that are saved. Pressing **Enter** advances to the next parameter: **Esc** exits to the previous screen.
- Any changes made to an Analyzer's parameters are immediately output to a local printer, but they do not take effect until the subsequent analysis cycle.

## 4.4 Contrast Adjustment

Once it has been installed, the contrast level of the Controller's background may have to be adjusted to make its display more easily visible under the ambient lighting conditions. This Controller display adjustment is found in the **System Setup Menu**.

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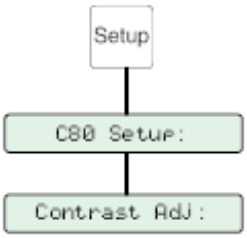


*Fig 4-2 :* Contrast Adjustment

To adjust the Controller's display contrast:

1) With any Channel View displayed, press the **Setup Key** and its menu selections are presented.
2) Use the **Up** and **Down Keys** to specify **C80 Setup**.

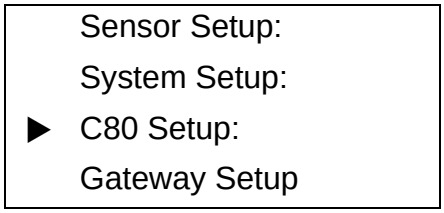


*Fig 4-3 :* C80 Setup Selections

3) Press **Enter** to access its submenu.

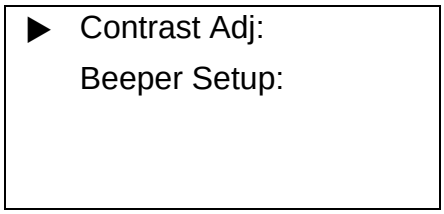


*Fig 4-4 :* C80 Setup Submenu

4) Specify **Contrast Adj** and press **Enter** once again to display its parameter screen.
5) Use the **Up** and **Down Keys** to lighten or darken the display as necessary.
6) With the contrast set to the desired level, press **Esc** three times to return to the normal display.


*Fig 4-5 :* C80 Contrast Adjustment Screen

## 4.5 View Options

The **View Key** determines the type of Anatel A643a information that is presented in the Controller's LCD display. Two data display formats are offered:

1) Detailed readings for a single Analyzer including the current TOC, trend, profile type, conductivity (or resistivity), and temperature values.
2) A multichannel listing of all Analyzers connected to the Controller, their respective TOC values and current trend. The Analyzer's alternate operational modes (**PURGE** or **CLEAN**) also are reported.

Repeatedly pressing the **View Key** cycles through these display formats. All displayed values are the result of the Anatel A643a's previously completed analysis cycle. These readings are updated at the conclusion of each cycle.

Simultaneous access to a particular Analyzer is not permitted with a multi-user network, such as when multiple C80 Controllers are connected to the same Analyzer. In the event a concurrent attempt is made to modify an Analyzer (through another Controller), the conflict is reported and access is denied to the second device. Press the **Esc Key** to return to the original menu.

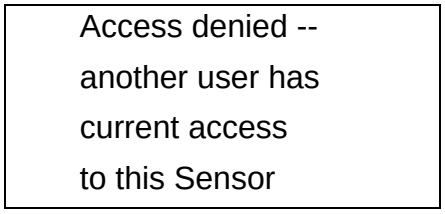


*Fig 4-6 :* View Submenu

### 4.5.1 The Single Channel

Detailed analysis data are available for each of the connected Analyzers through the Controller's Single Channel View. To examine an individual instrument's data, specify the Anatel A643a and then press the **View Key** until the Single Channel format is displayed.

The first line of the display identifies the instrument by its Channel ID number and user-entered name. The remaining lines furnish the following information on the Analyzer's previous analysis cycle:

**Line 2** The TOC concentration in ppb.

**Line 3** The trend of the Analyzer's TOC level averaged over the last hour, preceded by a "+" or "–" to indicate its direction. In addition, the Profile Type of the sample is reported as "P1," "P2" or "P3" (see "The Auto TOC Mode" on page 59 for an explanation of Profile Types).

**Line 4** The sample conductivity (or resistivity) and water temperature, in degrees Centigrade.

The individual readings for the other Analyzers associated with this Controller can be observed by pressing the **Up** and **Down Keys**.

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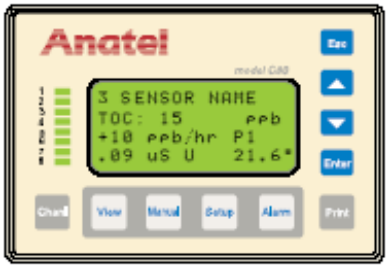


*Fig 4-7 :* Single Channel View

### 4.5.2 The Multichannel View

Multichannel is the initial default view when a C80 Controller is managing more than one instrument. This network display affords a summary listing of all its associated Analyzers to provide an overview of several aspects of the monitored process. To examine multiple channel data, press the **View Key** until that display format is presented.

The Multichannel View lists each Analyzer by its Channel ID and reports its respective TOC value, calculated at the conclusion of its last analysis cycle. The value is followed by a "↑" or "↓" to indicate the directional trend in TOC level for that Analyzer based on its running average over the last hour. This trend indication initially appears at the conclusion of the instrument's second analysis cycle. If no direction is denoted, the TOC level has not changed over the trend period. When the Analyzer is under remote digital control (see "Software Setup" on page 141), **r/c** is also displayed to report this condition.

**PURGE MODE** indicates that sample water is flowing through the corresponding instrument's measurement cell, but no TOC analysis is being conducted (conductivity, however, is reported). In the **CLEAN MODE**, the Analyzer's UV lamp is turned on to oxidize any residual organics while the water sample flows through its measurement cell.

The Multichannel listing can be scrolled in order to view any connected instruments that are not visible within the Controller's four-line display by pressing the **Up** and **Down Keys**.

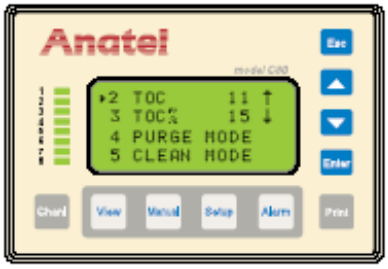


*Fig 4-8 :* The Multichannel View

### 4.5.3 The Channel Display

The **Chnl Key** furnishes general information about the instrument including its Model and Serial Number, operational mode and current state.

These Channel data are accessible either from the Single Channel View, or by using the **Up** and **Down Keys** to identify the desired Analyzer in the Multichannel View and then pressing **Chnl**. The four lines of data presented in the Channel Display are:

**Line 1** The instrument's Channel ID Number and userentered Name.

**Line 2** The Analyzer Model and Serial Number.

**Line 3** The Analyzer's current operational Mode.

**Line 4** The Analyzer's current operational State.

This information may be examined for other associated instruments simply by pressing the **Up** and **Down Keys** once the Channel display is presented.

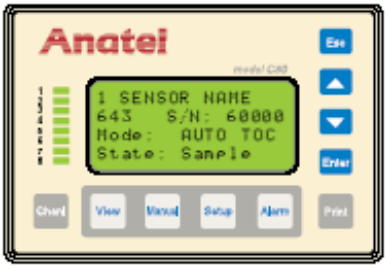


*Fig 4-9 :* The Channel Display

Pressing the **Chnl Key** twice displays the checksum value of the instrument's controlling EPROM as well as is current firmware version. This ROM checksum is calculated each time the instrument is powered-up and is the same value that would be produced by a device programmer. The checksum value and firmware version are also available on the Factory Configuration printout (see "Printouts" on page 117).

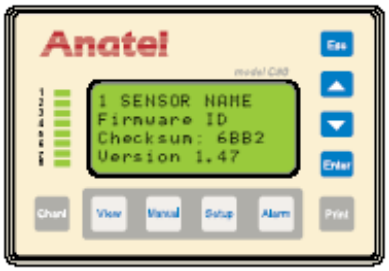


*Fig 4-10 :* The Checksum Display

# 5 Anatel A643a Setup

## 5.1 General Information

Once they have been installed, Anatel A643a Analyzers can begin analysis immediately based on the factory default parameters. The user can selectively alter these default values to tailor the instrument's operation to the requirements of the particular application.

Anatel A643a Analyzers run in one of three data-gathering modes:

**Auto TOC** is the Analyzer's standard operational mode for monitoring any high-purity water system. In this mode, the instrument automatically performs successive TOC analyses and reports the results until the cycle is interrupted by the user.

**Purge Mode** opens the Analyzer's internal sample valve, allowing sample water to flow through the instrument and flush the measurement cell. Conductivity (or resistivity) and temperature readings are reported.

**Manual Mode** allows the user to interrupt automatic operation and manually initiate an analysis cycle. A single on-line sample from the water system or a grab sample of off-line water sources, such as a sample vial can be analyzed.

Appropriate printouts are produced on a local printer. Parameter changes, limit excursions or any problems detected during operation automatically generate a printout to provide a hard copy record of the event. On-demand data printouts are available through the **Print Key** (see "Auto TOC Printout" on page 69).

## 5.2 Factory Defaults

Anatel A643a Analyzers are shipped from the factory equipped with a set of default parameter values so that they can generate data as soon as they have been installed and powered up. A list of the Analyzer's current parameter settings is available through the **Print Setup** menu selection (see "Printouts" on page 117). The Anatel A643a's factory default values are:

*Table 5-1 :* Factory Defaults

| **Identification** | |
|---|---|
| Sensor Name: | Sensor Serial Number: |
| Channel ID Number: | 1 |
| **Analysis** | |
| Sample Time: | 00:01:00 (hh:mm:ss) |
| Cycle Time: | 00:00:00 (hh:mm:ss) |
| Sampling Mode: | Water Saver |
| User TOC Slope: | 1.000 |
| User Conductivity Slope: | 1.000 |

*Table 5-1 :* Factory Defaults (Continued)

| **Outputs** | |
|---|---|
| mA Range: | 4 to 20mA |
| TOC Zero-Scale: | 0 ppb |
| TOC Full-Scale: | 1000 ppb |
| Conductivity Zero-Scale: | 0 µS/cm U |
| Conductivity Full-Scale: | 20 µS/cm U |
| Temperature Zero-Scale: | 5 °C |
| Temperature Full-Scale: | 95 °C |
| Activate External DAC: | No (Inactive) |
| DAC Error Output: | Minimum Output |
| DAC Calibration Output: | Inactive |
| Digital Control: | Disabled |
| Active Alarm Setup: | TOC Alarm |
| TOC Alarm Limit: | 0500 ppb |
| Alarm Beeper: | Enabled |
| Supervisor & Operator Passwords: | 00000 (Disabled) |
| Resistivity/Conductivity Units: | cm U / µS |
| Log Setup: | Data & Audit |
| TOC Print Interval: | Continuous |
| % Change in TOC | 1 percent |
| Cycle Mode: | TOC & Idle |
| Purge Print Interval: | Timed |
| Print Interval: | 00:01:00 (hh:mm:ss) |
| % Change in Resistivity: | 1 percent |

All of these variables, default or user-entered, are stored in battery-backed memory within each Analyzer to avoid loss when the instrument is powered down. A **10–Bad Config** code is reported (see “Alarm Codes” on page 175) if a bad battery corrupts these values. In this instance, the default parameters must be restored and then modified as necessary.

**Note:**
*This procedure restores all Analyzer parameters to their factory default values except customer calibrations, which are not affected.*

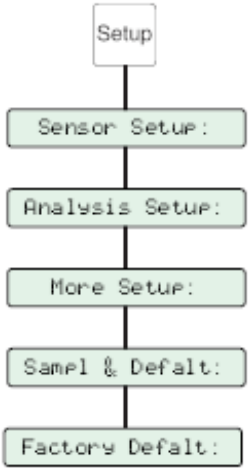


*Fig 5-1 :* Factory Defaults Menu

To reset the instrument's factory default parameters:

1) With the desired Analyzer selected in any View, press the **Setup Key**.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to display its submenu.
4) Specify **Analysis Setup** and press **Enter**.
5) Specify **More Setup**, press **Enter** to access its submenu and select **Sampl & Defalt**.
6) Use the **Up** and **Down Keys** to specify Factory Defalt.

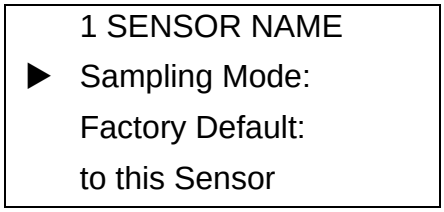


*Fig 5-2 :* Factory Default Selection

7) Press **Enter** to display the Factory Defaults Screen.
8) Press **Enter** once again to reinstate the Analyzer's default parameter settings; pressing **Esc** exits the screen without making any changes.

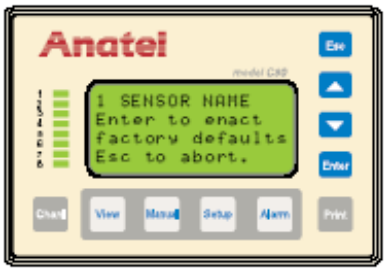


*Fig 5-3 :* Factory Defaults Screen

## 5.3 Password Security

**Note:**
*Defaults —*
*Identifier: Super*
*Supervisor: 00000 (None)*
*Identifier: Opera*
*Operator: 00000 (None)*

The Anatel A643a's operational modes (Setup, Manual and Print) can be password protected to prevent unauthorized users from accessing any of the instrument's configuration or control parameters, as well as its printout functions. The Anatel A643a allows two levels of password security: a Supervisor who has access to all functions and an Operator who can alter everything but the password entries and the **Log Setup Menu** (see "Internal Log" on page 114) which contains the instrument's audit trail.

The optional passwords are equipped with a required **Identifier** to trace accountability. Any parameter changes are recorded in the Analyzer's internal log for later retrieval and are automatically output to the printer (assuming one is attached). These records include the time, the parameter and the date of the change in addition to identifying the person authorized to make the modification.

By default, no passwords are defined (indicated by settings of **00000**), thereby allowing complete access to all personnel. A password, once enabled, is constrained by a 90-day limit. In other words, active passwords must be changed every three months. An alarm code is issued three times a day—at 12:00 AM, 8:00 AM and 4:00 PM—when the assigned limit has expired. This code will continue to be displayed (and printed) until the Supervisor changes the current password settings. To further enhance this security feature, the same passwords cannot be used in two successive 90-day periods.

**Note:**
*Settings of* **00000** *for the Supervisor and the Operator disable this security feature.*

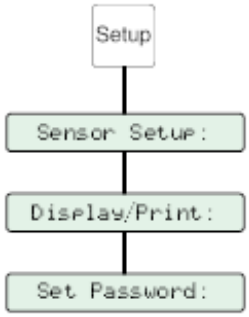


*Fig 5-4 :* Set Password Menu

To establish a supervisory Password and Identifier:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its submenu.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.

3) Press **Enter** to access its submenu.
4) Specify **Display/Print** from among the available selections and press **Enter** to display its options.
5) Specify **Set Password** and press **Enter**.
6) Use the **Up** and **Down Keys** to specify **Supervisor ID** and press **Enter** to display that screen.

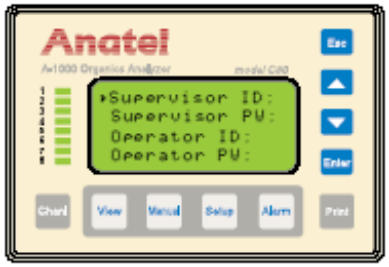


*Fig 5-5 :* Setting Supervisor Password Screen

7) Press **Enter** again and the flashing block cursor becomes a flashing underscore.

1 SENSOR NAME
Supervisor:
Identifier:
Super

*Fig 5-6 :* Enter Supervisor ID

8) Use the **Up** and **Down Keys** to specify the initial character in the identification. An identification is five alphanumeric characters and case-sensitive.
9) Press **Enter** to advance to the next character and similarly select it.
10) Repeat the selection procedure to define the other characters.
11) With the desired **Identifier** displayed, press **Esc** to return to the **Set Password** screen.

**Note:**
*Be sure to record the Identifier and Password somewhere in case it is forgotten.*

12) Use the **Up** and **Down Keys** to select **Supervisor PW** and press **Enter** to display that screen.
13) Press **Enter** and the flashing block cursor again becomes a flashing underscore.

1 SENSOR NAME
Supervisor:
Password:
00000

*Fig 5-7 :* Enter Supervisor Password

14) Similarly specify the Supervisor's password observing the same naming conventions as that used for the identification.
15) With the desired **Password** displayed, press **Esc** to enable this security feature and return to the **Set Password** screen.
16) If required, enter an **Operator Identifier** and **Password** using the same procedure.

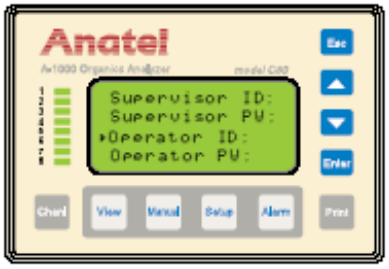


*Fig 5-8 :* Setting Operator Password Screen

17) Press **Esc** to enable this security feature and return the instrument to normal operation.

Once defined, a password must be entered in order to access the protected modes from a non-protected mode (**View**, **Channel** or **Alarm**). To disable the password, reset it to its default setting of **00000**.

18) Press **Enter** and the flashing block cursor cursor becomes a flashing underscore.
19) Use the **Up** and **Down Keys** to select the initial character in the password.
20) Press **Enter** to advance to the next character and similarly select it.
21) Repeat the selection procedure to define the other password characters.
22) With the correct password displayed, press **Esc** to continue with full instrument access.

It is suggested that when changes to the Anatel A643a have been completed, press **View** to exit this setting and safeguard access.

## 5.4 Display Units

This **Display/Print** submenu determines which measurement units are logged, displayed and output to the printer. Sample conductivity is reported in microsiemens per centimeter (µS/cm) and resistivity is reported in megohm-centimeters (MΩ-cm).

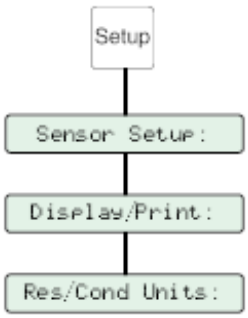


*Fig 5-9 :* Display Units Menu

To specify the reported display units:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its submenu.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to access its submenu.
4) Specify **Display/Print** from among the available selections and press **Enter** to display its options.
5) Specify **Resis or Cond** and press **Enter**.

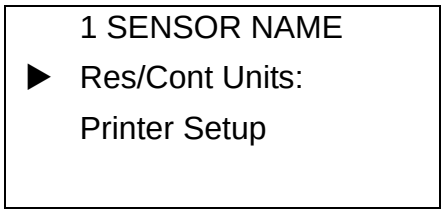


*Fig 5-10 :* Display Units Menu

6) Use the **Up** and **Down Keys** to select the desired format.

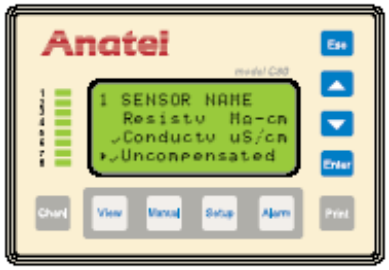


*Fig 5-11 :* Display Units Screen

The A643a TOC Analyzer software can report the actual or temperature-compensated conductivity (or resistivity) of the sample water. Compensated values are displayed as if the solution was being measured at 25 °C: Compensated conductivities are displayed as **µS C**. This calculation provides consistency from one analysis reading to the next regardless of changes in temperature.

Compensation is not always desirable in pharmaceutical high-purity water applications, however, so the uncompensated mode uses the actual sample water conductivity in its report and alarm functions. Uncompensated conductivity is reported for the Analyzer in place of the temperaturecompensated value on all the associated C80 Controller displays, as well as in all reports and any output signals. Any reported uncompensated values have units displayed as **µS U** to distinguish them from compensated values.

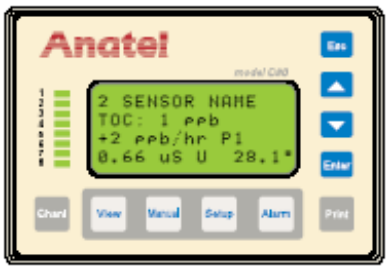


*Fig 5-12 :* Uncompensated Conductivity Display

**Note:**
*The compared values are recorded at the beginning of the analysis and when the data are reported.*

In addition to reporting the uncompensated values, they are monitored for limit excursions. The Anatel A643a Analyzer compares the uncompensated conductivity value to a set of USP (United States Pharmacopeia) limits and issues an alarm if the corresponding limit is exceeded (see “Uncompensated Conductivity Alarms” on page 106).

The Uncompensated Mode is enabled or disabled independent of the individual instrument’s conductivity (or resistivity) display units. Modifying an Anatel A643a to report temperature-uncompensated conductivity or resistivity values requires altering its **Display Units Screen** to reflect this new output. If an external DAC module is being used, its range may have to be adjusted to account for the new output (see “Conductivity/ Resistivity Output” on page 134).

**Note:**
*Uncompensated Resistivity may be chosen, but this selection is for display only and does not generate an alarm as the USP limits are not checked in this case.*

7) Use the **Down Key** to scroll to **Uncompensated** and press **Enter** to toggle the checkmark “on” and select the Uncompensated Mode. Choose **Conductv µS/cm** in order to report uncompensated conductivity alarms (see “TOC Validation” on page 87).
8) Press **Esc** repeatedly to exit this function and return to the normal display.

A “C” designates a compensated and a “U” designates an uncompensated value in the Controller display. Thus, uncompensated conductivity is reported as “µS U” and “M. U” is displayed for an Analyzer reporting uncompensated resistivity.

The column headers on printed outputs similarly report “COND UNCMP” and “RESIS UNCMP,” respectively. This also applies to the Gateway and the TOC View program where the appropriate headers are modified in the report and display columns. In instances where the data for multiple instruments are combined into a single report or view, a separate unit is given for each line of data.

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ANATEL
Access 643 TOC Analyzer
Model 643a-P S/N XXXXX
ID: 2 Name: SENSOR NAME

12/18/02

| TIME | COND UNCMP | TEMP [C] |
|---|---|---|
| 12:07 | 0.66 | 28.0 |
| 12:08 | 1.25 | 27.5 |
| 12:09 | 1.27 | 27.3 |
| 12:10 | 1.25 | 27.3 |
| 12:11 | 1.26 | 27.3 |
| 12:12 | 1.25 | 27.3 |
| 12:13 | 1.25 | 27.2 |
| 12:14 | 1.22 | 27.3 |
| 12:15 | 1.23 | 27.3 |
| 12:16 | 1.25 | 27.3 |

*Fig 5-13 :* Purge Printout

## 5.5 The Auto TOC Mode

In this normal (default) operating mode, the Anatel A643a conducts analysis and reporting functions based on its particular parameters. Water samples are analyzed independently by each instrument, their corresponding results displayed on the associated C80 Controller at the conclusion of each analysis cycle. Printouts are generated by an Analyzer's attached printer as specified on its **Printer Setup Menu**. Automatic analysis and reporting continues until manually interrupted by the user or until a critical fault is encountered.

To select the Auto TOC Mode:

1) With the desired Analyzer selected in any View, press **Manual** to display its operational options.
2) Use the **Up** and **Down Keys** to specify Auto TOC.
3) Press **Enter** to enable the Auto TOC Mode.

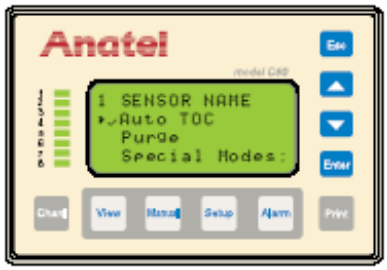



*Fig 5-14 :* Auto TOC Mode Selection

In this mode, water analyses are conducted automatically by the Anatel A643a using a patented procedure. TOC measurement uses a microprocessorcontrolled photocatalytic process in conjunction with conductivity detection. The initial conductivity of the water sample is determined to establish a reference value. An ultraviolet lamp then oxidizes the sample and

the resulting change in conductivity is used to calculate the concentration of Total Organic Carbon present in parts per billion (ppb).

The Auto TOC analysis process is comprised of three successive stages: the **Sample**, **Oxidation** and **Idle Times**. These intervals are referred to collectively as the Cycle Time, its duration specified in the Analyzer's setup (see "Cycle Time" on page 65).

During the **Sample Time** interval, the UV lamp is turned off and the Analyzer's internal Sample Valve 2 is opened to allow pressurized water from the Process Water Inlet to purge the measurement cell. Sample Valve 2 is closed at the conclusion of the **Sample Time** to capture a new sample in the cell. The conductivity and the temperature of the sample water are measured to establish reference values which are stored in the instrument's memory for use in calculating the TOC results.

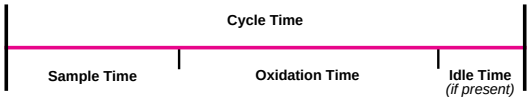



*Fig 5-15 :* Analysis Time Line

During the Oxidation Time, the Analyzer's Sample Valve 2 remains closed, the UV lamp is turned on and oxidation begins. This interval varies depending on the organic content of the water. The nature of the oxidation curve determines the sample to be one of the following Profile Types:

| | |
|---|---|
| Profile Type 1 ("P1") | Easy to oxidize |
| Profile Type 2 ("P2") | Moderately difficult to oxidize (only in TOC levels below 25 ppb) |
| Profile Type 3 ("P3") | Difficult to oxidize (intermediate organic acids are formed) |

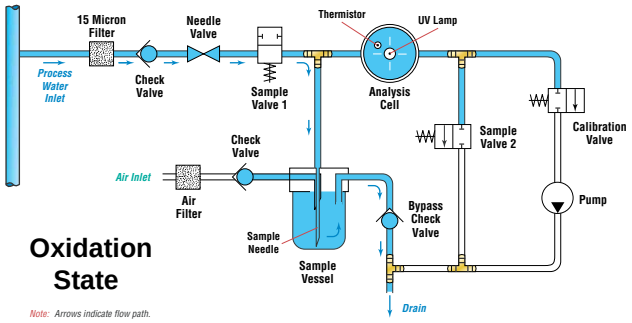



*Fig 5-16 :* Oxidation State

Conductivity is always increasing until oxidation is complete in a P1 sample. This indicates that few intermediate organic acids, which have higher conductivity than the equivalent $CO_2$, are formed. A P3 sample contains significant amounts of these acids. Consequently, conductivity peaks then decreases as analysis nears completion. P2 samples occur at low TOC levels and are similar to a P1, or minor P3, sample in which the organic "background" of the measurement cell must be measured.

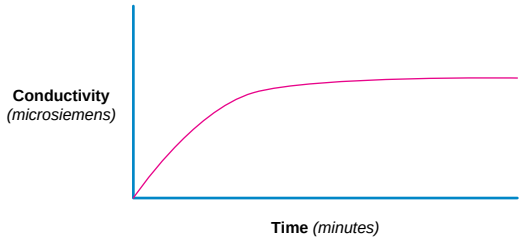



*Fig 5-17 :* P1-Type Oxidation Curve

Abrupt changes in the Profile Type can indicate a change in water chemistry. For example, a change from a P2 to a P3 Profile Type at a TOC level of 10 ppb, indicates a contamination shift towards more complex compounds. This comparison also is valid between water treatment systems when TOC levels are similar. Simple organics, such as methanol, report P1 up to moderate levels (in excess of 50 ppb). More complex organics tend to oxidize as a P3 Type at all but the lowest levels (less than 10 ppb). In this instance, complex indicates either very large organics with a high molecular weight or organics that contain some element which resists oxidation. As TOC levels vary, the location of this transition shifts but the accuracy of the measurement is maintained. Neither the Profile Type nor the analysis conditions cause any variations in TOC readings.

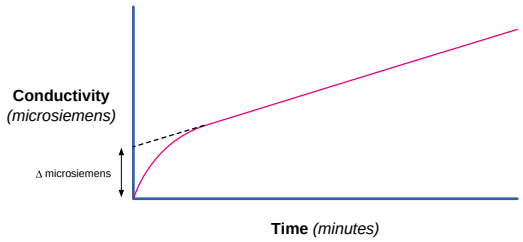



*Fig 5-18 :* P2-Type Oxidation Curve

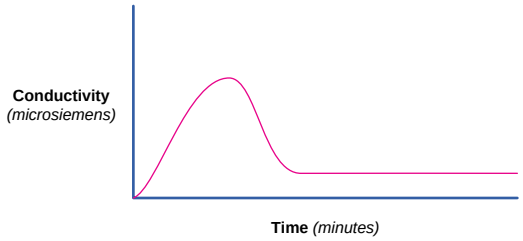



*Fig 5-19 :* P3-Type Oxidation Curve

The difference between the final equivalent TOC reading and the beginning reference value is calculated at the end of oxidation to yield the TOC content of the sample. The results of the analysis are then reported on the instrument and the C80 Controller, as well as output to the printer.

If TOC analysis is complete before the set **Cycle Time** has elapsed, the instrument goes into an Idle State and awaits the start of the next analysis. During this **Idle Time**, Sample Valve 1 either allows or prevents sample water flow, depending on the Analyzer's **Sample Mode** setting (see "Sampling Mode" on page 66). When the setting is **Continuous**, the measurement cell is continuously purged until the conclusion of the **Cycle Time**; when **Water Saver** is selected, sample flow through the Analyzer is suspended until initialization of the subsequent **Sample Time**. If the **Cycle Time** is less than the duration of the analysis, the next analysis begins immediately. Thus, in order to perform continuous analyses, the Analyzer's **Cycle Time** should be set to the default of **0** minutes. This setting is recommended unless a fixed and lengthy (hourly) analysis is required.

### 5.5.1 Auto TOC Software Setup

There are several parameters which define Anatel A643a operation in the Auto TOC Mode. These variables include setting the **Sample** and **Cycle Times**, as well as the instrument's Sample Mode setting. These time parameters are accessed through the instrument's **Times & Cycle Menu** and determine the duration of its analysis. As noted, the analysis **Cycle Time** is comprised of **Sample**, **Oxidation** and, in some instances, an **Idle Time**.

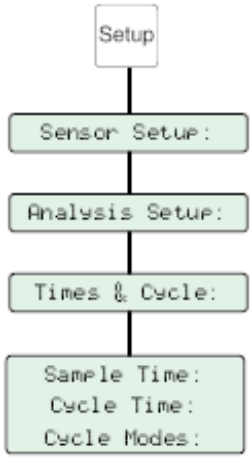



*Fig 5-20 :* Auto TOC Software Setup

To access the Anatel A643a's **Times & Cycle Menu**:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its submenu.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to access it submenu.
4) Specify **Analysis Setup** from among the available selections and press **Enter** to display its options.

The **Times & Cycle Menu** offers the following instrument-specific analysis parameters:

- **Sample Tim**e is the period of time water flows through the Analyzer before its internal sample valve closes and sample analysis begins.
- **Cycle Time** is the minimum length of time from the beginning of one analysis to the beginning of the subsequent analysis.

- **Cycle Modes** allows conductivity (or resistivity) and temperature readings to be reported while the instrument is purging between analyses.

#### 5.5.1.1 Sample Time

**Note:**
*Default: 1 Minute*

The **Sample Time** is the period during which water flows through the Anatel A643a's measurement cell prior to oxidation. This ensures that a discrete and representative water sample is oxidized during each analysis. The interval is user-selectable from **00:00:00** to **17:59:59** and a proper setting helps assure accurate and timely analysis results.

During the **Sample Time**, Sample Valve 2 is open to allow the measurement cell to purge of any residual contamination. An empirical method for determining an appropriate **Sample Time** for any flow rate is to switch the instrument into the Purge Mode at the end of an oxidation cycle and note the time it takes for the resistivity reading to stabilize. Double this time to obtain a proper **Sample Time** interval. For systems where the water pressure varies, use the average of several such readings or update the Sample Time settings when inlet conditions change.

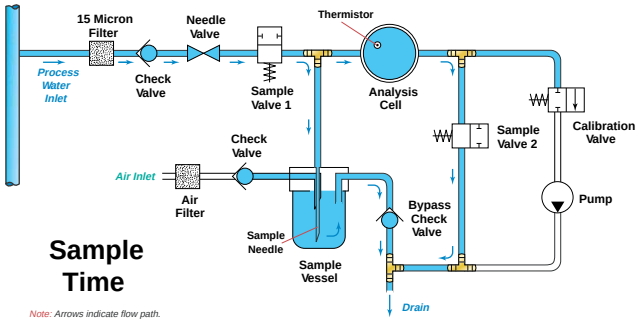



*Fig 5-21 :* Sample Time

The Analyzer must be rinsed completely in order to accurately measure sample resistivity. Even minute amounts of residual oxidation products will increase the conductivity of a high-purity water sample considerably. The Anatel A643a compensates the reported conductivity for variations in temperature caused by using high intensity UV which, in conjunction with an integral heater, warms the measurement cell. A substantial **Sample Time** reestablishes the temperature balance as well as flushing the previous sample.

As an example, in 0.05 µS/cm water containing 100 ppb TOC, a rinse of 99% will lower the measured TOC by only 1 ppb. Sample conductivity, however, will degrade by more than 0.4 µS/cm.

For analyses from sources where the water pressure exceeds 15 psig, a good rule-of-thumb is to set the **Sample Time** to two minutes. The setting should be increased by one additional minute for each two meters of 1/4" sample tubing, and another minute for each 10 °C differential in temperature between the sample water and the room temperature.

Although a lengthy **Sample Time** guarantees the most accurate conductivity and temperature readings, adequate TOC sampling can be accomplished in shorter intervals. In cases where

the Sample Time must be limited, the setting should allow a 60 mL sample flow through the instrument with an additional 25 mL for each meter of 1/4" tubing traveled. Measure the flow through the instrument during the preoxidation **Sample Time** and calculate the time necessary for this volume of water. The flow rate can be checked and verified with a stopwatch or second hand and a beaker or graduated cylinder.

To set the instrument's **Sample Time**:

1) With the **Times & Cycle Menu** displayed, use the **Up** and **Down Keys** to specify **Sample Time**.
2) Press **Enter** to access its parameter screen. The current **Sample Time**is displayed in an hour:minute:second format and represents duration, not clock time. The flashing block cursor highlights the hour division.

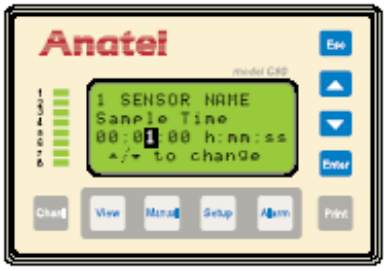



*Fig 5-22 :* Sample Time Screen

3) Use the **Up** and **Down Keys** to specify the time division to be changed.

1 SENSOR NAME
Sample Time
00:01:00 h:mm:ss
▲/▼ to change

*Fig 5-23 :* Sample Time Displayed

4) Press **Enter** to enable the Controller's Edit Mode and the flashing block becomes an underscore.
5) Use the **Up** and **Down Keys** to scroll until the desired period is displayed. A minimum **Sample Time** of one minute is recommended for the best TOC analysis results.

1 SENSOR NAME
Sample Time
00:03:00 h:mm:ss
▲/▼ to change

*Fig 5-24 :* Change Sample Time

6) Press **Enter** to update the setting and advance to the next time segment.

7) Repeat the editing process with each time division until the desired **Sample Time** has been entered into the display.
8) Press **Esc** twice to retain the setting and return to the **Times & Cycle Menu**.

#### 5.5.1.2 Cycle Time

**Note:**
*Default: 0 minutes*

The **Cycle Time** is user-selectable from **00:00:00** to **99:59:59** (100 hours) and defines the minimum duration of the analysis. If the **Cycle Time** exceeds the period required for the combined sample and oxidation steps, the Anatel A643a defaults to an Idle state until the next analysis is scheduled to begin. If the specified **Cycle Time** is less than the combined sample and oxidation times, the next analysis begins immediately.

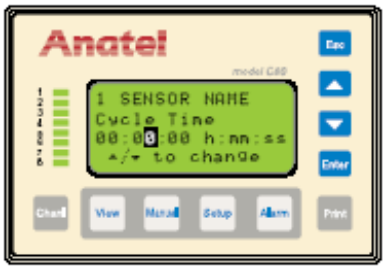



*Fig 5-25 :* The Cycle Time Screen

To set the instrument's **Cycle Time**:

1) With the **Times & Cycle Menu** displayed, use the **Up** and **Down Keys** to specify **Cycle Time**.
2) Press **Enter** to access its parameter screen. The current **Cycle Time** is displayed in an hour:minute:second format, the flashing block cursor highlighting the hour division.
3) Use the **Up** and **Down Keys** to specify the time division to be changed.
4) Press **Enter** to enable the Controller's Edit Mode and the flashing block becomes an underscore.

1 SENSOR NAME
Cycle Time
00:0<u>0</u>:00 h:mm:ss
▲/▼ to change

*Fig 5-26 :* Cycle Time Displayed

5) Again use the **Up** and **Down Keys** to scroll until the desired period is displayed. For example, if the **Cycle Time** is set to **00:30:00**, TOC data will be available at 30-minute intervals. Be sure that the frequency of data reports is appropriate for process management requirements when determining this interval.

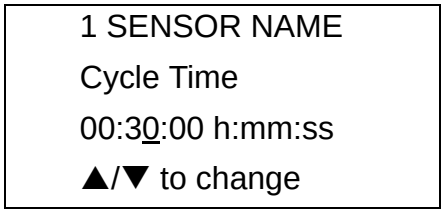



*Fig 5-27 :* Change Cycle Time

**Note:**
*To assure continuous analyses, set the* **Cycle Time** *to* **0***.*

6) Press **Enter** to retain the setting.
7) Repeat the editing process with each time division until the desired **Cycle Time** has been entered into the display.
8) Press **Esc** repeatedly to exit this function and return to the normal display.

### 5.5.1.3 Sampling Mode

**Note:**
*Default: Water Saver*

The **Sampling Mode** setting determines the state of the Analyzer's internal valves during oxidations and the **Idle Time** interval (if any) that occurs between the completion of a TOC analysis and the initiation of the next analysis (based on the set **Cycle Time**). Sample flow through the instrument can be minimized to conserve water or the Analyzer's Sample Vessel can be flushed continuously to prevent dead leg conditions.

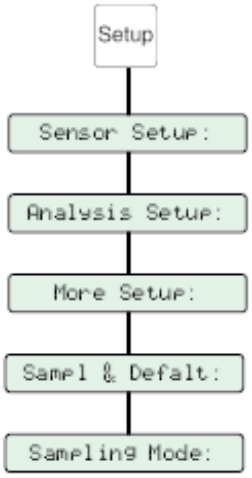



*Fig 5-28 :* Sampling Mode

To specify the **Sampling Mode**:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its submenu.

2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to access it submenu.
4) Specify **Analysis Setup** and press **Enter**.
5) Specify **More Setup** and press **Enter**.
6) Specify **Sampl & Defalt** from among the available selections and press **Enter** to display its options.
7) Specify **Sampling Mode** and press **Enter** to display its parameter screen.

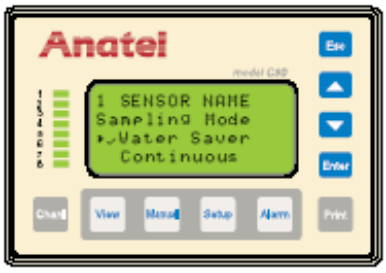



*Fig 5-29 :* Sampling Mode Screen

8) Use the **Up** and **Down Keys** to choose the desired sample valve setting:
   - **Water Saver** stops sample water flow through the analysis portion of the instrument.
   - **Continuous** constantly purges the instrument's Sample Vessel.
9) With the desired **Sampling Mode** setting indicated, press **Enter** to enable it.
10) Press **Esc** repeatedly to exit this function and return to the normal display.

#### 5.5.1.4 Cycle Modes

**Note:**
*Default: TOC & Idle*

The Anatel A643a can report the conductivity (or resistivity) and temperature of the sample water during the instrument's **Idle Time** (see "Cycle Time" on page 65), if desired, through the Cycle Modes. For example, a one-hour **Cycle Time** may require 15 minutes for TOC analysis; the instrument purges for the remaining 45 minutes until the next analysis cycle is initiated. Conductivity (or resistivity) values may be displayed and printed during this interval. The default is not to report these readings so that the last TOC analysis data is displayed at all times.

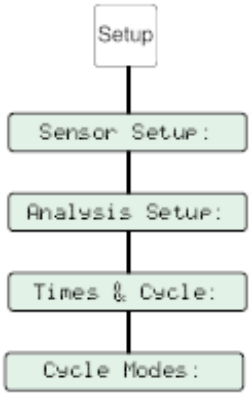



*Fig 5-30 :* Cycle Modes

To enable **Cycle Modes** data reporting:

1) With the desired instrument selected in any View, press the **Setup Key**.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup** and press **Enter**.
3) Select **Analysis Setup** and press **Enter**.
4) Select **Times & Cycle** and press **Enter**.

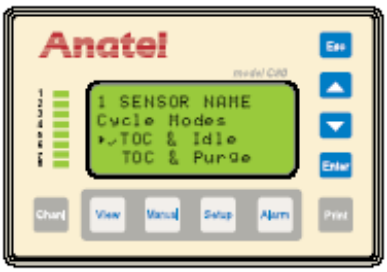


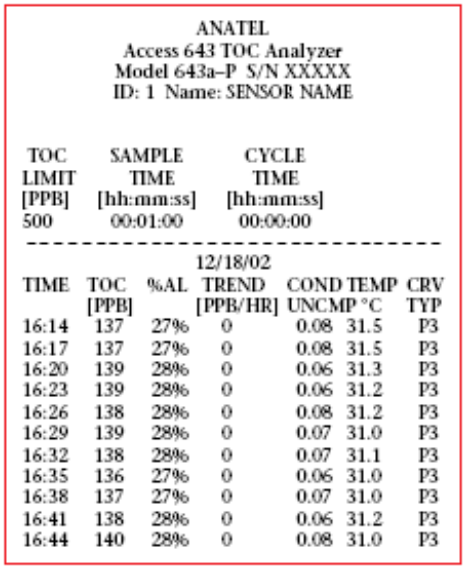

*Fig 5-31 :* Cycle Modes Screen

5) Select **Cycle Modes** and use the **Up** and **Down Keys** to choose the desired setting:
   - **TOC & Idle** displays the data from the last TOC analysis during the **Cycle Time** Idle interval.
   - **TOC & Purge** displays conductivity (or resistivity) and temperature data during the instrument's **Idle Time**.
6) With the desired **Cycle Mode** setting indicated, press **Enter** to enable it.
7) Press **Esc** repeatedly to exit this function and return to the normal display.

Reporting of this **Cycle Time** data can be limited to display only by disabling purge printouts (see "Purge Printouts" on page 72). TOC results will continue to be printed as specified in "Auto TOC Printout" on page 69.

### 5.5.2 Auto TOC Printout

**Note:**
*Default: Continuous*



ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

| TOC LIMIT [PPB] | SAMPLE TIME [hh:mm:ss] | CYCLE TIME [hh:mm:ss] |
|---|---|---|
| 500 | 00:01:00 | 00:00:00 |

12/18/02

| TIME | TOC [PPB] | %AL | TREND [PPB/HR] | COND UNCMP | TEMP °C | CRV TYP |
|---|---|---|---|---|---|---|
| 16:14 | 137 | 27% | 0 | 0.08 | 31.5 | P3 |
| 16:17 | 137 | 27% | 0 | 0.08 | 31.5 | P3 |
| 16:20 | 139 | 28% | 0 | 0.06 | 31.3 | P3 |
| 16:23 | 139 | 28% | 0 | 0.06 | 31.2 | P3 |
| 16:26 | 138 | 28% | 0 | 0.08 | 31.2 | P3 |
| 16:29 | 139 | 28% | 0 | 0.07 | 31.0 | P3 |
| 16:32 | 138 | 28% | 0 | 0.07 | 31.1 | P3 |
| 16:35 | 136 | 27% | 0 | 0.06 | 31.0 | P3 |
| 16:38 | 137 | 27% | 0 | 0.07 | 31.0 | P3 |
| 16:41 | 138 | 28% | 0 | 0.06 | 31.2 | P3 |
| 16:44 | 140 | 28% | 0 | 0.08 | 31.0 | P3 |

*Fig 5-32 :* Sample TOC Printout

The TOC printout furnishes the following Anatel A643a Analyzer information:

*Table 5-2 :* TOC Printout Information

| | |
|---|---|
| **Sensor** | |
| | The **Model Number** of the instrument. |
| **SN** | The Serial Number of the instrument. |
| **ID** | Its Channel ID Number. |
| **Name** | The user-entered name of the instrument. |
| **TOC LIMIT** | The instrument's set TOC alarm limit. |
| **SAMPLE TIME** | The instrument's set **Sample Time**. |
| **CYCLE TIME** | The instrument's set **Cycle Time**. |
| **Data** | |
| | The **Current Date**. |
| **TIME** | The time when the sample was captured. |
| **TOC [PPB]** | The measured TOC of the sample in parts per billion. |
| **%AL** | The current TOC value as a percentage of its set **Alarm Limit**. |

*Table 5-2 :* TOC Printout Information (Continued)

| **Sensor** | |
|---|---|
| **TREND [PPB/HR]** | The TOC directional trend in ppb over the last hour. |
| **COND** (or **RESIS**) | The conductivity (or resistivity) of the sample if it is temperature-uncompensated. |
| **TEMP** | The temperature of the sample. |
| **CRV TYP** | The profile type of the sample. |

Two **TOC Print** intervals are available. **Continuous** generates a TOC printout at the conclusion of each analysis; **Paper Saver** triggers a printout only when the change in TOC level between analyses exceeds a userdefined percentage.

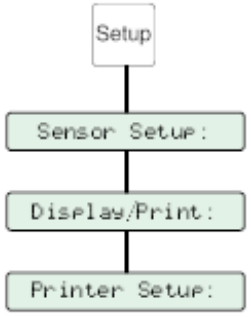



*Fig 5-33 :* Auto TOC Printout

To set the instrument's **TOC Print** interval:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its submenu.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to access it submenu.
4) Specify **Display/Print** and press **Enter**.
5) Select **Printer Setup** from the **Display/Print** menu and press **Enter**.
6) Specify **TOC Print** and press **Enter**.

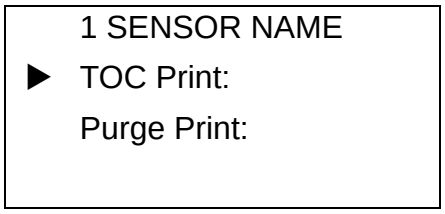



*Fig 5-34 :* TOC Print

7) Use the **Up** and **Down Keys** to specify one of the two **TOC Print** outputs.

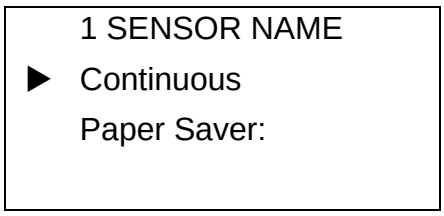



*Fig 5-35 :* TOC Print Format

8) Press Eto select the specified format.
   - **Continuous** generates a printout at the conclusion of each analysis.
   - **Paper Saver** generates a printout only when the difference in TOC values between the current and the previous analysis exceeds a user-specified percentage. If this format is chosen, the **% Change in TOC** must be specified. A flashing cursor underscores the setting.

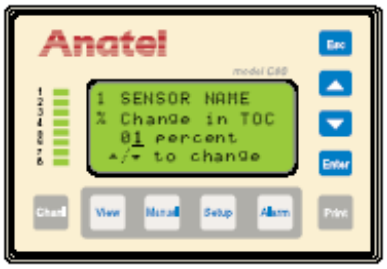



*Fig 5-36 :* Paper Saver Print Screen

9) Use the **Up** and **Down Keys** to scroll the value until the desired percentage is displayed.
10) Press **Esc** repeatedly to exit this function and return to the normal display.

## 5.6 The Purge Mode

In the Purge Mode, the Anatel A643a's internal sample valve is open to permit sample water to continuously flow through its measurement cell. This action provides a method of reporting the conductivity (or resistivity) and temperature values on the Controller's display and on local printouts.

To place the Analyzer in the Purge Mode:

1) With the desired instrument selected in any View, press the **Menu Key** to display its options.
2) Use the **Up** and **Down Keys** to specify **Modes** and press **Enter**.
3) Select **Purge** from the available selections and press **Enter** to enable the Purge Mode. The Analyzer remains in this operational state until another Mode is chosen.

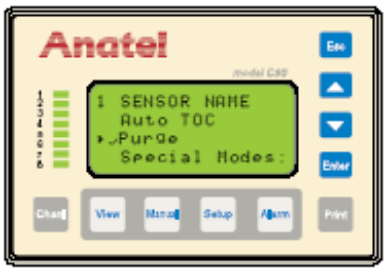



*Fig 5-37 :* Selecting the Purge Mode

### 5.6.1 Purge Printouts

**Note:**
*Default: Timed / 1 Minute*

As with the Auto TOC Mode, there are two potential Purge Print intervals: Timed generates a purge printout at user-specified intervals; Paper Saver triggers a purge printout only when the change in the water sample's conductivity (or resistivity) level exceeds a userdefined percentage in two successive analyses. The Purge Printout reports the following values:

*Table 5-3 :* Purge Printout Reports

| **Sensor** | |
|---|---|
| | The **Model Number** of the instrument. |
| **SN** | The Serial Number of the instrument. |
| **ID** | Its Channel ID Number. |
| **Name** | The user-entered name of the instrument. |
| **Data** | |
| | The Current Date |
| **TIME** | The time at which the measurement was taken. |
| **COND UNCMP** | The conductivity of the sample and whether it is temperature-uncompensated. |
| **TEMP °C** | The temperature of the sample in °C. |

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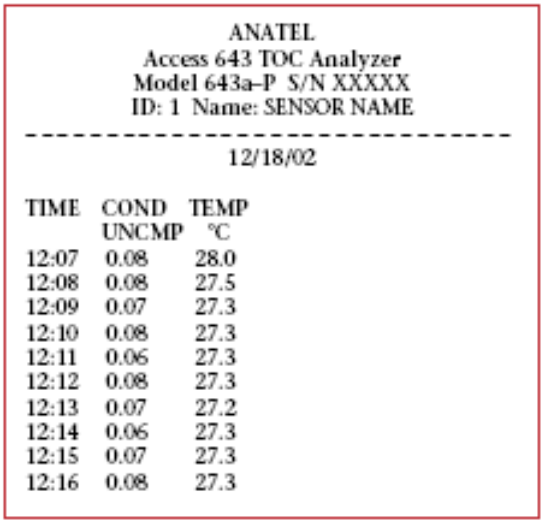

ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

12/18/02

| TIME | COND UNCMP | TEMP °C |
|---|---|---|
| 12:07 | 0.08 | 28.0 |
| 12:08 | 0.08 | 27.5 |
| 12:09 | 0.07 | 27.3 |
| 12:10 | 0.08 | 27.3 |
| 12:11 | 0.06 | 27.3 |
| 12:12 | 0.08 | 27.3 |
| 12:13 | 0.07 | 27.2 |
| 12:14 | 0.06 | 27.3 |
| 12:15 | 0.07 | 27.3 |
| 12:16 | 0.08 | 27.3 |

*Fig 5-38 :* Purge Printout

**Note:**
*Conductivity is shown as "COND uS/cm" if it is temperature compensated.*

To specify a **Purge Print** interval:

1) With the desired instrument selected in any View, press the **Setup Key** to display its submenu.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to access its submenu.
4) Specify **Display/Print** from among the available selections and press **Enter** to display its options.
5) Select **Printer Setup** and press **Enter**.
6) Specify **Purge Print** and press **Enter**.
7) Use the **Up** and **Down Keys** to specify one of the two **Purge Print** outputs:

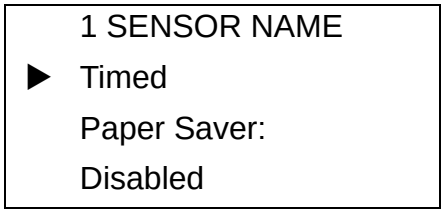


*Fig 5-39 :* Purge Print Outputs

- **Timed** generates a printout at the specified interval *(Default: 1 Minute).*
- **Paper Saver** generates a printout when the difference in conductivity values between the current and the previous analysis cycle exceeds a specified percentage. If chosen, this **% Change** in data must be specified *(Default: 1 percent).*
- **Disabled** inhibits all printouts. This option can be used in conjunction with the Cycle Mode **TOC & Purge** setting (see "Purge Printouts" on page 72) to limit printouts to TOC data *(Default: Off).*

8) Press **Enter** to select the specified format. A flashing cursor highlights the current value.

**Timed Purge Print**

If **Timed Purge Print** is selected, a flashing block cursor highlights the minutes division.

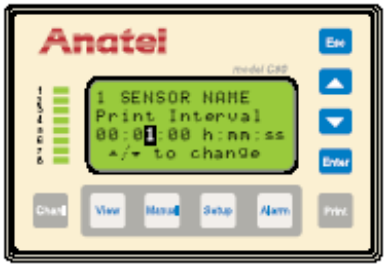


*Fig 5-40 :* Timed Purge Print Screen

9) Use the **Up** and **Down Keys** to specify the time division to be changed.
10) Press **Enter** to enable the Controller's Edit Mode and the flashing block becomes an underscore.
11) Use the **Up** and **Down Keys** to scroll until the desired period is displayed.

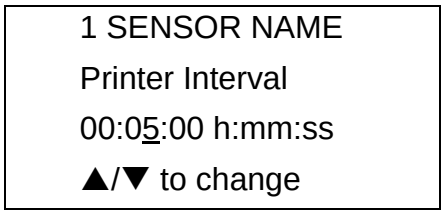


*Fig 5-41 :* Timed Purge Print

12) Press eto save the setting.
13) Repeat the editing process with each time division until the entire **Print Interval** has been entered into the display.
14) Press **Esc** repeatedly to exit this function and return to the normal display.

**Paper Saver Purge Print**

If **Paper Saver Purge Print** is selected, a flashing cursor underscores the second digit of the setting.

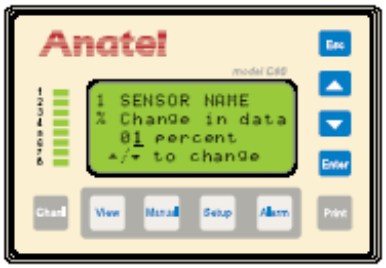


*Fig 5-42 :* Paper Saver Print Screen

| | |
|---|---|
| | 1 SENSOR NAME |
| % | Change in data |
| | 10 percent |
| | ▲/▼ to change |

*Fig 5-43 :* Paper Saver Print

9) Use the **Up** and **Down Keys** to scroll the value until the desired percentage is displayed.

10) Press **Esc** repeatedly to exit this function and return to the normal display.

## 5.7 The Manual Mode

Analysis and reporting functions are continuous when the Anatel A643a is in the Auto TOC Mode. There are times, however, when manual control over the instrument's analysis is desirable. The **Manual Samples** menu selection allows the user to conduct a single sample analysis when necessary.

The Manual Mode is used to interrupt the current analysis in order to start a new analysis. It is convenient for initiating a manual analysis during Anatel A643a installation, or to synchronize analysis with process equipment (sampling is under user control). Manual samples also may be acquired online from the water system or off-line from a sample vial (grab sample).

Access to the Analyzer by other connected C80 Controllers is denied while the instrument is in the Manual Sample or Oxidation State. Access is restored when the Manual Mode is exited.

### 5.7.1 Grab Samples

Off-line grab samples are accommodated by the Anatel A643a. Samples from various sources, such as in a laboratory setting, can be analyzed. Up to three analyses of a single sample may be performed using this procedure.

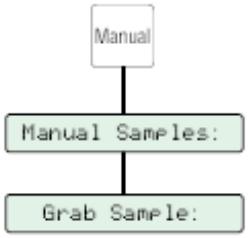


*Fig 5-44 :* Grab Samples

**CAUTION:**
*In a networked environment (see "Network Installation" on page 39), it is important to confirm the instrument's Serial Number before proceeding. Operation of the wrong Analyzer could result in water leakage from the sample vessel when it is removed during the procedure.*

To conduct a manual grab sample measurement:

1) With the desired Analyzer selected in any View, press the **Manual Key** to access its menu selections.
2) Use the **Up** and **Down Keys** to specify **Manual Samples**.
3) Press **Enter** to display its submenu.
4) Specify **Grab Sample** and press **Enter**.

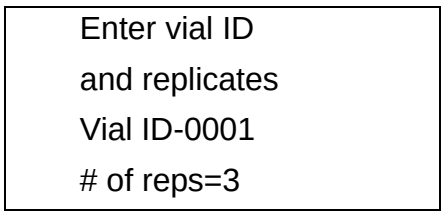


*Fig 5-45 :* Grab Sample Menu

5) There is a delay while the instrument stabilizes and then a flashing block cursor will appear to identify the vial for reporting purposes as well as specify the number of replicates. Press **Enter** to enable the editing mode and the flashing block becomes an underscore.
6) Use the **Up** and **Down Keys** to scroll the display until the desired **Vial ID** number is shown.
7) Press **Enter** and similarly specify the number of replicates to be run, then press **Enter** to continue.

8) Remove the sample vessel when prompted and install the appropriate sample vial, making sure it is securely seated.

**CAUTION:**
*Use extreme care when installing and removing the sample vessel and vials. Contact with the exposed needle could cause serious injury.*

9) Press **Enter** to initiate the selected number of analyses. The instrument's internal pump is activated and the measurement cell is flushed with the sample solution before it is analyzed. The results are displayed at the conclusion of the analysis cycle.

| |
|---|
| Rep #1=489 ppb |
| Rep #2=487 ppb |
| Rep #3=489 ppb |
| Press Enter |

*Fig 5-46 :* Analysis Cycle Results

10) Press **Enter** and the average TOC reading is displayed.


*Fig 5-47 :* Grab Sample Analysis

11) Press **Enter** to continue and then again to perform another sample analysis, if desired.
12) When grab sampling is complete, press **Esc** to exit the procedure.
13) Remove the sample vial and reinstall the sample vessel, making sure it is securely seated.
14) Press the **Enter Key** to return to the **Manual Samples Menu**.

ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

12/18/02

| TIME | TOC [PPB] | VIAL ID | REP# | COND UNCMP | TEMP [C] | CRV TYP |
|---|---|---|---|---|---|---|
| 08:46 | 136 | 1 | #1 | 0.08 | 31.5 | P3 |
| 08:46 | 137 | 1 | #2 | 0.08 | 31.5 | P3 |
| 08:46 | 139 | 1 | #3 | 0.06 | 31.3 | P3 |
| 08:46 | 139 | 1 | Ave | 0.06 | 31.2 | |

*Fig 5-48 :* Grab Sample Printout

## 5.7.2 On-Line Samples

The Anatel A643a can perform individual analyses of on-line samples, with sampling controlled by the user.

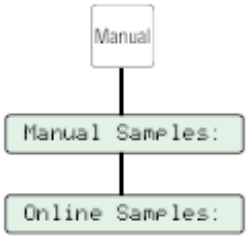


*Fig 5-49 :* On-Line Samples

To conduct an on-line sample measurement:

1) With the desired Analyzer selected in any View, press the **Manual Key** to access its menu selections.
2) Use the **Up** and **Down Keys** to specify **Manual Samples**.
3) Press **Enter** to display its submenu.
4) Use the **Up** and **Down Keys** to specify **Online Samples** and press **Enter** to display its submenu.
5) Use the **Up** and **Down Keys** to specify **Sampl**.

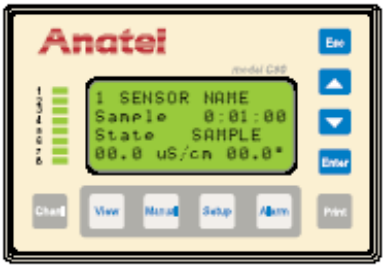


*Fig 5-50 :* Manual Sample State

6) Press **Enter** to initiate a single analysis. **Sampl** reflects the **Sample Time** interval specified in the Analyzer's setup (see "Sample Time" on page 63). Note this if the sample interval is to be matched. The instrument's analysis **State** and values are reported as soon as they become available.

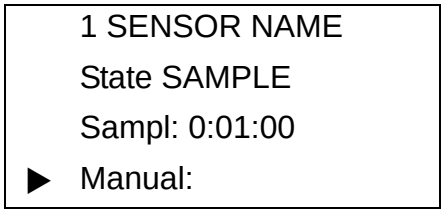


*Fig 5-51 :* Sample Time Interval

7) Press **Esc** to return to the **Online Samples Menu**.
8) Use the **Up** and **Down Keys** to specify **Manual**.
9) Press **Enter** to access its parameters and initiate a single analysis. The **Duration** of the sampling period is reported during the course of the fill.
10) Press **Enter** to stop sampling and the analysis continues with the Oxidation (measurement) stage. Once oxidation is complete, the sample's TOC value is displayed.

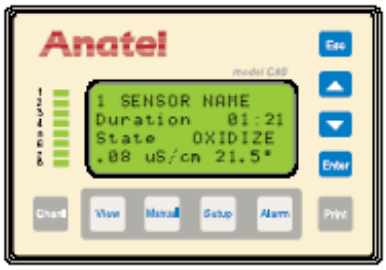


*Fig 5-52 :* Manual Oxidize State

The Manual Mode can be terminated at any time by pressing the **Esc Key** to exit the screen.

# 6 Calibration and Validation

## 6.1 General Information

The Anatel A643a is equipped with on-demand calibration and validation capability to ensure the reliability of its results. Calibration assures the accuracy of instrument's readings at regular intervals; validation ensures the accuracy of the calibration by "challenging" it with the analysis of a known standard. Calibration and validation data are available for viewing via a C80 Controller or through a local or network printer.

**Note:**
*The* Anatel A643a *is calibrated at the factory before shipment. It is not necessary to perform a TOC Calibration prior to placing the instrument into service.*

Proper calibration of the Anatel A643a is critical to maintaining optimum instrument performance. There are several approaches to calibration to run unknown samples and accurately report the results. Calibration and validation involve running analyses of one or more standards and blanks in order to determine instrumental response:

| | |
|---|---|
| **TOC Calibration** | Select from up to three levels (250, 500 and 750 ppb) of a sucrose standard. The procedure also allows up to three analysis replicates per standard for maximum accuracy. |
| **TOC Validation** | Perform either a single-point or multipoint validation of the TOC calibration using using up to three levels of sucrose validation standards. |
| **Conductivity Calibration** | Performed according to the guidelines established in USP Method <645>. The procedure uses a NIST-traceable calibrated resistor for the determination of meter accuracy and a NIST-traceable 100 µS/cm conductivity standard for cell constant verification. |
| **System Suitability** | Performed according to the guidelines established in USP Method <643> using prepackaged 500 ppb sucrose and 500 ppb 1,4-benzoquinone standards. |

Each procedure is prompted by a series of menus and all analyses are performed automatically. The necessary materials are available through Anatel in prepackaged Reagent Kits.

**Note:**
*These are intended as general instructions on the performance of the calibration and validation procedures. Refer to the specific Standard Operating Procedure (SOP) for detailed instructions.*

## 6.2 TOC Calibration

**Note:**
*Refer to Standard Operating Procedure (SOP) #643–1/1A for complete instructions on performing this procedure.*

Calibration ensures the accuracy of the TOC values obtained by the Anatel A643a Analyzer. TOC values are determined by measuring the change in conductivity of a high-purity water sample as its organic compounds are oxidized to carbon dioxide inside the instrument's analysis cell. The confirmation procedure subtracts the average of a series of background TOC measurements from the average of a series of working standard measurements.

Linear regression is performed on the data and a correlation coefficient (R) for the analysis is reported. The instrument automatically determines whether the calibration passes or fails based on the factory calibration. If the absolute value of the percent slope change ($\%_{SC}$) of the new calibration is ≤15% of the factory calibration, the instrument indicates that the new calibration has passed. If the result is >15% of the factory calibration, the Analyzer indicates that the new calibration has failed.

**Note:**
*It is recommended the correlation coefficient, a user-accepted (R) value, be ≥0.990. The calibration will not fail if the R value is ≤0.990, only if the % slope change is not within the specified limits.*

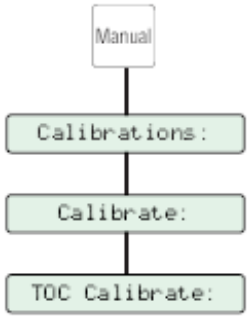


*Fig 6-1 :* TOC Calibration

To perform a TOC calibration:

1) With the desired Analyzer selected in any View, press the **Manual Key** to access its menu selections.
2) Use the **Up** and **Down Keys** to specify **Calibrations**.
3) Press **Enter** to display its submenu.
4) Use the **Up** and **Down Keys** to specify **Calibrate**.
5) Select **TOC Calibrate** and press **Enter**. If the Analyzer is connected to an A-Net network on which other instruments reside, confirm that it is the correct instrument by verifying its serial number. The Analyzer will begin a temperature stabilization process, its duration depending on the sample water temperature. The actual time required is displayed and counted down.

**CAUTION:**
*Some instrument surfaces may be hot if the sample water is hot. Allow surfaces to cool before touching.*

**CAUTION:**
*In a networked environment (see “Network Installation” on page 39), it is important to confirm the instrument’s Serial Number before proceeding. Operation of the wrong Analyzer could result in water leakage from the sample vessel when it is removed during this procedure.*

**Note:**
*The Anatel A643a TOC Analyzer was designed to be calibrated by the user. Anatel provides pre-packaged reagents to assist the user in simplifying the calibration process and to easily comply with USP TOC Method <643>. If desired, reagents can be prepared by the user for use with the A643a TOC Analyzer. User-prepared reagents will not affect or alter the calibration of the instrument. User prepared standards can be introduced into the analyzer using a container/closure system that includes a 50 mL glass vial (VWR cat #16171341), a 20 mm teflon-coated stopper (VWR cat #16171561) and a 20 mm crimp-top aluminum seal (VWR cat #16171829). The user is responsible for the traceability and USP compliance of all reagents that are not pre-packaged.*

6) Press **Enter** to continue and wait while the sample line is drained. The remaining time is counted down on the display.
7) Specify the calibration standard levels to be performed. All three available ppb concentration levels are enabled by default, indicated by the checkmark (✓) preceding them. Disable any unwanted levels by pressing the **Up** and **Down Keys** to select the desired concentration, then pressing **Enter** to edit and **Up** and **Down** toggle it on and off. At least two levels must be selected, however.

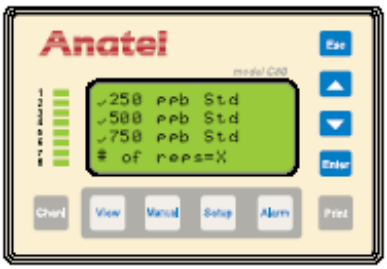


*Fig 6-2 :* Calibration Standard Criteria

**Note:**
*Calibration requires at least two* **Replicates** *at two levels of* **Standards**. *The concentration of* **Standards** *used should bracket the concentration of the samples to be analyzed. Three* **Standards** *with three Replicates each is recommended for the best accuracy of calibration.*

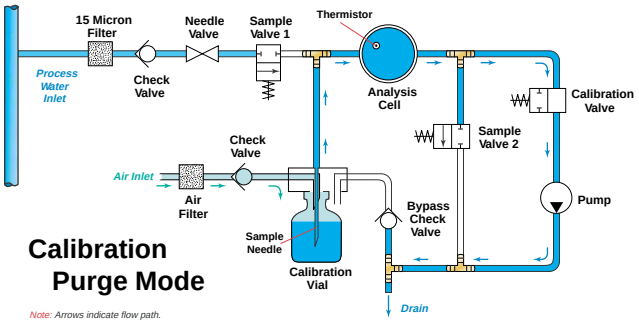


*Fig 6-3 :* Calibration Purge Mode

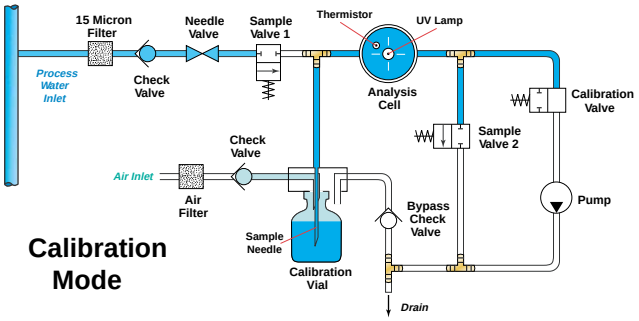


*Fig 6-4 :* Calibration Mode

8) After specifying a given ppb concentration level, press **Enter** to highlight the concentration value. Using the **Up** and **Down Keys**, enter the actual TOC value for the given standard concentration as it appears on the **Certificate of Analysis** and press **Enter** to select the final value. Repeat this procedure for all calibration standard levels selected.

9) Also highlight the **# of reps** and specify the number of replicates to be performed at each level. Press **Up** and **Down Keys** to toggle through the available selections (1–3). Typically, the more replicates, the more accurate the calibration results. With the desired number replicates displayed, press **Enter**.

10) Press **Enter**. The analyzer will asked if the “C of A” values have been entered. If not, press **Esc** to enter the “C of A” values: once they are properly entered, press **Enter** to continue.

11) If any changes must be made to the standard concentrations or the number of replicates, press **Esc** followed by **Enter** to abort the procedure. Immediately press **Enter** at the **TOC Calibrate Menu** to re-enter the **Standard Selection Menu**.

12) Remove the sample vessel and install the blank vial at the prompt. Press **Enter** and its contents are sampled and analyzed. The results of each of the analysis replicates are reported.

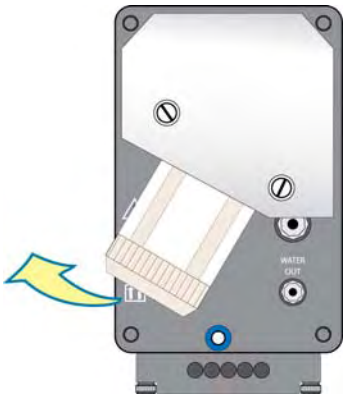

*Fig 6-5 :* Remove Instrument Vessel

**CAUTION:**

*Use extreme care when installing and removing the sample vessel and vials. Contact with the exposed needle could cause serious injury.*

13) Press **Enter** to view the average of the blank replicates, which establishes the reference for the calibration, then press it again to continue.

14) Remove the blank bottle and insert the requested standard (250, 500 or 750 ppb). Press **Enter** and its contents are sampled, analyzed and reported.

15) Repeat step 14 for each of the selected standard levels. The blank average is subtracted from each replicate and the results for each are displayed once all analyses have been completed. Note that only one blank is analyzed, not one blank per calibration level.

| |
|---|
| Blank=XX |
| 250 ppb Std=XXXX |
| 500 ppb Std=XXXX |
| Press Enter |

*Fig 6-6 :* Calibration Data

16) Press **Enter** to display the correlation coefficient. The instrument is suitable for measuring TOC in HPW if the slope change is within ±15% of the factory calibration.

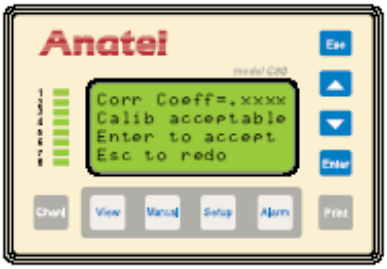


*Fig 6-7 :* TOC Calibration Results

17) Press **Enter** to accept the new calibration and initiate a printout of the data. If the percent change in the slope exceeds ±15% of factory calibration, the calibration is deemed “unacceptable.” A opportunity to repeat the calibration procedure using new sucrose standards will be given.

18) Once the calibration procedure is complete, remove the standard vial and reinstall the sample vessel before proceeding.

A printout or display of the calibration information also is available through the **Data History Menu** selection (see “Data History” on page 99).

ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

TOC Calibration
Passed on mm/dd/yy hh:mm

| Analyte | Replicates | Average |
|---|---|---|
| Blank | 011 012 013 | 012 ppb |
| 250 std | 251 252 253 | 252 ppb |
| 500 std | 501 502 503 | 502 ppb |
| 750 std | 751 752 753 | 752 ppb |

Correlation Coefficient = 0.9999
Calibration Accepted

*Fig 6-8 :* Sample TOC Calibration Printout

## 6.3 TOC Validation

The principles and procedure for performing a TOC validation are essentially the same as those used to perform a calibration. The intent of validation is to check the accuracy of the calibration, thereby ensuring that the Anatel A643a measures samples reliably. Validation can be either a single-point analysis or multipoint analysis and the standard concentrations are user-selected.

**Note:**
*Refer to Standard Operating Procedure (SOP) #643–5/5A for complete instructions on performing this procedure.*

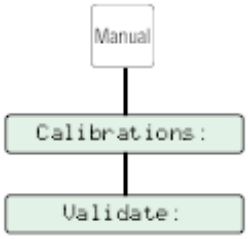


*Fig 6-9 :* TOC Validation

To perform a TOC validation:

1) With the desired Analyzer selected in any View, press the **Manual Key** to access its menu selections.
2) Use the **Up** and **Down Keys** to specify **Calibrations**.
3) Press **Enter** to display its submenu.

**CAUTION:**
*In a networked environment (see “Network Installation” on page 39), it is important to confirm the instrument’s Serial Number before proceeding. Operation of the wrong Analyzer could result in water leakage from the sample vessel when it is removed during this procedure.*

4) Use the **Up** and **Down Keys** to specify **Validate**. If the chosen Analyzer is connected to an A-Net network on which other instruments reside, the analyzer will prompt to confirm that it is the correct instrument by verifying its serial number. The Analyzer will begin a temperature stabilization process, its duration depending on the sample water temperature. The actual time required is displayed and counted down.
5) Press **Enter** to continue and wait while the sample line is drained.
6) Specify the validation standard levels to be performed. A 500 ppb TOC sucrose concentration level is enabled by default, indicated by the checkmark preceding it.

   Enable any other levels by pressing the **Up** and **Down Keys** to select the desired concentration, then pressing **Enter** to edit and **Up** and **Down** toggle the checkmark on and off. At least one validation level must be selected.

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**CAUTION:**
*Some instrument surfaces may be hot if the sample water is hot. Allow surfaces to cool before touching.*

7) After specifying a given ppb concentration level, press **Enter** to highlight the concentration value. Using the **Up** and **Down Keys**, enter the actual TOC value for the given standard concentration as it appears on the **Certificate of Analysis** and press **Enter** to select the final value. Repeat this procedure for all validation standard levels selected.

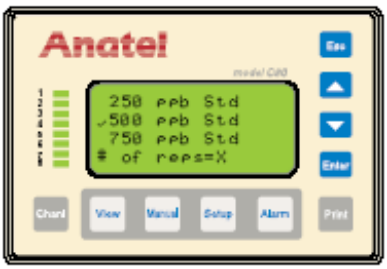


*Fig 6-10 :* Validation Standard Criteria

8) Also highlight the **# of reps** and specify the number of replicates to be performed at each level. Press **Up** and **Down Keys** to toggle through the available selections (1–3). Typically, the more replicates, the more accurate the validation results.
9) Press **Enter**. The analyzer will asked if the “C of A” values have been entered. If not, press **Esc** to enter the “C of A” values: once they are properly entered, press **Enter** to continue. Press Eagain to toggle through the available replicate selections (1–3). With the standard and number of replicates displayed, press **Enter**.
10) If any changes must be made to the standard concentrations or the number of replicates, press **Esc** followed by **Enter** to abort the procedure. Immediately press **Enter** at the **Validate Menu** to re-enter the **Standard Selection Menu** and continue with TOC validation.
11) Remove the empty sample vessel and insert the blank vial at the prompt. Press **Enter** and its contents are sampled and analyzed. The results of each of the analysis replicates are reported.

**CAUTION:**
*Use extreme care when installing and removing the sample vessel and vials. Contact with the exposed needle could cause serious injury.*

Rep #1 = xxx ppb
Rep #2 = xxx ppb
Rep #3 = xxx ppb
Press Enter

*Fig 6-11 :* Analysis Replicates

12) Press **Enter** to view the average of the blank replicates, which establishes the reference for the validation, then press it again to continue. Note that only one blank is analyzed, not one blank per validation level.

Blank ave=xxx

Press Enter

*Fig 6-12 :* Blank Average

13) Remove the blank bottle and insert the requested standard vial. Press **Enter** and its contents are sampled, analyzed and reported.

14) Repeat step 12 for each of the selected validation standard levels. The blank average is is analyzed only once during the validation process and is subtracted from each replicate average. The results for each are displayed once all analyses have been completed.

xxx ppb std
response=XXX ppb
deviation=XX%
Press Enter

*Fig 6-13 :* Analysis Results

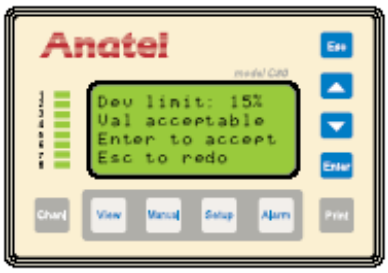


*Fig 6-14 :* TOC Validation Results

15) Press **Enter** three times. Each time **Enter** is pressed, the next validation level results are averaged then reported in the form of a **ppb response** and **deviation percentage**. The instrument passes the validation test if all responses have a deviation of less than 15% from the given standard value.

16) Press **Enter** again to accept the test results and initiate a printout of the data. If the response deviation exceeds ±15%, the corresponding results are displayed and the validation is deemed *"unacceptable."* The opportunity to repeat the validation procedure using a new sucrose standard will be given.

17) Once the validation procedure is complete, remove the standard vial and reinstall the sample vessel before proceeding.

A printout or display of this validation information also is available through the **Data History Menu** selection (see "Data History" on page 99).

ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

TOC Validation
Passed on mm/dd/yy hh:mm

| Analyte | Replicates | Average |
|---|---|---|
| Blank | 011 012 013 | 012 ppb |
| 500 std | 501 502 503 | 502 ppb |

Response = 490 ppb
Deviation = –2%

*Fig 6-15 :* Sample Single-Point TOC Validation Printout

ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

TOC Validation
Passed on mm/dd/yy hh:mm

| Analyte | Replicates | Average |
|---|---|---|
| Blank | 011 012 013 | 012 ppb |
| 250 std | 271 276 278 | 275 ppb |
| 500 std | 501 502 503 | 502 ppb |
| 750 std | 761 773 778 | 771 ppb |

250 ppb std response = 263 ppb
250 ppb std deviation = –1%
500 ppb std response = 490 ppb
500 ppb std deviation = –2%
750 ppb std response = 759 ppb
750 ppb std deviation = –1%

Deviation limit: 15%
Validation accepted

*Fig 6-16 :* Sample Three-Point TOC Validation Printout

## 6.4 Conductivity Calibration

Conductivity calibration provides a confirmation of the accuracy of the conductivity values reported by Anatel's on-line Total Organic Carbon instrumentation. The calibration consists of determining the instrument's meter accuracy by installing a NIST-traceable resistor and then verifying the cell constant by measuring a solution of known conductivity according to USP Method <645>. The instrument's meter accuracy must be within 0.1 µS/cm and its cell constant must be known to be within ±2%, therefore the conductivity solution measurement must be within ±2% of the reported label concentration.

**Note:**
*Refer to Standard Operating Procedure (SOP) #643–3 for complete instructions on performing this procedure.*

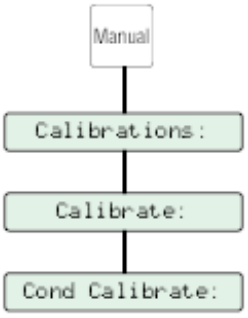


*Fig 6-17 :* Conductivity Calibration

To perform a conductivity calibration:

1) With the desired Analyzer selected in any View, press the **Manual Key** to access its menu selections.
2) Use the **Up** and **Down Keys** to specify **Calibrations**.
3) Press **Enter** to display its submenu.
4) Use the **Up** and **Down Keys** to specify **Calibrate**.

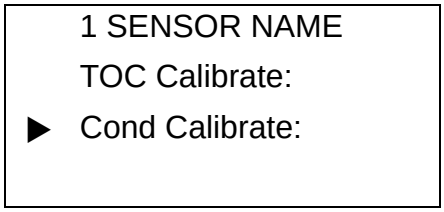


*Fig 6-18 :* Calibrate Menu

5) Select **Cond Calibrate** from the subsequent screen and press **Enter**. If the chosen Analyzer is connected to an A-Net network on which other instruments reside, the analyzer will prompt to confirm that it is the correct instrument by verifying its serial number.

**CAUTION:**
*In a networked environment (see "Network Installation" on page 39), it is important to confirm the instrument's Serial Number before proceeding. Operation of the wrong Analyzer could result in water leakage from the sample vessel when it is removed during this procedure.*

The Analyzer will begin a temperature stabilization process, its duration depending on the sample water temperature. The actual time required is displayed and counted down.

6) Press **Enter** to continue and wait while the sample line is drained.
7) Remove the shroud protecting the sample vessel by loosening the two screws that secure it.


*Fig 6-19 :* Remove Shroud

8) Insert the calibration resistor into the receptacle provided in the end lid until it firmly connects with the internal receptacle; two "clicks" indicate a tight electrical connection. The resistor should be fully inserted up to the second black band.
9) Press **Enter** to perform the meter test. The instrument measures the value of the calibration resistor and automatically multiplies it by the cell constant to obtain a result in µS/cm. The meter must be within ±0.1 µS/cm. If the meter fails, an opportunity to test it again will be given. A failure condition continues to be reported every 8 hours until the meter passes. Press **Enter** to proceed.

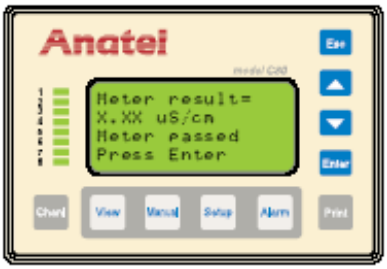


*Fig 6-20 :* Conductivity Meter Results

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10) Remove the resistor at the prompt. Also replace the shroud, tighten the screws fingertight to secure it and replace the protective plug. Specify the value of the conductivity standard found on the **Certificate of Analysis** and press **Enter**.

**CAUTION:**
*Some instrument surfaces may be hot if the sample water is hot. Allow surfaces to cool before touching.*

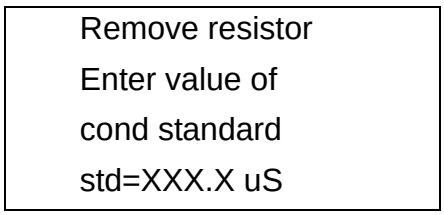


*Fig 6-21 :* Remove Resistor

11) Remove the sample vessel, insert the conductivity standard vial and press **Enter**.

**CAUTION:**
*Use extreme care when installing and removing the sample vessel and vials. Contact with the exposed needle could cause serious injury.*

12) Three replicates are run and the results are reported in **µS/cm**. The results are displayed once all analyses have been completed. The instrument passes the conductivity test if the deviation between the actual value of the solution and the measured result is less than ±5% from the previous calibration or ±10% from the factory calibration.

**Note:**
*USP Method <645> requires the cell constant be known to within ±2%. To ensure this is the case, the cell constant is adjusted to the value of the conductivity standard and, therefore, is always within ±2%. If the measured values are greater than ±10% of the original factory value, or ±5% of the previous calibration, an alarm message is displayed.*

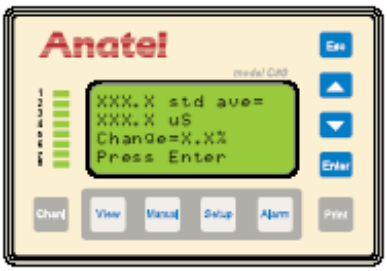


*Fig 6-22 :* Conductivity Calibration Results

13) Discard the results or press **Enter** to save the test results and initiate a printout of the data at the prompt. If the results exceed the test criteria, the calibration is *"unacceptable."* The opportunity to repeat the procedure using a new conductivity standard will be given.

14) Once the conductivity calibration procedure is complete, remove the standard vial and reinstall the sample vessel before proceeding.

A printout or display of this information also is available through the **Data History Menu** selection (see "Data History" on page 99).

ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

Conductivity Calibration
Passed on mm/dd/yy hh:mm

| Standard | Replicates | | | Average |
|---|---|---|---|---|
| 103 uS | 104 | 105 | 103 | 104 uS |

Meter = X.X uS/cm
Slope Change = x.x%
Slope Change Limits:
5% from previous calibration
10% from factory calibration
Calibration Accepted

*Fig 6-23 :* Sample Conductivity Calibration Printout

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## 6.5 System Suitability

System suitability provides a confirmation of the performance and efficiency of Anatel's on-line Total Organic Carbon instrumentation. The procedure compares the average of a series of TOC measurements from an easy-to-oxidize working standard (in the form of sucrose) to the average of a corresponding series of measurements of a hard-tooxidize system suitability solution (in the form of 1,4-benzoquinone). The response efficiency (RE) should be within 85% to 115%.

**Note:**
*Refer to Standard Operating Procedure (SOP) #643–2/2A for complete instructions on performing this procedure.*

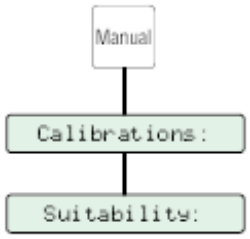


*Fig 6-24 :* System Suitability

To determine system suitability:

1) With the desired Analyzer selected in any View, press the **Manual Key** to access its menu selections.
2) Use the **Up** and **Down Keys** to specify Calibrations.
3) Press **Enter** to display its submenu.
4) Use the **Up** and **Down Keys** to specify **Suitability**. If the chosen Analyzer is connected to an A-Net network on which other instruments reside, the analyzer will prompt to confirm that it is the correct instrument by verifying its serial number. The Analyzer will begin a temperature stabilization process, its duration depending on the sample water temperature. The actual time required is displayed and counted down.

**CAUTION:**
*In a networked environment (see* "Network Installation" on page 39*), it is important to confirm the instrument's Serial Number before proceeding. Operation of the wrong Analyzer could result in water leakage from the sample vessel when it is removed during this procedure.*

5) Press **Enter** to continue and wait while the sample temperature stabilizes and the sample line is drained. Enter the certified sucrose and 1,4-benzoquinone standard values from the **Certificate of Analysis** in the System Suitability Kit at the prompt.
6) Press **Enter** to enable the Controller's Edit Mode and the flashing block cursor becomes an underscore.


*Fig 6-25 :* Certificate of Analysis Values

7) Use the **Up** and **Down Keys** to scroll until the sucrose standard value found on the **Certificate of Analysis** is displayed.

| |
|---|
| Enter “C of A" |
| values |
| 508 ppb sucrose |
| 500 ppb benz |

*Fig 6-26 :* Certificate of Analysis Displayed

8) Press **Enter** to retain the setting and the cursor advances to the 1,4-benzoquinone standard.
9) Again use the **Up** and **Down Keys** to enter the certified 1,4-benzoquinone standard value from the **Certificate of Analysis**, then press **Enter**.
10) Press **Enter** to confirm both **Certificate of Analysis** values have been properly entered.
11) Remove the empty sample vessel and insert the blank vial. Press **Enter** and its contents are sampled and analyzed. The results of each of the analysis replicates are reported.

**CAUTION:**
*Some instrument surfaces may be hot if the sample water is hot. Allow surfaces to cool before touching.*

**CAUTION:**
*Use extreme care when installing and removing the sample vessel and vials. Contact with the exposed needle could cause serious injury.*

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Rep #1 = xxx ppb
Rep #2 = xxx ppb
Rep #3 = xxx ppb
Press Enter

*Fig 6-27 :* Analysis Replicates

12) Press **Enter** to view the average of the blank replicates, which establishes the reference for the test, then press it again to continue.

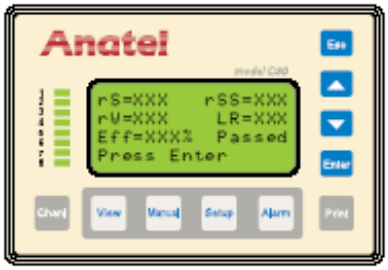


*Fig 6-28 :* System Suitability Results

13) Remove the blank bottle and insert the requested sucrose standard vial. Press **Enter** and its contents are sampled and analyzed. The sucrose replicates are displayed once all analyses have been completed. Press **Enter** to view the average of the sucrose replicates.

14) Press **Enter** and then remove the sucrose standard and install the 1,4-benzoquinone standard.

15) Press **Enter** to sample, analyze and then average the 1,4-benzoquinone standard. The 1,4-benzoquinone replicates are displayed once all analyses have been completed. Press **Enter** to view the average of the 1,4-benzoquinone replicates.

16) Press **Enter** and the results of the system suitability test are reported:

| | |
|---|---|
| $r_s$ | is the average TOC response for the sucrose standard C. |
| $r_{ss}$ | is the average TOC response for the 1,4-benzoquinone system suitability standard. |
| $r_w$ | is the average TOC response for the reagent blank. |
| LR | is the limit response of the instrument. |
| $R_E$ | is the TOC response efficiency of the Analyzer which is calculated by the formula: $100\ [(r_{ss} - r_w) / (r_s - r_w)]$ |

The instrument passes the system suitability test if the response efficiency is no less than 85% and no more than 115% of the limit response for the sucrose standard.

**Note:**
*Because the sucrose and 1,4-benzoquinone standards cannot be made to exactly 500 ppb, the reported sucrose and 1,4-benzoquinone responses are corrected with the Certificate of Analysis values as follows:*

$$\text{Corrected Response} = \text{Raw Response (ppbC)} \left(\frac{500}{\text{C of A Value}}\right)$$

17) Press **Enter** to save the test results and initiate a printout of the data. If the limit response exceeds the current TOC alarm limit, adjust the instrument's **Alarm Limit** to the calculated limit response. Press the appropriate key to continue.

Set TOC alarm
limit equal to
Limit Response
Enter=Yes Esc=No

*Fig 6-29 :* Adjust Alarm Limit

18) Once the system suitability procedure is complete, remove the standard vial and reinstall the sample vessel before proceeding.

A printout or display of this system suitability information also is available through the **Data History Menu** selection (see "Data History" on page 99).

ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

System Suitability Test
Passed on mm/dd/yy hh:mm

| Analyte | Replicates | Average |
|---|---|---|
| rW | 094 094 096 | 095 ppb |
| 508 rS | 533 547 553 | 544 ppb |
| 511 rSS | 545 563 565 | 558 ppb |

Limit response (rS–rW) = 449 ppb
Suitability resp (rSS–rW) = 463 ppb
Response efficiency = 103%
Efficiency Limit = 85% to 115%

*Fig 6-30 :* Sample System Suitability Printout

**CAUTION:**
*In the event of instrument failure, the sample discharge may contain 1,4-benzoquinone, which is a hazardous substance (refer to "Material Data Safety Sheets" on page 205).*

## 6.6 Data History

The results of Anatel A643a calibration and validation procedures are available for review or printout at any time through the **Data History Menu**.

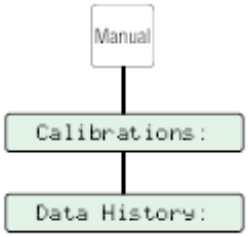


*Fig 6-31 :* Data History

To access saved data:

1) With the desired Analyzer selected in any View, press the **Manual Key** to access its menu selections.
2) Use the **Up** and **Down Keys** to specify **Calibrations**.
3) Press **Enter** to display its submenu.
4) Use the **Up** and **Down Keys** to specify **Data History** and press **Enter**.
5) Choose the desired test category (**Validation**, **System Suitability**, **TOC Calibration** or **Conductivity Calibration**) and the test type (**Last Accepted** or **Last Done**). Press **Enter** to display it.

**Note:**
*Data History screens and printouts are identical to those produced during the calibration/ validation; refer to the appropriate procedure in this Section.*

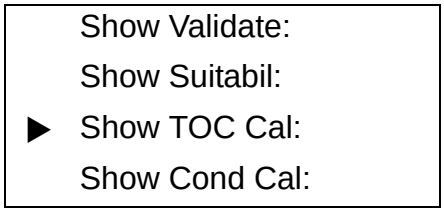


*Fig 6-32 :* Show TOC Cal

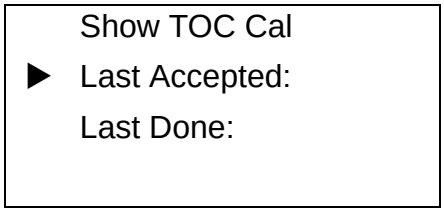


*Fig 6-33 :* Last Accepted

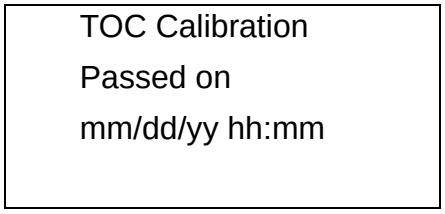


*Fig 6-34 :* Data History Screen

6) Press **Enter** repeatedly to display the average as well as the individual replicate results for each analysis, followed by the results of the test.
7) The option of printing the test data for the most recent or all (up to five) tests will be given. The last five test results for each test category are retained in the Anatel A643a's **Data History** regardless of whether they passed or failed. The **Last Accepted** test that passed also is saved.
8) Press **Esc** repeatedly to exit this function and return to the normal display.

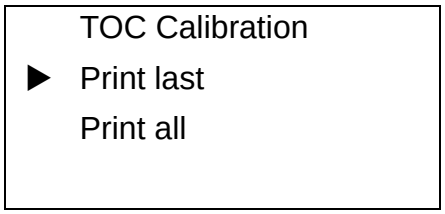


*Fig 6-35 :* Data History Print

# 7 Anatel A643a Alarms

## 7.1 General Information

An Analyzer's TOC level can be monitored for fluctuations, any excursion triggering an alarm condition. The alarm limit can be independently defined for each instrument.

The user is alerted to any TOC limit excursions on the C80 Controller by flashing its entire LCD display, as well as the affected instrument's Channel LED. When enabled, an audible beeper also sounds to provide additional warning. A hardcopy printout of the excursion is generated automatically and the Analyzer's **Digital Output #1** port may be used to transmit its alarm status to a compatible device (see "Digital Outputs" on page 142).

The Anatel A643a alarm reporting facility also is used to report any detected Analyzer problems such as a defective UV lamp or an excessively low sample temperature (see "Alarm Codes" on page 175). Summary data on any limit excursion or Analyzer alarms are displayed on the Controller by pressing the **Alarm Key**; detailed information is available on the printout.

## 7.2 Software Setup

There are two alarm variables which can be defined by the user. The Analyzer's **Alarm Setup** parameter specifies the level of the limit excursion that triggers an alarm condition. Beeper Setup enables and disables the Controller's audible alarm.

### 7.2.1 Alarm Setup

**Note:**
*Default: TOC Alarm/500 ppb*

The **Alarm Setup** parameter enables the alarm limits for the Anatel A643a and, in the case of a TOC alarm, defines the limit at which the indication is triggered.

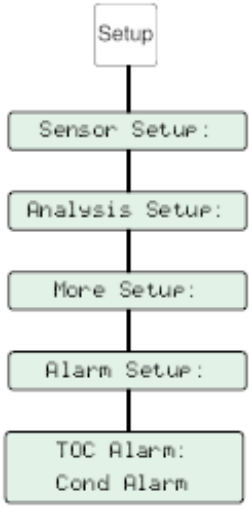


*Fig 7-1 :* Alarm Setup

To access the Analyzer's **Alarm Setup** parameters:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its menu selections.

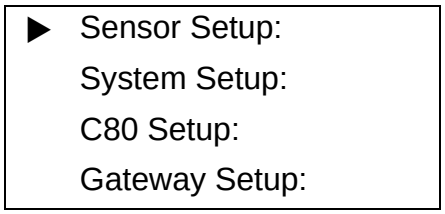


*Fig 7-2 :* Alarm Setup Menu

2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to display the **Sensor Setup Menu**.

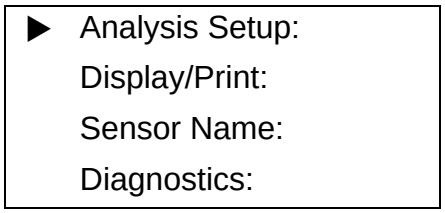


*Fig 7-3 :* Sensor Setup Menu

4) Similarly specify and select **Analysis Setup**.

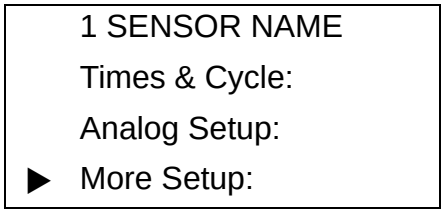


*Fig 7-4 :* Analysis Setup Menu

5) Specify and select **More Setup**.

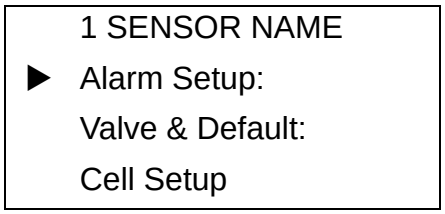


*Fig 7-5 :* More Setup Menu

6) Specify and select **Alarm Setup** to display its submenu.

```
1 SENSOR NAME
▶ TOC Alarm:
  Cond Alarm
```

*Fig 7-6 :* Alarm Setup Menu

| | |
|---|---|
| **TOC Alarm** | Triggers an alarm indication when the Analyzer's reported TOC reading exceeds its specified limit. |
| **Cond Alarm** | Triggers an alarm when the instrument's uncompensated conductivity exceeds the USP limit. |

**Note:**
*A Cond Alarm only appears if Uncompensated and Conductv both are checked in the* **Display Units Menu** *(see* "Display Units" on page 56*).*

7) Use the **Up** and **Down Keys** to choose the desired alarm type, indicated by an arrow.
8) Press **Enter** to toggle the **Cond Alarm** selection on (preceded by a checkmark) and off in order to enable and disable this type of alarm (see "Uncompensated Conductivity Alarms" on page 106). Enabling the **TOC Alarm** type causes the corresponding **TOC Alarm Limit** to be displayed.
9) Use the **Up** and **Down Keys** to specify which digit is to be changed.
10) Press **Enter** to enable the Controller's Edit Mode and the flashing block cursor becomes an underscore.

```
1 SENSOR NAME
TOC Alarm Limit
  0500 ppb
▲/▼ to change
```

*Fig 7-7 :* Change Alarm Limit

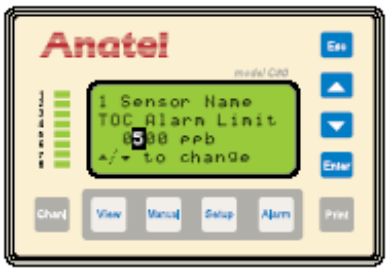


*Fig 7-8 :* TOC Alarm Limit Screen

11) Again use the **Up** and **Down Keys** to scroll until the desired value is displayed.
12) Press **Enter** to retain the pair's setting.
13) Repeat the editing process with the other pair of digits, if necessary, to specify the Analyzer's **TOC Alarm Limit** (**0000** to **1000 ppb**). Setting the **Limit** to **0000** disables the alarm.

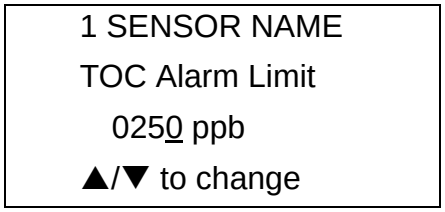


*Fig 7-9 :* Alarm Limit Changed

14) Press **Esc** repeatedly to exit this function and return to the normal display.

## 7.2.2 Beeper Setup

**Note:**
*Default: Enabled*

The **Beeper Setup** is a global parameter for sounding the Controller's audible alarm in the event of a TOC limit excursion by one of its connected instruments. The alarm continues to sound until acknowledged by pressing the **Alarm Key**.

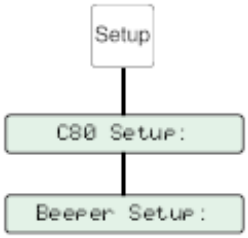


*Fig 7-10 :* Beeper Setup

To enable/disable the Controller's Beeper:

1) With any Channel View displayed, press the **Setup Key** and its menu selections are presented.
2) Use the **Up** and **Down Keys** to specify **C80 Setup**.

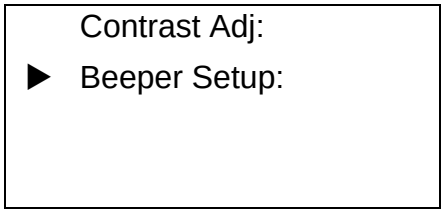


*Fig 7-11 :* Beeper Setup Menu

3) Press **Enter** to access its submenu.
4) Specify **Beeper Setup** and press **Enter** to display its parameter screen:

| | |
|---|---|
| **Enabled** | The Controller's audible alarm is triggered by a TOC limit excursion. |
| **Disabled** | The Controller's onboard alarm will not sound when any of its connected Analyzers experiences a TOC limit excursion. |

5) Specify the desired **Beeper Setup**, then press **Enter** to save the setting and exit the screen.


*Fig 7-12 :* C80 Alarm Beeper Screen

## 7.3 Alarm Reporting

The most common Anatel A643a fault condition is an Analyzer that measures a TOC value greater than its specified **TOC Alarm** setting (see "Alarm Setup" on page 101). There are several ways an alarm condition is reported:

- The associated Controller's LCD display flashes.
- The Analyzer's Channel LED flashes red.
- If enabled, the Controller beeps an audible alarm.
- If connected to a printer, a printout is generated documenting the fault. A **High TOC Alarm Warning** is reported on a separate line and includes the limit that was exceeded:

  High TOC Alarm: 560 ppb >[500 ppb]

- When connected, the signal at the Analyzer's *Digital Output #1* port is pulled low (see "Digital Outputs" on page 142).

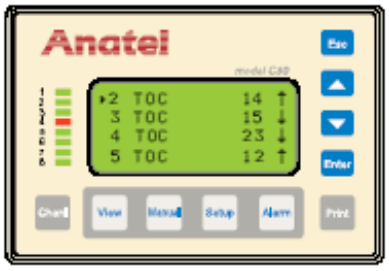


*Fig 7-13 :* Reported Sensor Alarm

In the example, the LED indicating the instrument on Channel #4 has changed from green to flashing red, indicating a TOC excursion. The user can acknowledge the alarm and display its summary status by pressing the AKey.

The Controller LCD also is used to display Analyzer malfunctions, reported as Codes (see “Alarm Codes” on page 175). Different than a limit excursion, a Code indicates an electromechanical or analytical failure. The Analyzer’s Channel LED and the Controller’s display still flash, but there is no audible alarm (regardless of the **Beeper Setup**) to alert the user that there is a problem.

### 7.3.1 Uncompensated Conductivity Alarms

Alarms are reported for conductivity excursions only in the Uncompensated Mode (see “Sensor Diagnostics” on page 182) and require that **Conductivity** and **Uncompensated** be selected in the **Display Units Menu**.

The actual (uncompensated) conductivity limits are in accordance with the specifications set forth in the method “<645> Water Conductivity” of the USP 25–NF 20 (January, 2002). These temperature-based limits are:

*Table 7-1 :* Temperature-based Conductivity Limits

| Temperature (°C) | Conductivity (µS/cm) | Temperature (°C) | Conductivity (µS/cm) |
|---|---|---|---|
| 0 | 0.6 | 55 | 2.1 |
| 5 | 0.8 | 60 | 2.2 |
| 10 | 0.9 | 65 | 2.4 |
| 15 | 1.0 | 70 | 2.5 |
| 20 | 1.1 | 75 | 2.7 |
| 25 | 1.3 | 80 | 2.7 |
| 30 | 1.4 | 85 | 2.7 |
| 35 | 1.5 | 90 | 2.7 |
| 40 | 1.7 | 95 | 2.9 |
| 45 | 1.8 | 100 | 3.1 |
| 50 | 1.9 | | |

The actual sample water temperature is rounded downward to the nearest 5° increment in order to establish the conductivity limit, thereby assuring any potential excursions are detected early. For example, if the measured water temperature is 24.5 °C, the 20 °C limit is applied and an alarm is generated if the conductivity exceeds 1.1 µS/cm.

To ensure agreement between all data outputs on the System, TOC, conductivity and temperature values are all rounded to match the Controller’s accuracy for alarm limit checking, display, printouts, and any digital outputs.

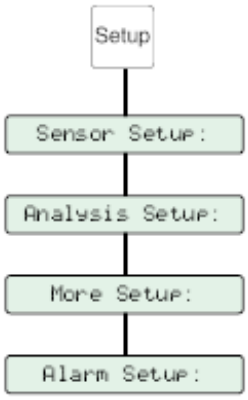


*Fig 7-14 :* Alarm Setup

To access an Anatel A643a's **Alarm Setup** parameters:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its menu selections.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to display the **Sensor Setup Menu**.
4) Similarly specify and select **Analysis Setup**.
5) Specify and select **More Setup**.
6) Specify and select **Alarm Setup** to display its submenu.

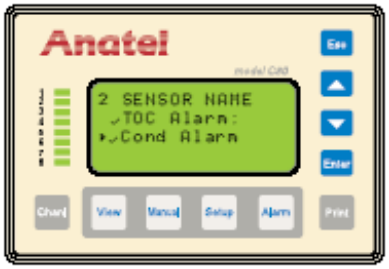


*Fig 7-15 :* Alarm Setup Menu

**Note:**
*The Cond Alarm parameter does not appear unless the display was set to both* **Conductv** *and* **Uncomp** *(see* "Display Units" on page 56*).*

7) Use the **Down Key** to select the **Cond Alarm** format for this Analyzer and press **Enter** to toggle the check mark "on," indicating that uncompensated conductivity alarm monitoring has been enabled.
8) Press **Esc** repeatedly to exit this function and return to the normal display.

In the Auto TOC mode, the alarm limit is checked at the end of each analysis cycle. In the Purge mode, the limit is checked every 15 seconds.

When the uncompensated limit is exceeded, an alarm is generated and several things occur:

- The LED corresponding to the Anatel A643a Analyzer's Channel ID flashes red on all of its associated C80 Controllers.
- The alarm is logged and becomes available for display on any of those Controllers.
- If the Analyzer is attached to a local or a Gateway printer, a hardcopy of the condition is generated containing the time of the excursion, the measured conductivity and temperature, and the USP conductivity limit exceeded. For example:

  12:07 Alarm 1.45 µS @ 33.2C >[1.4 @ 30C]

  Excursions reported in subsequent analyses are output only at the normal user-specified interval (or in response to a percent change in the readings) unless the sample water conductivity falls below the specified limit. In that case, a new alarm report is output to ensure that each limit excursion is recorded.
- The Sensor's **Digital Output #2** is asserted to allow alarm annunciation to an external device (see "Hardware Setup" on page 143).

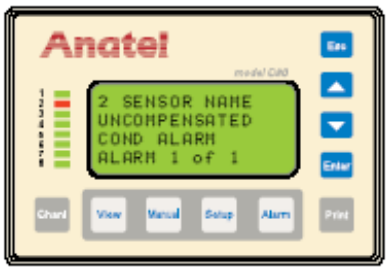


*Fig 7-16 :* Uncompensated Conductivity Alarm

## 7.4 Alarm Acknowledgement

A limit excursion is acknowledged by specifying the errant Analyzer and then pressing the **Alarm Key**. Acknowledgement stops the Controller's LCD from flashing, stops the flashing red Channel ID, and silences the audible warning. If more than one alarm has been detected, all must be acknowledged before these fault indications are terminated. The red Channel LED is restored to green when the Analyzer's TOC level falls below its set limit.

Acknowledgement presents the following alarm information on the Controller's LCD display:

| | |
|---|---|
| Line 1 | The affected instrument's Channel ID and its userentered **Name**. |
| Line 2 | The cause of the alarm. |
| Line 3 | The date and time the alarm was detected. |
| Line 4 | The current number of alarms logged for the displayed Analyzer. |

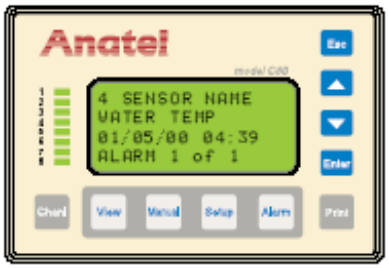


*Fig 7-17 :* Acknowledged Sensor Alarm

In the example, the message reports that the TOC level exceeded its specified alarm limit on Channel #4. In the event of multiple excursions, the date and the time each alarm was detected are displayed, as well as the total currently logged for the instrument.

Any additional (different) alarms for the Analyzer can be examined by pressing the **Up** and **Down Keys** to scroll through its log. Once displayed, Codes are erased but still available on the Analyzer's internal log (see "Internal Log" on page 114). The alarm status of the other Analyzers can be observed by pressing the **Alarm Key** repeatedly. If no fault conditions exist for a particular instrument, "No Codes" is reported.

The **Alarm Key** also is used to acknowledge Anatel A643a Codes. When an Analyzer problem is detected, it displays the following information:

| | |
|---|---|
| Line 1 | The affected instrument's Channel ID and its userentered **Name**. |
| Line 2 | The Code number representing the problem. |
| Line 3 | A brief message describing the nature of the alarm. |

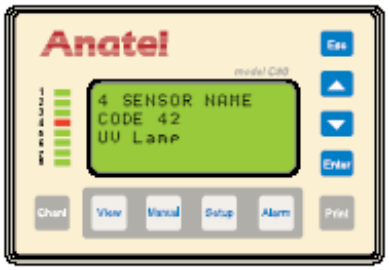


*Fig 7-18 :* Alarm Reporting

# 8 Printer Output

## 8.1 General Information

All Anatel A643a Analyzers are equipped with an output port for a local printer, although the 643a–P is already equipped with an integral printer. Automatic hardcopy reports are generated periodically, although printouts detailing individual Analyzer and global Network information can be produced on demand through the **Print Key**. This function also furnishes access to the Analyzer's data log permitting the contents to be printed or its memory erased.

## 8.2 Hardware Setup

Printer connections are made to the PRINTER Port on the Analyzer's Connector Block. This RS-232C interface communicates at 1200 baud, 8 data bits, 1 stop bit and no parity. Three- or five-conductor cable is adequate for most serial interfaces (AWG 24 is recommended), depending on the particular printer.

**CAUTION:**
*Always disconnect the instrument from its power source before attempting to access internal components.*

**Note:**
*When supplied by* Hach Ultra*, the local printer's interface cable is provided.*

Printer output connections are made on the Analyzer's I/O Connector Block as follows:

1) Turn the instrument OFF and disconnect the power cord from its source.
2) Remove the I/O Connector Block from the bottom of the Analyzer by loosening its four screws.
3) Loosen and remove the two screws that secure the metal strain relief plate.
4) Feed the interface wiring through one of the five holes at the end of the Connector Block cover and along the corresponding slot in the foam padding.

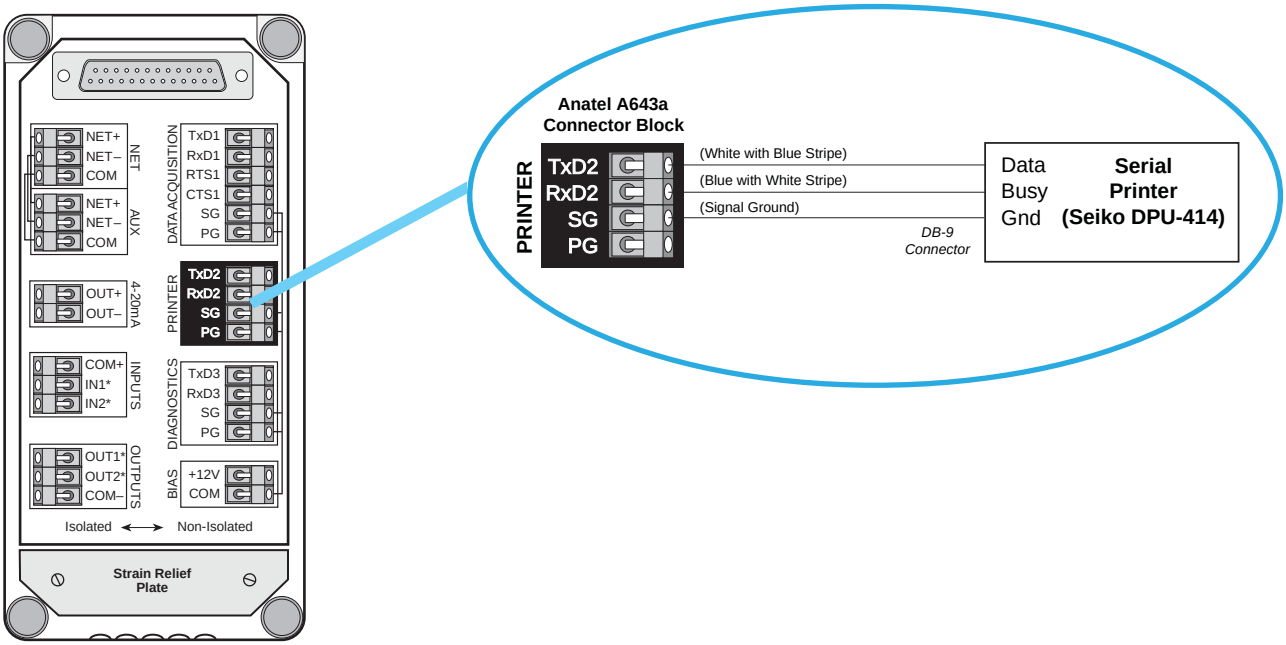


*Fig 8-1 :* External Printer Wiring

**Note:**
*The I/O Connector Block must be reinstalled correctly to conform to emissions specifications.*

5) Make the necessary serial connections to the Analyzer's PRINTER port as shown.
6) Replace the metal strain relief plate.
7) Replace the I/O Connector Block on the bottom of the Analyzer, taking care not to pinch any wires, and secure it in place by tightening the screws.
8) Reconnect power and turn the Analyzer **ON**.

When using the Seiko Instruments Inc. DPU-414 Type II Thermal Printer, the electronic DIP switches are preset at the factory as follows:

*Table 8-1 :* Preset DIP Switches

| **DIP Switch 1** | | |
|---|---|---|
| Switch | Setting | Function |
| 1 | Off | Serial Input |
| 2 | On | High Print Speed |
| 3 | On | Autoloading Enabled |
| 4 | Off | Auto Linefeed Disabled |
| 5 | On | Enabled Setting |
| 6 | Off | Print Density (100%) |
| 7 | On | Print Density (100%) |
| 8 | On | Print Density (100%) |

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*Table 8-1 :* Preset DIP Switches (Continued)

| **DIP Switch 2** | | |
|---|---|---|
| Switch | Setting | Function |
| 1 | On | 40-Column Printing |
| 2 | On | Backup Font Enabled |
| 3 | On | Normal Characters |
| 4 | Off | Zero = Slash |
| 5 | On | International Character Set = USA |
| 6 | On | International Character Set = USA |
| 7 | On | International Character Set = USA |
| 8 | Off | International Character Set = USA |
| **DIP Switch 3** | | |
| Switch | Setting | Function |
| 1 | On | 8 Data Bits |
| 2 | On | No Parity Setting |
| 3 | Off | Even Parity |
| 4 | On | Flow Control (XON/XOFF) |
| 5 | On | 1200 Baud |
| 6 | Off | 1200 Baud |
| 7 | On | 1200 Baud |
| 8 | Off | 1200 Baud |

To change any of these settings:

1) Turn the printer power switch **OFF**.
2) Restore power while pressing the **ONLINE** button. Release the button when a printout of the current settings begins.
3) Push the **ONLINE** button once again and **DIP SW1** is printed, prompting for changes on switches 1–8.
4) Enter the settings for **DIP Switch 1** by pressing **ONLINE** for **On** (enabled) and **FEED** for **Off** (disabled) for each of the switches 1–8 in succession. The **ONLINE** LED illuminates to indicate an “On” entry: the **OFFLINE** LED correspondingly indicates an “Off” entry.

**Note:**
*Be sure to enter a setting for all eight switches because this setup mode cannot be cancelled once initiated.*

5) Once all eight of the switches have been set, a printout prompts whether to “Continue” to repeat the procedure for **DIP Switch 2** and then **DIP Switch 3**, or “Write” the current settings to memory. Once saved, a printout is generated and the printer returns to normal operation.

**CAUTION:**
*Do not turn the printer off while it is saving settings—wait until* **Dip SW setting complete!** *is printed before removing power.*

## 8.3 Software Setup

Hard copies of Analyzer data can be produced on demand and other print-related operations can be performed. The available print options include the following functions:

- The ability to print and examine the Analyzer’s internal log.
- The capacity to print comprehensive Analyzer setup and factory configuration parameters.

### 8.3.1 Internal Log

**Note:**
*Default: Data & Audit*

Each Anatel A643a Analyzer’s onboard log protects against data loss by chronologically recording any events. An **Audit Only** selection in the **Log Setup Menu** records power cycles, alarm codes and parameter changes. The default setting of **Data & Audit** also stores analysis results and Purge Mode data. In either case, all events are time-stamped and the log is only updated when information is sent to the printer. Any parameter changes have an additional line containing the date and identifying the person who made the instrument change.

The log also tracks the Analyzer’s available memory. The amount of data stored in the log depends on the **Log Setup** as well as the instrument’s **TOC Print** (see “Auto TOC Printout” on page 69) and **Purge Print** (see “Purge Printouts” on page 72) settings. For example, with **Data & Audit** selected and sampling at one-minute intervals in the Purge Mode, the log will retain approximately two and a half days worth of information before it begins writing over the earliest data recorded; sampling every six minutes would hold about 16 days of data. With **Audit Only** selected and few changes made to the instrument, the log will store information for an indefinite period.

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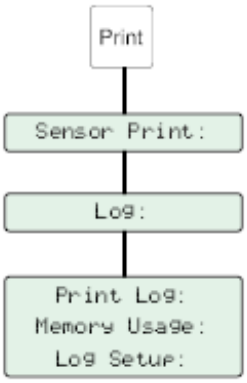



*Fig 8-2 :* Log Setup

To access **Log** information:

1) With the desired Analyzer selected in any View, press the **Print Key** to access its submenu.
2) Select **Sensor Print** and then press **Enter** to display that menu.
3) Use the **Up** and **Down Keys** to specify **Log**.
4) Press **Enter** to display the available options:

| | |
|---|---|
| **Print Log** | Generates a printout of all the data currently stored in the Analyzer's memory. **Print All** outputs all records: **Print Range** outputs only those records over a certain period of a specified time. |
| **Memory Usage** | Estimates the percentage of the Analyzer's memory log occupied by data. |
| **Log Setup** | Specifies the amount of information stored in the log. Data & Audit also includes all TOC analysis and Purge Mode data: Audit Only records only instrument events. |

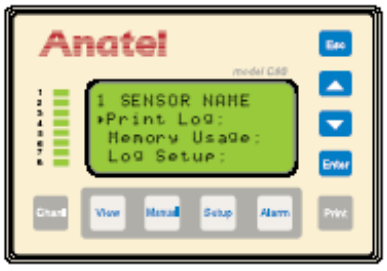



*Fig 8-3 :* Log Screen

5) Use the **Up** and **Down Keys** to specify the desired Log function.
6) Press Eto perform the specified function.

If a **Print Range** has been specified, there may a slight delay before the default **Range** is displayed, depending on how full the data log is. During this delay, **??** is displayed in **Range** fields. If no data records are contained in the log over the specified range, zeros are displayed in the **Range** fields and no data will be printed. Once the default **Print Range** is displayed, the block cursor begins flashing to indicate that the span can be altered.

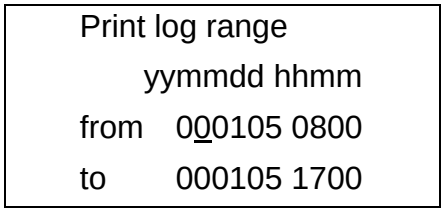
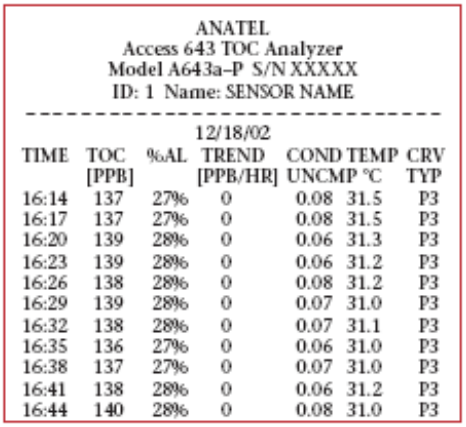



*Fig 8-4 :* Print Range

**Note:**
*The Print Range function is inactive when the Log Setup selection is set to "Audit Only."*



ANATEL
Access 643 TOC Analyzer
Model A643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

12/18/02

| TIME | TOC [PPB] | %AL | TREND [PPB/HR] | COND UNCMP | TEMP °C | CRV TYP |
|---|---|---|---|---|---|---|
| 16:14 | 137 | 27% | 0 | 0.08 | 31.5 | P3 |
| 16:17 | 137 | 27% | 0 | 0.08 | 31.5 | P3 |
| 16:20 | 139 | 28% | 0 | 0.06 | 31.3 | P3 |
| 16:23 | 139 | 28% | 0 | 0.06 | 31.2 | P3 |
| 16:26 | 138 | 28% | 0 | 0.08 | 31.2 | P3 |
| 16:29 | 139 | 28% | 0 | 0.07 | 31.0 | P3 |
| 16:32 | 138 | 28% | 0 | 0.07 | 31.1 | P3 |
| 16:35 | 136 | 27% | 0 | 0.06 | 31.0 | P3 |
| 16:38 | 137 | 27% | 0 | 0.07 | 31.0 | P3 |
| 16:41 | 138 | 28% | 0 | 0.06 | 31.2 | P3 |
| 16:44 | 140 | 28% | 0 | 0.08 | 31.0 | P3 |

*Fig 8-5 :* Sample Log Printout

7) Press **Enter** to enable the Controller's Edit Mode and the flashing block cursor becomes an underscore, indicating the year which starts the "from" date. The year must be between 1990 and 2050, inclusive. The year (yy) is interpreted as 20XX (2005, for instance) if it is less than 90; otherwise, it is treated as 19XX (such as 1998). The default **Range** includes the time span from the first to the last logged record.
8) Use the **Up** and **Down Keys** to scroll to the appropriate year and press **Enter** to advance to the month field.
9) Similarly specify the month and press **Enter**.
10) Repeat the procedure with the hour and minute settings, then specify the corresponding "to" date and time.
11) With the desired Range displayed in the "from" and "to" fields, press **Esc** and the logged records are output to the printer. The ongoing progress of the printout is displayed as a percentage.
12) Press **Esc** to exit this function and return to the **Log Menu**.

13) To change the **Log Setup** to include or exclude analysis and purge data, scroll down to that function and press **Enter**.

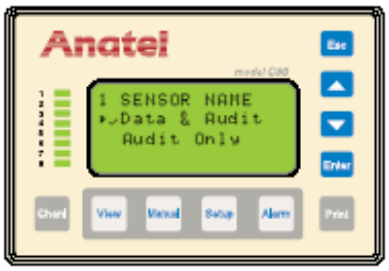



*Fig 8-6 :* Log Setup Screen

14) Use the **Up** and **Down Keys** to scroll to the appropriate selection and press **Enter**.

15) Press **Esc** repeatedly to exit this function and return to the normal display.

### 8.3.2 Printouts

The **Printouts** option provides detailed setup information on the individual instruments. These two hardcopy outputs list all of the Analyzer's operational parameters and its factory configuration parameters.

To generate **Printouts** of this parameter information:

1) With the desired Analyzer specified in any View, press the **Print Key** to access its menu.

2) Use the **Up** and **Down Keys** to select Sensor Print and then press **Enter**.

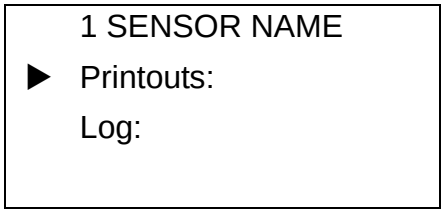



*Fig 8-7 :* Sensor Print

3) Specify **Printouts** and press **Enter** to display the available options:

| | |
|---|---|
| **Print Setup** | Generates a hard copy of all the Analyzer's current user-defined parameters. |
| **Print Factory** | Outputs a copy of the instrument's factoryprogrammed parameters. These values facilitate Analyzer service and cannot be changed by the user. The Controller display also reports the firmware Version, its time and date. |
| **Print Cal/Suit** | Outputs a copy of all the instrument's stored data histories. Individual Cal/Suit histories can be obtained through Data Histories (see "Data History" on page 99) and sample printouts may be found: |

| | |
|---|---|
| TOC Printout | “TOC Calibration” on page 82 |
| TOC Validation | “TOC Validation” on page 87 |
| Conductivity Calibration | “Conductivity Calibration” on page 91 |
| System Suitability | “System Suitability” on page 95 |

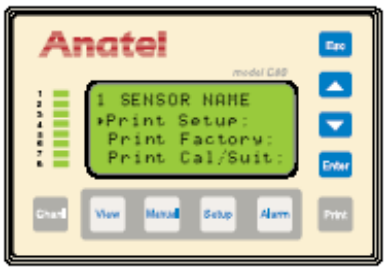
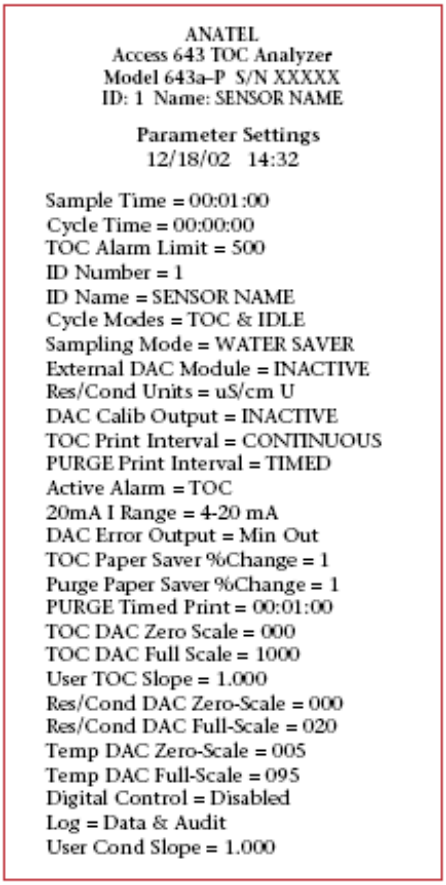



*Fig 8-8 :* Printouts Screen

4) Use the **Up** and **Down Keys** to specify the desired **Printout** function.
5) Press **Enter** to generate the specified output. The information in both **Printouts** is preceded by the following Analyzer-specific header data:

   Model
   Serial Number
   Channel ID Number
   User-entered Name
   Current Date and Time

6) Press **Esc** repeatedly to exit this function and return to the normal display.

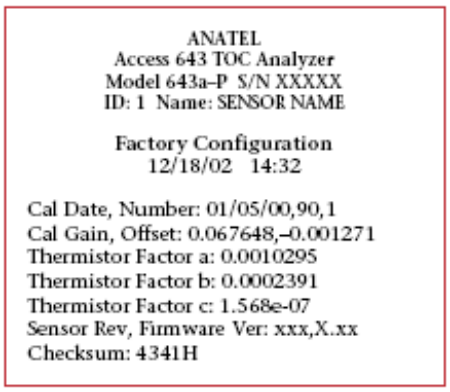


ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

Parameter Settings
12/18/02 14:32

Sample Time = 00:01:00
Cycle Time = 00:00:00
TOC Alarm Limit = 500
ID Number = 1
ID Name = SENSOR NAME
Cycle Modes = TOC & IDLE
Sampling Mode = WATER SAVER
External DAC Module = INACTIVE
Res/Cond Units = uS/cm U
DAC Calib Output = INACTIVE
TOC Print Interval = CONTINUOUS
PURGE Print Interval = TIMED
Active Alarm = TOC
20mA I Range = 4-20 mA
DAC Error Output = Min Out
TOC Paper Saver %Change = 1
Purge Paper Saver %Change = 1
PURGE Timed Print = 00:01:00
TOC DAC Zero Scale = 000
TOC DAC Full Scale = 1000
User TOC Slope = 1.000
Res/Cond DAC Zero-Scale = 000
Res/Cond DAC Full-Scale = 020
Temp DAC Zero-Scale = 005
Temp DAC Full-Scale = 095
Digital Control = Disabled
Log = Data & Audit
User Cond Slope = 1.000

*Fig 8-9 :* Setup Printout



ANATEL
Access 643 TOC Analyzer
Model 643a–P S/N XXXXX
ID: 1 Name: SENSOR NAME

Factory Configuration
12/18/02 14:32

Cal Date, Number: 01/05/00,90,1
Cal Gain, Offset: 0.067648,–0.001271
Thermistor Factor a: 0.0010295
Thermistor Factor b: 0.0002391
Thermistor Factor c: 1.568e-07
Sensor Rev, Firmware Ver: xxx,X.xx
Checksum: 4341H

*Fig 8-10 :* Factory Printout

# 9 Analog Outputs

## 9.1 General Information

Anatel A643a Analyzers provide two methods for outputting signals to external analog devices. The first offers TOC data through the dedicated 4–20 mA port located on the instrument's Connector Block; the second outputs conductivity (or resistivity) and/or temperature data to optional External DAC (Digitalto-Analog Conversion) Modules via the Analyzer's DIAGNOSTICS port. The output from the DAC Module is a 4-20 or a 0-20 mA signal which then can be used by a variety of compatible analog devices.

This section describes how to establish hardware connections for the standard TOC output and the optional External DAC output as well as how to set the necessary operational parameters for each.

## 9.2 TOC Output

As noted, an analog signal corresponding to the Analyzer's TOC reading is always available via its 4-20 mA port. This current output may be converted to a voltage if desired by inserting a conversion resistor into the wiring scheme.

Software settings determine the analog output range in addition to its corresponding zero-scale and fullscale values. A user-specified signal also may be output to designate Anatel A643a Analyzer alarms.

### 9.2.1 Hardware Setup

The Analyzer can generate an isolated current output ranging from 4-20 or 0-20 mA that is proportional to its most recent TOC reading. This analog output drives resistances between 50 and 500 ohms, including the interconnecting cables. The signal can be converted to a voltage output by incorporating an appropriate conversion resistor:

*Table 9-1 :* Conversion Reistors

| Resistor | 4–20 mA DC Voltage Range | 0–20 mA DC Voltage Range |
|---|---|---|
| 50Ω | 0.2–1 VDC | 0–1 VDC |
| 250Ω | 1–5 VDC | 0–5 VDC |
| 500Ω | 2–10 VDC | 0–10 VDC |

Note that the precision of the resistor directly affects the accuracy of the data. A 1% wirewound resistor or better is recommended. For maximum data integrity, the resistor should be mounted across the receiving device's input terminals.

TOC Analog output connections are made to the Analyzer's I/O Connector Block as follows:

**CAUTION:**
*Always disconnect the instrument from its power source before attempting to access internal components.*

1) Turn the Anatel A643a Analyzer **OFF** and disconnect the power cord from its source.
2) Remove the I/O Connector Block from the bottom of the Analyzer by loosening its four screws.
3) Loosen and remove the two screws that secure the metal strain relief.
4) Feed the interface wiring through one of the five holes at the end of the Connector Block cover and along the corresponding slot in the foam padding.
5) Make the necessary positive and ground connections to the Analyzer's 4-20mA terminals.
6) Replace the metal strain relief plate.
7) Replace the I/O Connector Block on the bottom of the Analyzer, taking care not to pinch any wires, and secure it in place by tightening the screws.
8) Reconnect power and turn the Analyzer **ON**.

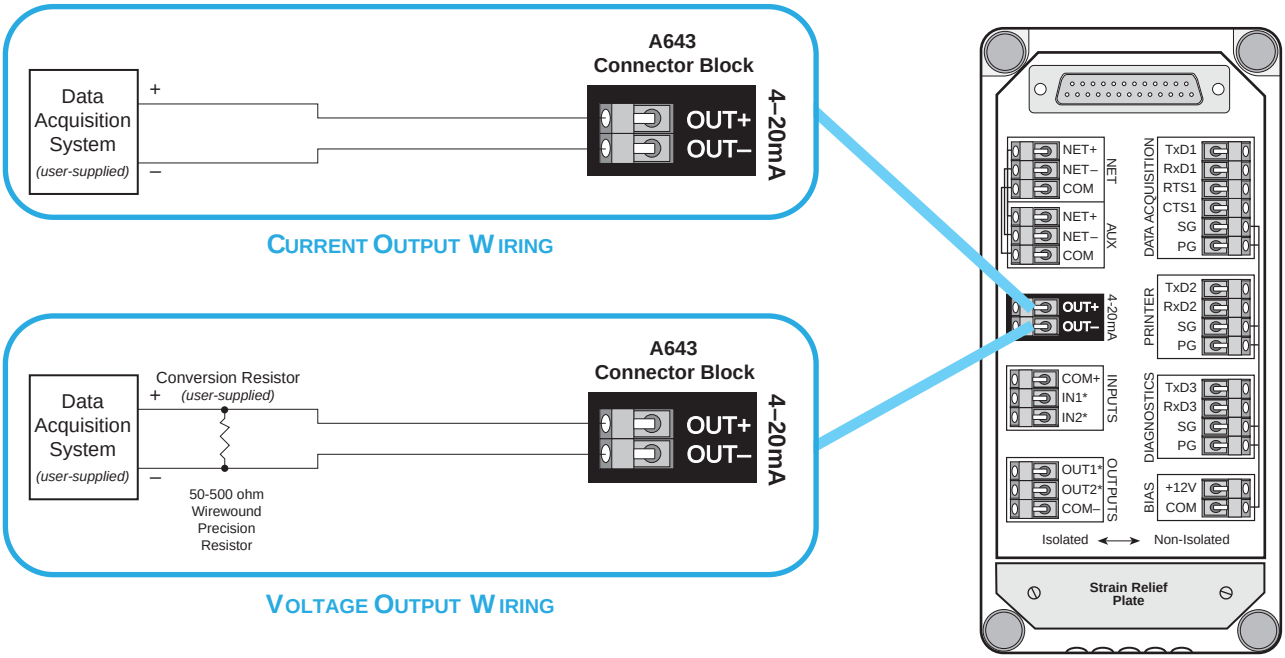



*Fig 9-1 :* Current and Voltage Output Wiring

**Note:**
*The I/O Connector Block must be reinstalled correctly to conform to emissions specifications.*

### 9.2.2 Software Setup

The analog signal generated at the conclusion of an analysis cycle is calculated based on the sample's reading and represents TOC in ppb. The transmitted signal remains constant until the next analysis cycle is complete. If a critical problem is encountered during a TOC analysis, the analog output goes to a pre-defined state. Setting the TOC output consists of:

1) Specifying the analog output range.
2) Defining the associated zero-scale and full-scale values that establish the resolution of that signal.
3) Establishing the signal that is to be output in the event of an Anatel A643a alarm.
4) Activating the DAC Calibration Output, if desired.

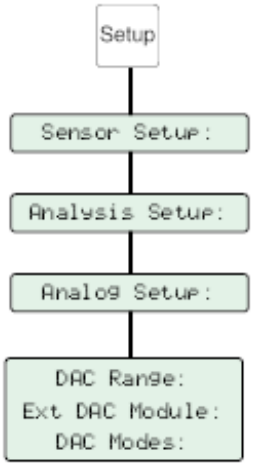



*Fig 9-2 :* Analog Setup

All of the Anatel A643a's analog parameters are defined through its **Analog Setup Menu**:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its submenu.

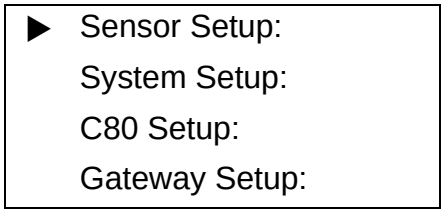



*Fig 9-3 :* Setup Menu

2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to display the **Sensor Setup Menu**.

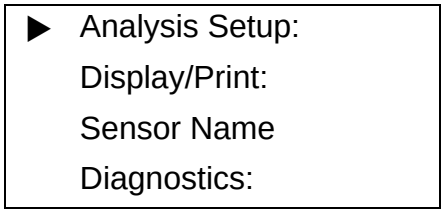



*Fig 9-4 :* Sensor Setup Menu

4) Specify **Analysis Setup** and then press **Enter** to access its submenu.
5) Specify **Analog Setup** and press **Enter** to display its parameter options.

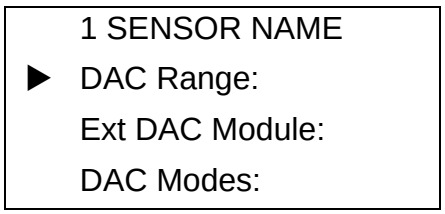



*Fig 9-5 :* Analog Setup

| | |
|---|---|
| **DAC Range** | Sets the Analyzer's internal, and external, analog output range as 4-20 mA or 0–20 mA (see "Analog Output Range" on page 125). The limits of this range correspond to the zero-scale and full-scale values entered for TOC, conductivity or resistivity, and temperature ("TOC Output Range" on page 126). |
| **Ext DAC Module** | Enables the output to an External DAC Module ("Optional Conductivity/Resistivity & Temperature Outputs" on page 129). |
| **DAC Modes** | Allows access to the DAC Error Output and DAC Calibration Output settings ("DAC Error Output" on page 128). |

#### 9.2.2.1 DAC Range Settings

The **DAC Range Menu** provides access to the Analyzer's analog output range as well as its zero-scale and full-scale settings.

To display the **DAC Range Menu**:

1) With the Analog Setup Menu displayed, specify **DAC Range** and then press **Enter** to display its available menu selections.

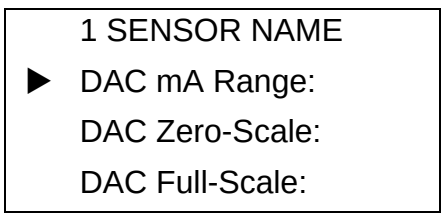



*Fig 9-6 :* DAC Range Menu

#### 9.2.2.2 Analog Output Range

**Note:**
*Default: 4 to 20 mA*

The **DAC mA Range** internally defines the span (4 to 20 or 0 to 20 mA) of the analog output that is presented at the Anatel A643a's 4–20 mA port. The lower and upper limits of the chosen range correspond to the **Zero-Scale** and **Full-Scale TOC** values.

To set the Analyzer's **mA Range**:

1) With the **DAC Range Menu** displayed, specify **DAC mA Range** and press **Enter** to display its parameters screen.

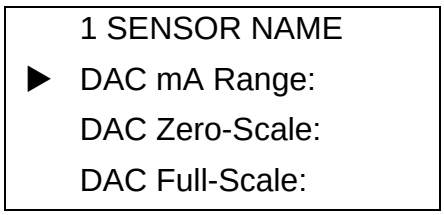



*Fig 9-7 :* DAC Range Menu

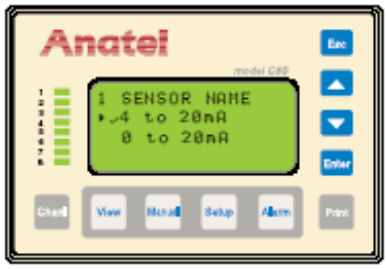



*Fig 9-8 :* mA Range Screen

2) Use the **Up** and **Down Keys** to select the desired analog output range.
3) Press **Enter** to enable the **DAC mA Range** selection.
4) Press **Esc** to return to the **DAC Range Menu**.

**Note:**
*The chosen analog output range must match the range on the connected device for proper reporting.*

### 9.2.2.3 TOC Output Range

**Note:**
*Defaults: Zero-Scale – 0000 ppb*
*Full-Scale – 1000 ppb*

These settings define the lower and upper ppb limits proportional to the **DAC mA Range** setting. The analog signal generated at the conclusion of each analysis is converted to a scaled TOC value for display and reporting purposes.

To set the TOC output range:

1) With the **DAC Range Menu** displayed, use the **Up** and **Down Keys** to specify **DAC Zero-Scale**.

```
  1 SENSOR NAME
  DAC mA Range:
▶ DAC Zero-Scale:
  DAC Full-Scale:
```

*Fig 9-9 :* DAC Range Menu

2) Press **Enter** to display its menu selections.
3) Specify **TOC DAC** and press **Enter** to display its zeroscale parameter screen. The flashing block cursor highlights the first pair of digits.

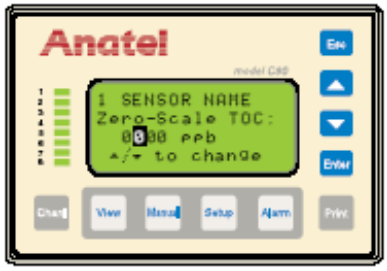



*Fig 9-10 :* Zero-Scale TOC Screen

4) Use the **Up** and **Down Keys** to specify the pair of digits to be changed.
5) Press **Enter** to enable the Controller's Edit Mode and the flashing block becomes an underscore.

```
  1 SENSOR NAME
  Zero-Scale TOC:
    0000 ppb
  ▲/▼ to change
```

*Fig 9-11 :* Zero-Scale TOC Menu

6) Again use the **Up** and **Down Keys** to scroll the pair until the desired value is displayed.
7) Press the **Esc Key** to retain the setting.
8) Repeat the editing process with the other pair of digits if necessary to display the desired value.

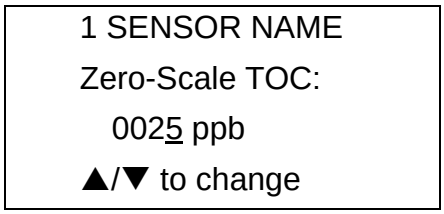



*Fig 9-12 :* Zero-Scale TOC Data

9) Press **Esc** twice to retain the **Zero-Scale TOC** setting and return to the **DAC Range Menu**.
10) Select **DAC Full-Scale** and press **Enter**.

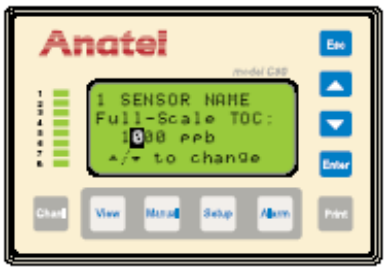



*Fig 9-13 :* Full-Scale TOC Screen

**Note:**
*The* **Full-Scale TOC** *value must be greater than the Zero-Scale TOC value.*

11) Specify **TOC DAC** once again and then press E to display its full-scale parameter screen. The flashing block cursor highlights the first pair of digits.
12) Use the same procedure as that described in step 4 through step 9 to specify the **Full-Scale TOC** value and return to the **DAC Range Menu**.

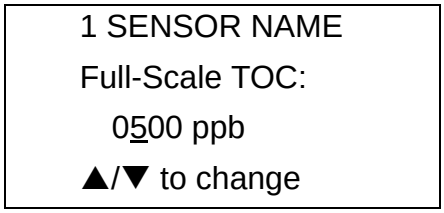



*Fig 9-14 :* Full-Scale TOC Data

#### 9.2.2.4 DAC Error Output

**Note:**
*Default: Minimum Output*

The user may select from among three states to be output when a condition is encountered which causes the Anatel A643a to abort its current analysis. This fixed signal is global for all analog outputs and can be used externally to report an alarm condition.

**Note:**
*In the Calibrate mode, the analog output reflects on-line values. A zero-scale analog output indicates the instrument is off-line; a full-scale output indicates an error condition.*

To specify the **DAC Error Output**:

1) With the Analyzer's **Analog Setup Menu** displayed, use the **Up** and **Down Keys** to specify **DAC Modes**.
2) Select **DAC Err Output** and press **Enter** to display its parameter screen.

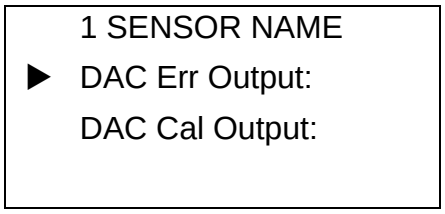



*Fig 9-15 :* DAC Error Output Menu

3) Use the **Up** and **Down Keys** to specify the desired setting:

| | |
|---|---|
| **Minimum Output** | Transmits the Analyzer's corresponding Zero-Scale TOC value. |
| **Last Output** | Transmits the Analyzer's last reading. |
| **Maximum Output** | Transmits the Analyzer's corresponding Full-Scale TOC value. |

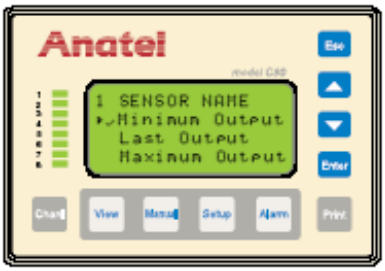



*Fig 9-16 :* DAC Error Output Screen

4) Press **Esc** to return to the **DAC Modes Menu**. Select **DAC Cal Output** to enable that feature, if desired. When "Active," an analog signal proportional to each analysis result is sent to an external DAC Module during calibration.

5) Press **Esc** repeatedly to exit this function and return to the normal display.

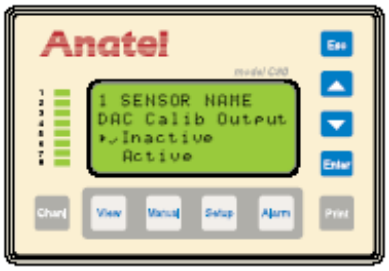



*Fig 9-17 :* DAC Calibration Output Screen

## 9.3 Optional Conductivity/Resistivity & Temperature Outputs

**Note:**
*Resistivity DAC: P/N FG2006702*
*Temperature DAC: P/N FG2006802*

The necessity for an analog output to report the Anatel A643a's conductivity (or resistivity) and temperature values is addressed through external Digital-to-Analog Converter (DAC) Modules. A separate DAC Module is required for each desired analog output. Anatel supplies pre-programmed, prewired DAC Modules to forward this processed information to a data acquisition system, remote meter or other analog input device. Software setup of the External DAC Module includes enabling the Analyzer output, defining its range as well as its zeroscale and full-scale values, and the signal that is to be output in the event of an alarm.

### 9.3.1 Hardware Setup

**Note:**
*Refer to the manufacturer's manual for complete instructions on installing and using external DAC Modules.*

External DAC Modules are connected to the Anatel A643a at its DIAGNOSTICS Port. This RS232C serial interface communicates at 1200 baud, 8 data bits, 1 stop bit and no parity. Three- or five-conductor cable is adequate for this analog interface (AWG 24 is recommended). Two DAC Modules can be daisychained to obtain both conductivity (or resistivity) and temperature data and can be positioned up to 50 feet from the associated Analyzer. Anatel provides five feet of cabling.

**CAUTION:**
*Always disconnect the instrument from its power source before attempting to access internal components.*

These auxiliary analog connections are made on the Analyzer's I/O Connector Block as follows:

1) Turn the Anatel A643a Analyzer **OFF** and disconnect the power cord from its source.
2) Remove the I/O Connector Block from the bottom of the Analyzer by loosening its four screws.
3) Loosen and remove the two screws that secure the metal strain relief plate.
4) Feed the Module wiring through one of the five holes at the end of the Connector Block cover and along the corresponding slot in the foam padding.
5) Make the necessary connections to the Analyzer's DIAGNOSTICS port as shown.

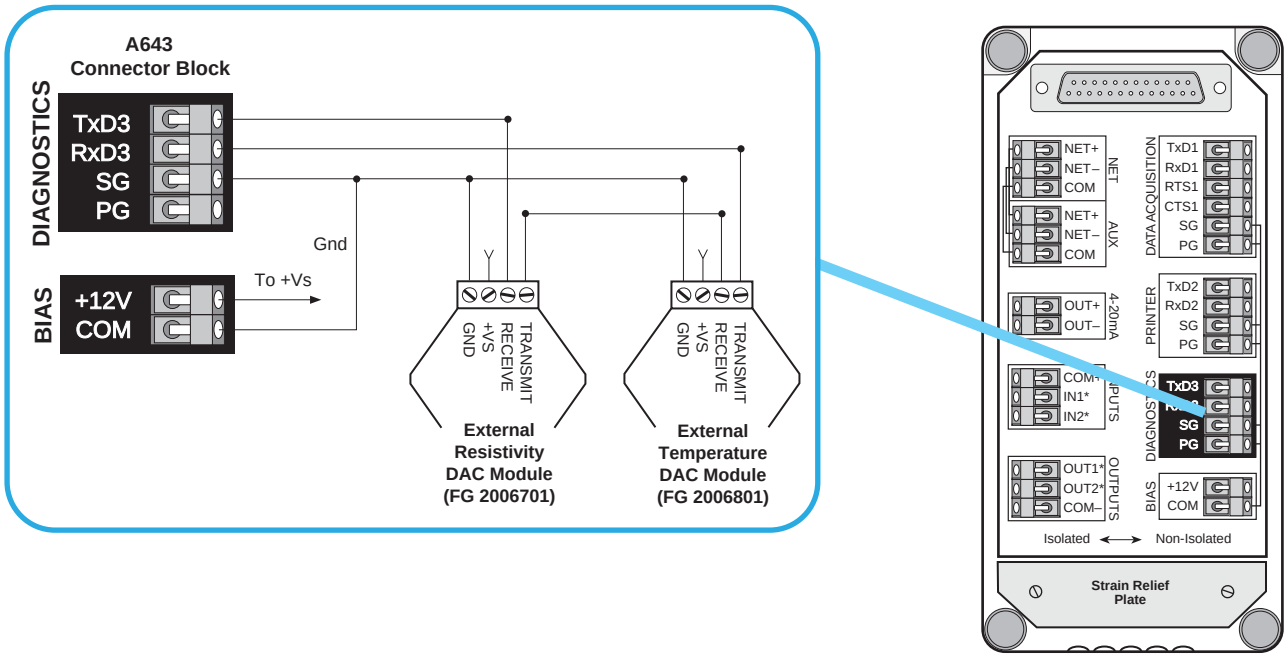



*Fig 9-18 :* External DAC Wiring

**Note:**
*The Access 643P Analyzer's integral printer is wired to its BIAS port. An external +12 VDC supply must be provided for any DAC Modules used with these instruments.*

6) Replace the metal strain relief plate.
7) Replace the I/O Connector Block on the bottom of the Analyzer, taking care not to pinch any wires, and secure it in place by tightening the screws.
8) Reconnect the power cord and turn the Sensor **ON**.

### 9.3.2 Software Setup

The output signal generated at the conclusion of an analysis cycle is calculated based on the sample's reading and represents either conductivity (in µS/cm), resistivity (in M.-cm) or temperature (in °C). The transmitted signal remains constant until the next analysis cycle is complete. If a critical alarm is encountered during an analysis, the external analog output goes to a pre-defined output state.

Setting the External DAC output consists of:

1) 1. Enabling the Analyzer's DAC output.
2) Specifying the analog output range.
3) Defining the associated zero-scale and full-scale values that establish the resolution of that signal.
4) Establishing the signal that is to be output in the event of an Anatel A643a alarm.

#### 9.3.2.1 External DAC Module

**Note:**
*Default: No*

This software switch enables and disables the conductivity (or resistivity) and temperature output to an External DAC Module. The Module then converts the output into an analog signal for processing by a variety of devices. This signal also reflects the **DAC Error Output** (see "DAC Error Output" on page 128) in the event of an Anatel A643a alarm.

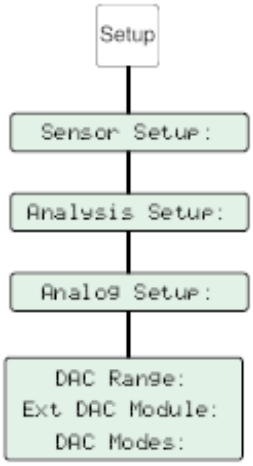



*Fig 9-19 :* External DAC Module Setup

To enable/disable the **External DAC Module** interface:

1) With the desired Analyzer selected in any View, press the **Setup Key** to display its menu.

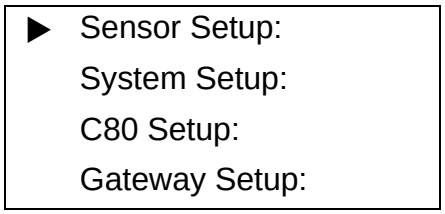



*Fig 9-20 :* Setup Menu

2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to display the **Sensor Setup Menu**.
4) Specify **Analysis Setup** and press **Enter**.
5) Specify **Analog Setu**p and press **Enter** to access its parameter options.
6) With the **Analog Setup Menu** displayed, specify **Ext DAC Module**.

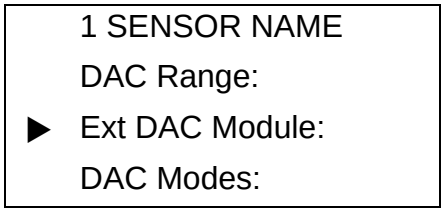



*Fig 9-21 :* DAC Error Output Menu

7) Press **Enter** to view its parameter screen.
8) Use the **Up** and **Down Keys** to toggle the software switch to **Yes** to enable this analog output, **No** disables it.

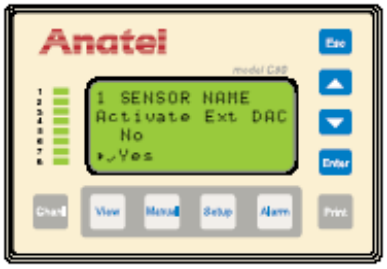



*Fig 9-22 :* External DAC Module Screen

**Note:**
*On activation of the External DAC Module, an Error Code #17: "Bad DAC Module" indicates that there is a communications problem.*

9) Press **Enter** to save the **Ext DAC Module** setting.
10) Press **Esc** to return to the **Analog Setup Menu**.

#### 9.3.2.2 Analog Output Range

**Note:**
*Default: 4 to 20 mA*
*Optional: 0 to 20 mA*

The **DAC mA Range** internally defines the span (**4 to 20** or **0 to 20 m**A) of the analog output that is presented at the Anatel A643a's digital-to-analog (DAC) port. Note that this setting is global for all analog outputs including the external DAC modules as well as the internal DAC. The lower and upper limits of the chosen range correspond to the **Zero-Scale** and **Full-Scale Conductivity/Resistivity** or **Temperature** values, depending on the output.

To set the Analyzer's **DAC mA Range**:

1) With the **Analog Setup Menu** displayed, select **DAC Range** to display its menu selections.

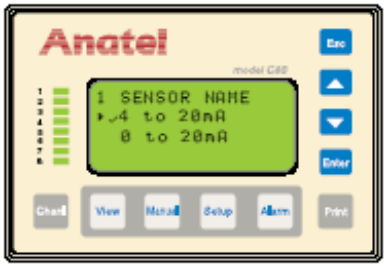



*Fig 9-23 :* DAC mA Range Screen

**Note:**
*The chosen analog output range must match the range of the connected device for proper communication.*

2) Specify **DAC mA Range** and press **Enter** to display its parameter screen.

1 SENSOR NAME
▶ DAC mA Range:
DAC Zero-Scale:
DAC Full-Scale:

*Fig 9-24 :* DAC mA Range Menu

3) Use the **Up** and **Down Keys** to specify the desired analog output range.
4) Press **Enter** to enable the **DAC mA Range** selection.
5) Press **Esc** to return to the **DAC Range Menu**.

#### 9.3.2.3 Conductivity/ Resistivity Output

**Note:**
*Defaults: Zero-Scale – 00 µS/cm*
*Full-Scale – 20 µS/cm*

The **DAC Zero-Scale** and **Full-Scale** settings define the upper and lower limits that are proportional to the **DAC mA Range** setting. The analog signal is converted to a scaled conductivity or resistivity value for output, depending on the selected **Display Units** setting (see "Display Units" on page 56).

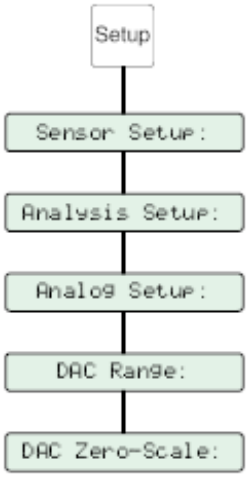



*Fig 9-25 :* Conductivity/Resistivity Output Setup

To set the output range:

1) With the **DAC Range Menu** displayed, use the **Up** and **Down Keys** to specify **DAC Zero-Scale**.

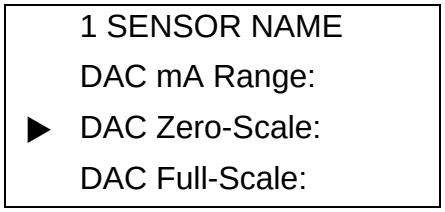



*Fig 9-26 :* DAC Zero-Scale Menu

2) Press **Enter** to display its menu selections.
3) Specify **Res/Cond DAC** and press **Enter** to display its zero-scale parameter screen. The units reflect the **Resis/Cond** parameter selection, displayed in **uS/cm** for conductivity or **MΩ-cm** for resistivity. If either unit is followed by a **U**, it indicates that the reading is uncompensated.

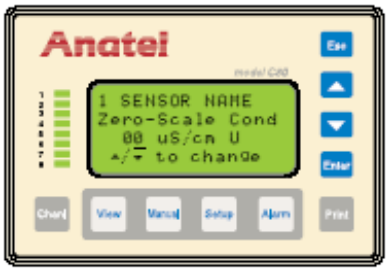



*Fig 9-27 :* Zero-Scale Uncompensated Conductivity Display

4) Use the **Up** and **Down Keys** to scroll in single increments until the desired value is displayed.

1 SENSOR NAME
Zero-Scale Cond
01 uS/cm U
▲/▼ to change

*Fig 9-28 :* Zero-Scale TOC Data

5) Press **Esc** twice to retain the **Zero-Scale Cond** setting and return to the **DAC Range Menu**.
6) Select **DAC Full-Scale** and press **Enter**.

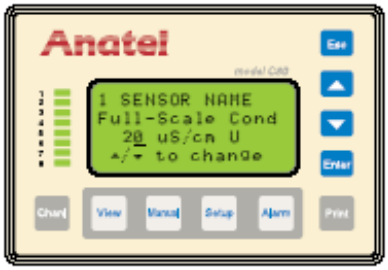



*Fig 9-29 :* Full-Scale Uncompensated Conductivity Display

**Note:**
*The* **Full-Scale Cond** *value must be greater than the* **Zero-Scale Cond** *value.*

7) Specify **Res/Cond DAC** and press **Enter** to display its full-scale parameter screen.
8) Use the **Up** and **Down Keys** to scroll the setting until the desired value is displayed.

| |
|---|
| 1 SENSOR NAME |
| Full-Scale Cond |
| 15 uS/cm U |
| ▲/▼ to change |

*Fig 9-30 :* Full-Scale TOC Data

9) Press **Esc** twice to retain the **Full-Scale Res/Cond** setting and return to the **DAC Range Menu**.

#### 9.3.2.4 Temperature Output

**Note:**
*Defaults: Zero-Scale – 5 °C*
*Full-Scale – 95 °C*

The **DAC Temp** setting defines the upper and lower limits that are proportional to the **DAC mA Range** setting. The analog signal is converted to a scaled temperature value for output.

To set the temperature output range:

1) With the **DAC Range Menu** displayed, use the **Up** and **Down Keys** to specify **DAC Zero-Scale**.

| |
|---|
| 1 SENSOR NAME |
| DAC mA Range: |
| ▶ DAC Zero-Scale: |
| DAC Full-Scale: |

*Fig 9-31 :* DAC Zero-Scale Menu

2) Press **Enter** to display its menu selections.
3) Specify **Temp DAC** and press **Enter** to display its zero-scale parameter screen.

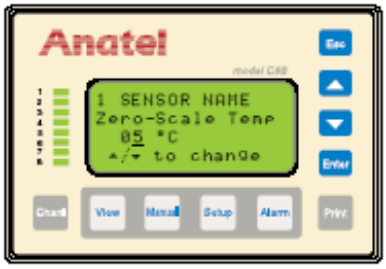



*Fig 9-32 :* Zero-Scale Temperature Screen

4) Use the **Up** and **Down Keys** to scroll in one degree increments until the desired value is displayed.

1 SENSOR NAME
Zero-Scale Temp
25 °C
▲/▼ to change

*Fig 9-33 :* Zero-Scale Temp Data

5) Press **Esc** twice to retain the **Zero-Scale Temp** setting and return to the **DAC Range Menu**.
6) Select **DAC Full-Scale** and press **Enter**.

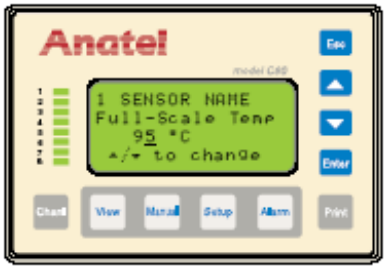



*Fig 9-34 :* Full-Scale Temperature Screen

**Note:**
*The* **Full-Scale Temp** *value must be greater than the* **Zero-Scale Temp** *value.*

7) Specify **Temp DAC** and press **Enter** to display its fullscale parameter screen.
8) Use the **Up** and **Down Keys** to scroll the setting until the desired value is displayed.

1 SENSOR NAME
Full-Scale Temp
75 °C
▲/▼ to change

*Fig 9-35 :* Full-Scale Temp Data

9) Press **Esc** twice to retain the **Full-Scale Temp** setting and return to the **DAC Range Menu**.

# 10 Digital Inputs & Outputs

## 10.1 General Information

The Anatel A643a's I/O Connector Block is equipped with two opto-isolated inputs and two opto-isolated outputs for receiving and sending digital signals. The digital inputs allow limited supervisory control of the Analyzer by a remote device or switch. A pair of digital outputs also is provided for connection to such compatible devices as a remote alarm indicator or a Programmable Logic Controller (PLC).

**CAUTION:**
*Always disconnect the instrument from its power source before attempting to access internal components.*

**CAUTION:**
*The* Anatel A643a *digital outputs* ***ARE NOT*** *designed for process control functions such as pump On/Off switching or water system shutdown. These connections are not intended to act as, or replace, a PLC.*

Digital input and output connections are made on the instrument's I/O Connector Block as follows:

1) Turn the Anatel A643a Analyzer **OFF** and disconnect the power cord from its source.
2) Remove the I/O Connector Block from the bottom of the Analyzer by loosening its four screws.
3) Loosen and remove the two screws that secure the metal strain relief plate.
4) Feed the interface wiring through one of the five holes at the end of the Connector Block cover and along the corresponding slot in the foam padding.
5) Make the necessary connections to the appropriate DIGITAL terminals (see below).

**Note:**
*Observe the correct polarity when making any digital input and output connections to the Analyzer.*

6) Replace the metal strain relief plate.
7) Replace the I/O Connector Block on the bottom of the Analyzer, taking care not to pinch any wires, and secure it by tightening the screws.

**Note:**
*The I/O Connector Block must be reinstalled correctly to conform to emissions specifications.*

8) Reconnect power and turn the Analyzer **ON**.

## 10.2 Digital Inputs

Both of the digital inputs perform specific Anatel A643a functions, allowing total control over its operation as well as synchronization with the rest of the process. The first set of inputs is used to initiate an analysis from an external device. The analysis is based on the instrument's specified **Sample Time** and **Cycle Time** settings. The second input dictates the instrument's operational mode as either Auto TOC or Purge. Both inputs also require that the Analyzer be placed under **Digital Control**.

### 10.2.1 Hardware Setup

The two digital inputs share a common positive terminal. They are driven by a 5 to 30 VDC external power source or the Analyzer's 12 VDC, 0.5 Amp Bias and designed to operate from open collector, open drain or relay outputs. Each input draws between 1 and 14 mA, depending on the applied voltage. The hardware connections are established as described in "General Information" on page 139, the Inputs terminals having the following designations and functions:

**IN1*** Allows external initiation of an analysis. When Input #2 selects the Auto TOC Mode, a high-to-low state transition forces the instrument to initiate an analysis cycle.

**IN2*** Selects between the Auto TOC (high state) and the Purge (low state) Mode. State transitions are ignored on IN1* when the instrument is in the Purge Mode.

*Table 10-1 :* Digital Inputs

| IN1* | IN2* | Mode |
|---|---|---|
| X | High | Auto TOC |
| X | Low | Purge |
| H→L† | High | Begin Analysis |
| †Min 0.1 second pulse duration<br>X = Don't care | | |

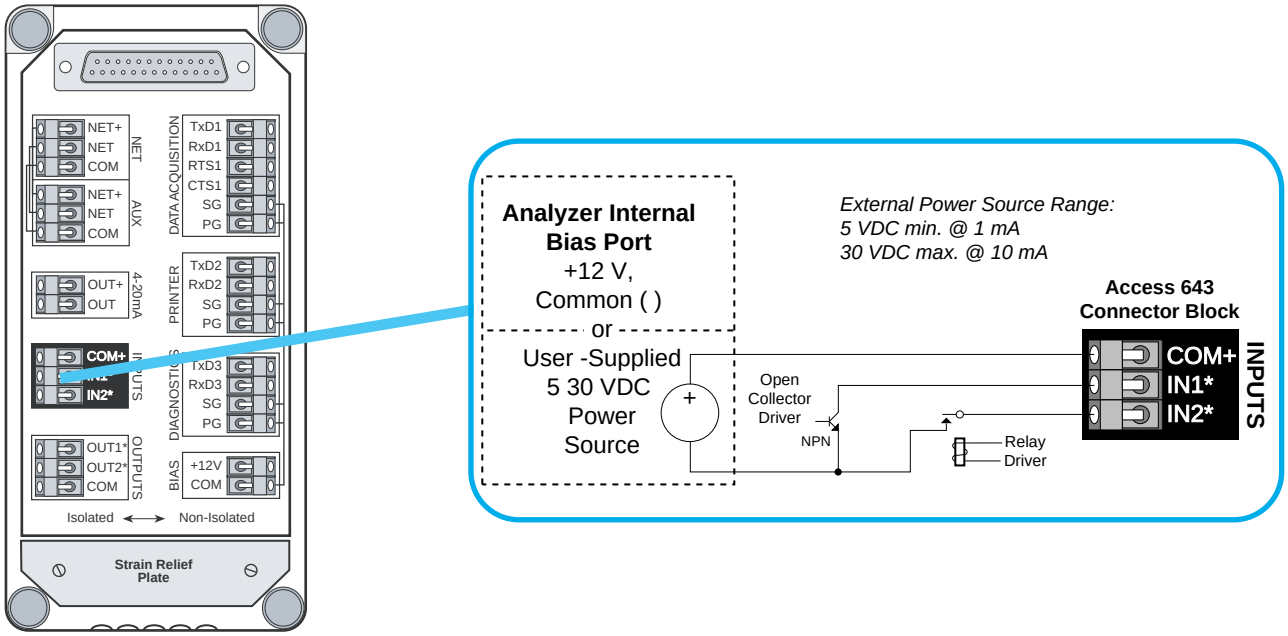



*Fig 10-1 :* Typical Digital Input Wiring

## 10.2.2 Software Setup

The **Digital Control** parameter must be enabled for the Anatel A643a to accept any digital input signals. This software switch is accessed through the **Manual Key** and, once enabled, displays **r/c** in conjunction with the Analyzer's displayed TOC readings to indicate that the instrument is operating under remote control.

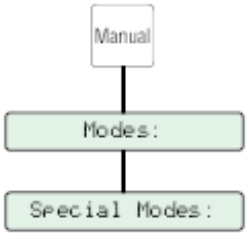



*Fig 10-2 :* Software Setup

To enable external **Digital Control**:

1) With the desired Analyzer selected in any View, press the **Manual Key** to display its submenu.

1 SENSOR NAME
▶ Modes:
Manual Samples:
Calibrations:

*Fig 10-3 :* Manual Submenu

2) Use the **Up** and **Down Keys** to specify **Modes**.
3) Press **Enter** to display the **Modes Menu**.

1 SENSOR NAME
Auto TOC
Purge
▶ Special Modes

*Fig 10-4 :* Modes Menu

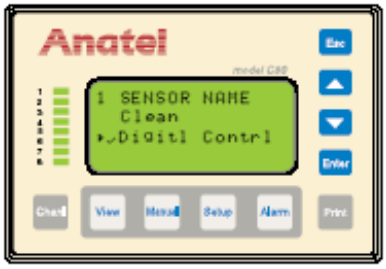



*Fig 10-5 :* Special Modes Screen

4) Specify **Special Modes** and press **Enter** to display its operational options.
5) Use the **Up** and **Down Keys** to indicate **Digitl Control**.
6) Press **Enter** to enable external digital control of the Analyzer. Activating this mode inserts **r/c** anywhere the instrument's TOC status is displayed to indicate that it is under remote control.
7) Press **Esc** repeatedly to exit this function and and return to the normal display.

## 10.3 Digital Outputs

The digital outputs also transmit specific Anatel A643a information. The first digital output reports the instrument's current TOC alarm status and can be used to trigger an alarm indication or similar response. The second digital output reports the state of the Analyzer's internal sample valve or, if alternatively configured, the uncompensated conductivity alarm status (see "Uncompensated Conductivity Alarms" on page 106).

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### 10.3.1 Hardware Setup

Both digital outputs are 8.5 mA current sinks which share a common negative terminal. They are designed to drive solid state relay inputs and have a compliance range from 5 to 30 VDC. The hardware connections are established as described in “General Information” on page 139, the OUTPUTS terminals carrying the following designations and functions:

**OUT1*** Reports the instrument’s TOC level as above (low state) or below (high state) the user-specified Alarm Limit.

**OUT2*** Reports the state of the instrument's sample valve as open (high state) or closed (low state). Alternatively, if temperature uncompensated conductivity alarm is enabled, the output is based on the USP uncompensated conductivity alarm table (see “Uncompensated Conductivity Alarms” on page 106).

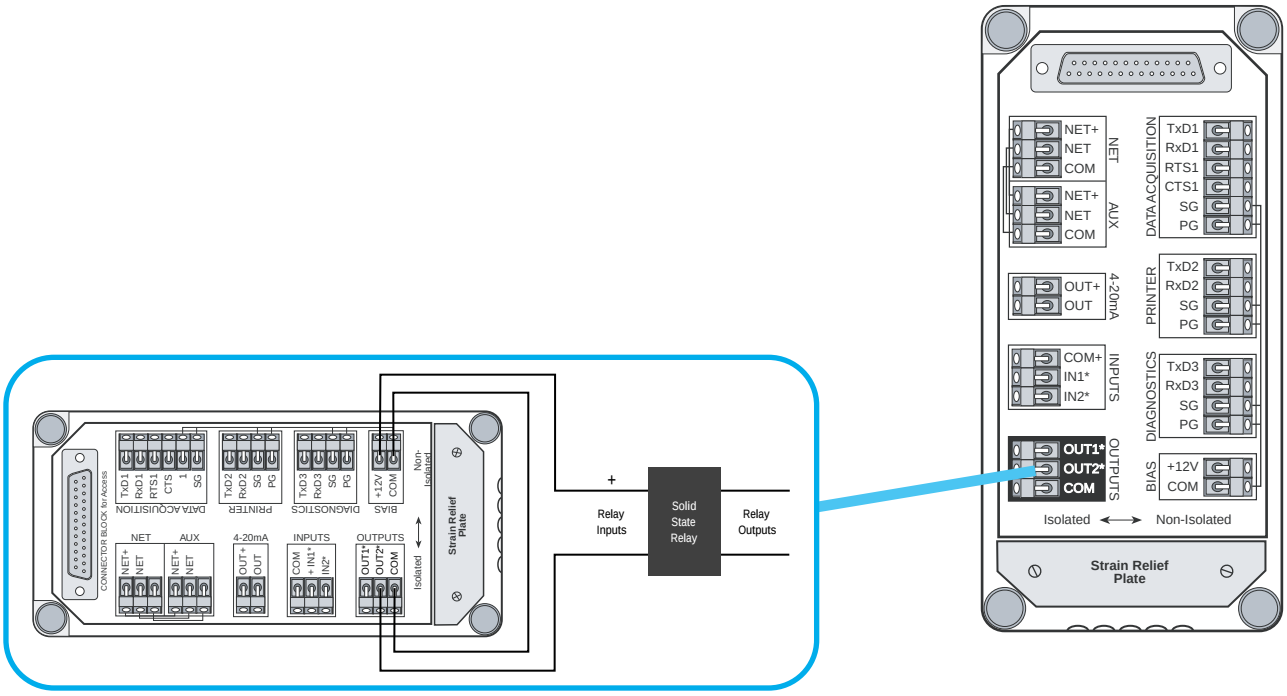


*Fig 10-6 :* Typical Digital Output Wiring

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# 11 12 VDC Bias Output

## 11.1 General Information

Anatel A643a Analyzers are equipped with a connection that can supply power for such auxiliary devices as the External DAC Modules to obtain conductivity (or resistivity) and temperature data from Anatel A643a Analyzers: the Bias connection is used by the integral printer on Access 643P Analyzers.

## 11.2 Hardware Setup

The BIAS Port furnishes 12 VDC, 1/2 Amp power from the Analyzer's supply. The port is non-isolated and therefore discretion should be used when attaching an external device.

**CAUTION:**
*Always disconnect the instrument from its power source before attempting to access internal components.*

Bias connections are made to the instrument's I/O Connector Block as follows:

1) Turn the Anatel A643a Analyzer **OFF** and disconnect the power cord from its source.
2) Remove the I/O Connector Block from the bottom of the Analyzer by loosening its four screws.
3) Loosen and remove the two screws that secure the metal strain relief plate.
4) Feed the interface wiring through one of the five holes at the end of the Connector Block cover and along the corresponding slot in the foam padding.
5) Make the necessary positive and ground connections to the Analyzer's BIAS terminals.
6) Replace the metal strain relief plate.
7) Replace the I/O Connector Block on the bottom of the Analyzer, taking care not to pinch any wires, and secure it by tightening the screws.

**Note:**
*The I/O Connector Block must be reinstalled correctly to conform to emissions specifications.*

8) Reconnect power and turn the Analyzer **ON**.

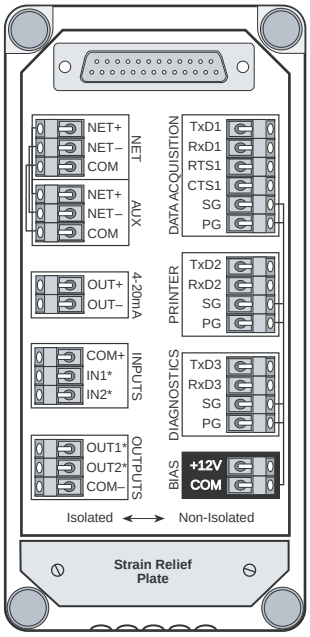


*Fig 11-1 :* Bias Connections

**CAUTION:**

*Drawing more than the available power may cause erratic behavior, loss of data, instrument shutdown, and/or component damage.*

# 12 Serial Communications

## 12.1 General Information

Anatel A643a Analyzers are equipped with a bidirectional serial interface that allows them to communicate with a wide variety of intelligent devices such as a Programmable Logic Controller (PLC) or a host computer. The wiring is configured as for any PC-compatible RS-232C serial interface.

## 12.2 Hardware Setup

Serial connections are made to the Analyzer on its DATA ACQUISITION Port. This RS-232C connection communicates at 1200 baud, 8 data bits, 1 stop bit and no parity. Three- or five-conductor cable is adequate for most serial interfaces (AWG 24 is recommended), depending on the connected device.

**Note:**
*Always disconnect the instrument from its power source before attempting to access internal components.*

Interface connections are made on the instrument's I/O Connector Block as follows:

1) Turn the Anatel A643a Analyzer **OFF** and disconnect the power cord from its source.
2) Remove the I/O Connector Block from the bottom of the Analyzer by loosening its four screws.
3) Loosen and remove the two screws that secure the metal strain relief plate.
4) Feed the interface wiring through one of the five holes at the end of the Connector Block cover and along the corresponding slot in the foam padding.

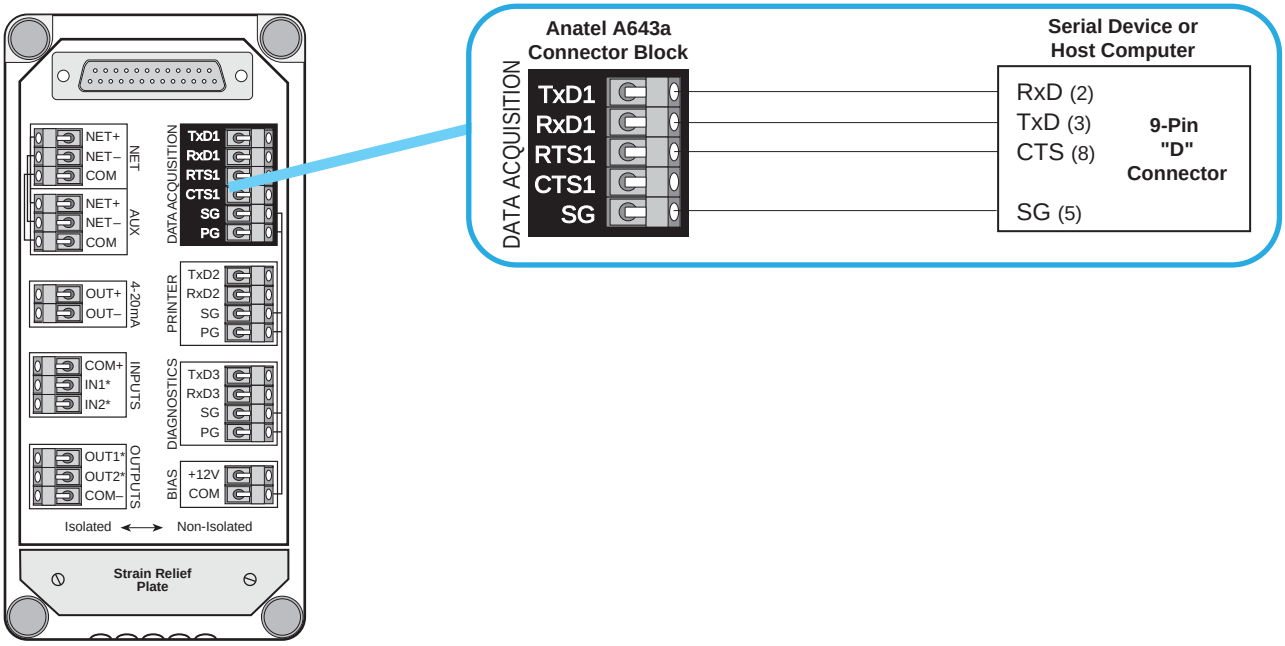


*Fig 12-1 :* Serial Wiring

5) Make the necessary connections to the Analyzer's DATA ACQUISITION Port as shown.
6) Replace the metal strain relief plate.
7) Replace the I/O Connector Block on the bottom of the Analyzer, taking care not to pinch any wires, and secure it by tightening the screws.
8) Reconnect power and turn the Analyzer ON.

**Note:**
*The I/O Connector Block must be reinstalled correctly to conform to emissions specifications.*

## 12.3 Anatel A643a Command Set

Serial interface commands consist of Mode Set, Parameter Set, Data Read, Data Logger and Data History functions. The commands consist of twocharacter ASCII text mnemonics. Some commands also require one or more arguments, each delimited by at least one space (ASCII 32; 20 Hex), followed by the command mnemonic. Each command string is terminated with a carriage return (ASCII 13; 0D Hex).

**Note:**
Anatel A643a *Analyzers respond to either uppercase or lowercase commands.*

The Anatel A643a Analyzer will respond with an “OK>” prompt after the command has been accepted. In addition, Data Read and Parameter Set commands elicit a reply that consists of one or more numeric or text values, each delimited by at least one space, and terminated by a carriage return, linefeed pair (ASCII 13,10; 0D,0A Hex).

Both commands and replies use a “free field” format, so the number of delimiting spaces and length of each argument or data field may vary. If a command is rejected due to invalid syntax, for instance, refusal is indicated by a question mark (ASCII63; 3F Hex) reply preceding the “OK>” prompt.

The notations used to represent command arguments below are as follows:

| | |
|---|---|
| *hh:mm:ss* | hours:minutes:seconds |
| *n* | decimal number (e.g., “1.234) |
| *i* | integer (e.g., “1”) |
| *s* | text string (e.g., “SENSOR_NAME”) |
| *b* | binary flag (“1” or “0”) |

### 12.3.1 Mode Set Commands

The Mode Set commands are used to determine the instrument’s operational mode.

*Table 12-1 :* Mode Set Commands

| Command | Function | Comment |
|---|---|---|
| MC | Self-Clean Mode | Valve open, lamp on. |
| MD | Auto TOC Mode | Continuous TOC analyses. |
| ME | Clear Code Log | Erases Codes from memory. |
| MO i | Start TOC Analysis | One or more TOC analyses, then goes to Idle State. The default is one analysis cycle if an argument (“i”) is not specified. |
| MP | Purge Mode | Valve open, lamp off, shows resistivity/conductivity and temperature. |
| MZ | Idle State | Places the Analyzer in the Idle State (if present). |

### 12.3.2 Parameter Set Commands

Issuance of the “HR” command displays or sets the user-defined Anatel A643a parameters. When issued without arguments, the Analyzer’s current settings are displayed; issued with arguments, the specified parameters are changed for the Analyzer and a printout is generated documenting the modification. If an "out of bounds" value is sent, the entire command is ignored.

**Note:**
*Issuing the “HR” command without specifying arguments displays the current parameter settings.*

**Note:**
*“Read-Only” values cannot be modified.*

*Table 12-2 :* Parameter Set Commands

| Command | Function | Section |
|---|---|---|
| HR t t i i… | Sample Time (hh:mm:ss) | 5.5.1.1 |
| | Cycle Time (hh:mm:ss) | 5.5.1.2 |
| | Absolute TOC Alarm Limit (ppb) | 7.2.1 |
| | Reserved (always “0”) | |
| | Reserved (always “0”) | |
| | Analyzer Channel ID # (1–8) | 3.2.1 |
| | Analyzer Name (1–13 characters) | 2.2.3.2 |
| | Cycle Modes (0 = TOC & Idle, 1 - TOC & Purge) | 5.5.1.4 |
| | Sampling Mode (0 = Water Saver, 1 = Continuous) | 5.5.1.3 |
| | Diagnostic Port Function (0 = normal,<br>1 = External DAC Module) | 9.3.2.1 |
| | Conductivity/Resistivity Units of Measure<br>(0 = MΩ-cm, 1 = µS/cm,<br>2 = MΩ-cm uncompensated,<br>3 = µS/cm uncompensated) | 5.4 |
| | 20 mA Output during TOC Calibration<br>(0 = inactive, 1 = active) | 9.2.2.4 |
| | TOC Mode Print Strategy ( 0 = Continuous,<br>1 = Paper Saver) | 5.5.2 |
| | Purge Mode Print Strategy ( 0 = Continuous,<br>1 = Paper Saver) | 5.6.1 |
| | Active Alarm Type (0 = absolute ppb,<br>2 = absolute ppb & uncompensated conductivity alarm) | 7.3.1 |
| | Analog Output Type (0 = 4 to 20 mA,<br>1 = 0 to 20 mA) | 9.2.2.2 |

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*Table 12-2 :* Parameter Set Commands (Continued)

| Command | Function | Section |
|---|---|---|
| | 20mA Output On Alarm (0 = minimum value, 1 = unchanged, 2 = maximum value) | 9.2.2.4 |
| | TOC Mode Paper Saver Percentage Change (1–99) | 5.5.2 |
| | Purge Mode Paper Saver Percentage Change (1–99) | 5.6.1 |
| | Purge Mode Interval Between Printouts (hh:mm:ss) | 5.6.1 |
| | Zero-Scale TOC Range (ppb) | 9.2.2.3 |
| | Full-Scale TOC Range (ppb) | 9.2.2.3 |
| | User TOC Calibration Slope *(Read-Only)* | |
| | External DAC Zero-Scale Conductivity/Resistivity Range | |
| | (Units depend on *Conductivity/Resistivity Units of Measure)* | 9.3.2.3 |
| | External DAC Full-Scale Conductivity/Resistivity Range | |
| | (Units depend on *Conductivity/Resistivity Units of Measure)* | 9.3.2.3 |
| | External DAC Zero-Scale Temperature Range (°C) | 9.3.2.4 |
| | External DAC Full-Scale Temperature Range (°C) | 9.3.2.4 |
| | Digital Control (0 = disabled, 1 = enabled) | 10.2 |
| | Log (0 = Data & Audit, 1 = Audit Only) | 8.3.1 |
| | User Conductivity Calibration Slope *(Read-Only)* | |
| | *Example:* "HR 00:01:00 00:00:00 500 0 0 1 SENSOR_NAME 0 0 0 0 0 0 0 0 0 1 1 00:01:00 0 1000 1.0 0 20 5 95 0 1.0 <cr>" | |
| SY | Set Time (MM:DD:YY:hh:mm:ss format) | 2.2.3.1 |
| | *Example:* "SY 03 04 1993 12 33 00 <cr>" | |

### 12.3.3 Data Read Commands

The Data Read functions return multiple values, the string terminated with a <cr><lf>.

**Note:**
*If the Anatel A643a Analyzer is in an operational mode that does not generate a TOC result (modes 6 through 12), the TOC, TOC Alarm Percentage, TOC Trend, Profile (Curve) Type and Oxidation Time are not returned.*

**Note:**
*Data normally is returned only in response to issuance of the RD or RE commands. When collecting data with a serial communications program such as Windows 95 Hyperterminal, however, it is more convenient to have the data displayed automatically. This can be done using the SA command, which then displays data whenever they are reported.*

*Table 12-3 :* Data Read Commands

| Command | Function | Comment |
|---|---|---|
| RD | Read Analyzer Data | Returns one line of time stamped data from when the unit began oxidation: mm/dd/yyyy, hh:mm, mode, state, TOC in ppb, alarm percentage, trend in ppb/hr, resistivity in MΩ-cm, temperature in °C, curve (profile) type and oxidation time in seconds.<br><br>The mode is:<br>1 = Auto TOC<br>2 = Single TOC<br>3 = Digital TOC<br>4 = Sample Manual<br>5 = Manual Manual<br>6 = Clean Mode<br>7 = Purge Mode<br>8 = Digital Purge<br>9 = Temperature Test<br>10 = Self-Calibrate<br>11 = Idle Mode<br>12 = Failure Mode<br><br>The state is:<br>1 = Idle<br>2 = Sample<br>3 = Oxidize<br>4 = Self-Calibrate<br>5 = Repurge |
| RE | Read Analyzer Codes | Returns time stamped alarms, if any, since the last power-up or ME command issued, one Code per line: hh:mm:ss (time of first occurrence), alarm code, number of occurrences and alarm description. |

### 12.3.4 Log Commands

Log functions return information on the instrument's internal Log.

*Table 12-4 :* Log Commands

| Command | Function | Comment |
|---|---|---|
| LP | Display Log | Displays the contents of the internal Log. If any third character is appended to the command (i.e., "LPx"), the display is aborted. |
| LU | Report Log Usage | Displays what percentage (0 to 100) of the internal Log has been used. |

### 12.3.5 Data History Commands

The Data History commands return the results of the most recent calibration and validation procedures performed on the instrument.

*Table 12-5 :* Data History Command

| Command | Function | Comment |
|---|---|---|
| PC | Conductivity Calibration History | Up to five calibrations are displayed. |
| PT | TOC Calibration History | Up to five calibrations are displayed. |
| PS | System Suitability Calibration History | Up to five tests are displayed. |
| PV | TOC Validation History | Up to five tests are displayed. |

# 13 Anatel A643a Maintenance

## 13.1 General Information

Anatel A643a Analyzers require periodic maintenance in order to ensure the continued accuracy and reliable performance of the instrument. The UV lamp has a limited life and should be replaced every six months. It is recommended that the measurement cell have an annual calibration verification. The lithium battery has a service life of 3–5 years.

Maintenance procedures may be performed either by the user or by Anatel customer service personnel. The most common maintenance procedures are UV lamp replacement, cleaning the air filters, lithium battery replacement and printer maintenance. In most instances, the user can perform these procedures in the field. If problems persist after performing maintenance or repair procedures, contact the Hach Ultra Customer Service department at 541.472.6500. Should it be necessary to return Anatel equipment to the factory for maintenance or repair, obtain a Return Materials Authorization (RMA) number. At that time furnish the Model and serial number, and any additional relevant information. Ship the instrument(s) to *Hach Ultra, Attn: RMA #xxxx.*

**CAUTION:**
*Purge all water from the Analyzer when taking the instrument out of service. Residual water can freeze inside the unit, expand and damage the measurement cell. Such damage is timeconsuming to repair and is not covered by the warranty.*

Anatel also offers service and extended warranty options to cover scheduled maintenance, calibration and repairs. In cases where returning the Analyzer to the factory is impractical, on-site maintenance and/or verification can be performed by an Anatel technician, or a certified instrument may be rented. Repairs are performed only at Hach Ultra Service Centers due to the specialized equipment and parts required.

## 13.2 Self-Cleaning Mode

It is possible to contaminate an Anatel A643a Analyzer’s measurement cell on any water system or after long-term storage or inactivity. This condition is indicated by suddenly changing or erratic TOC or resistivity readings. Extended self-cleaning using the ultraviolet lamp to oxidize contaminants in the cell is the recommended procedure to alleviate such problems. In the Self-Clean Mode, the Analyzer’s sample valve is opened to allow water to flow through the cell. The UV lamp is turned on to oxidize any organic contaminants, which subsequently are flushed from the instrument by the sample flow.

**Note:**
*The Anatel A643a Analyzer must have the sample vessel attached and be on-line with sample pressure so that there is flow through the instrument.*

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To place an Anatel A643a in the Self-Clean Mode:

1) With the desired Analyzer selected in any View, press the **Manual Key** to display its menu.

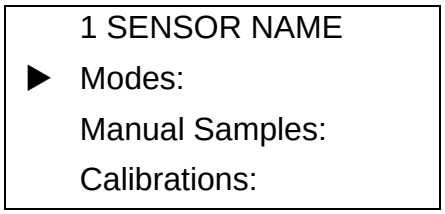


*Fig 13-1 :* Manual Menu

2) Use the **Up** and **Down Keys** to specify **Modes**.
3) Press **Enter** to display its submenu.
4) Specify **Special Modes** from among the available options and press **Enter**.

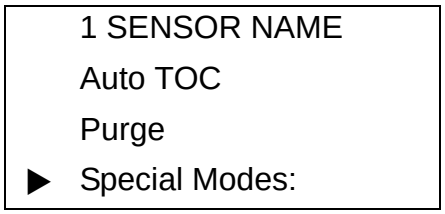


*Fig 13-2 :* Special Modes Menu

5) Specify **Clean** and press **Enter** once again to initiate this operational mode. Allow the Analyzer to operate in the Self-Clean Mode for 3 to 4 hours, longer if contamination is significant.

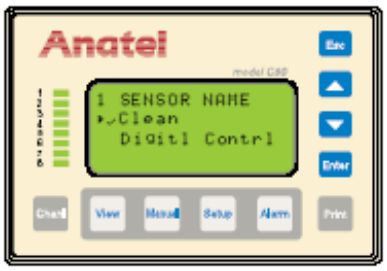


*Fig 13-3 :* Selecting the Self-Clean Mode

6) Repeat step 1 through step 3 and select **Auto TOC** in the **Modes Menu** to terminate instrument self-cleaning and restore normal analysis.

The unit's external case can be cleaned by wiping it with a soft cloth moistened with water. Do not use abrasive cleaners as they can scratch the instrument's painted finish and do not subject the enclosure to a direct spray as it could damage internal components.

## 13.3 Preparatory Maintenance Procedures

Certain maintenance procedures require the removal of either of the Anatel A643a's covers to access the instrument's internal components. These procedures are common to both Analyzer models in order to service the following components:

- UV Lamp
- Air Filters
- 15 Micron Filter
- Lithium Battery
- (Optional) Printer

The following tools are required:

- 7/16" Open-End Wrench
- 9/16" Open-End Wrench
- 5/64" Allen Wrench

To access the Analyzer's internal components:

1) Close the upstream isolation valve to stop water flow to the instrument.

**CAUTION:**
*Unplug the Analyzer's power cord and exercise extreme CAUTION as there are HIGH VOLTAGES present inside the instrument's Power Supply. It is also recommended that you electrically ground yourself before opening the Analyzer to avoid potential electrostatic damage to any of its internal components.*

2) Turn the Anatel A643a Analyzer **OFF** and disconnect the power cord from its AC source.
3) To disconnect the inlet tubing, loosen its compression fitting with a 9/16" wrench. The outlet fitting is loosened using a 7/16" wrench.
4) If necessary, remove the I/O Connector Block by loosening the four screws that secure it to the bottom of the instrument.
5) Loosen the four 5/64" hex bolts at each corner of the Analyzer cover to remove it.

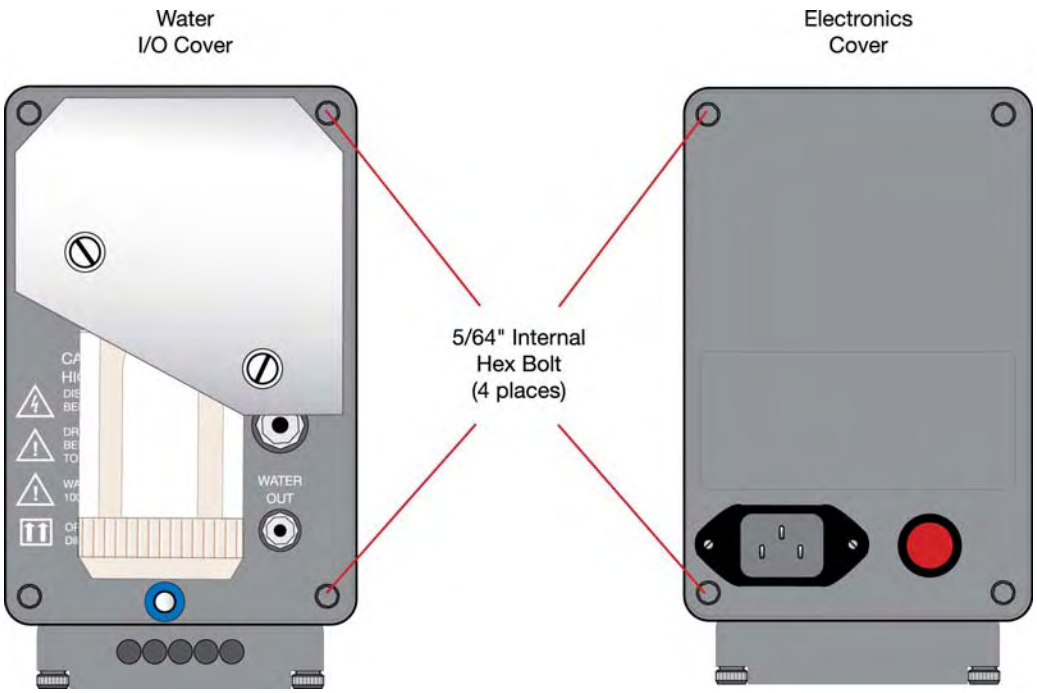


*Fig 13-4 :* Location of Hex Bolts

## 13.4 UV Lamp Maintenance

**Note:**
*Replacement Kit: P/N FG6002601*

The ultraviolet (UV) lamp in the A643a TOC Analyzer requires periodic replacement to ensure accurate analyses. The Anatel A643a logs UV lamp usage based on its total hours of operation. Anatel recommends replacement of the UV lamp every six months to ensure uninterupted operation due to lamp degradation.

*Fig 13-5 :* Anatel A643a UV Lamp Assembly

**CAUTION:**
***DO NOT*** *touch the glass surface of the new UV Lamp. A lamp contaminated with fingerprints can be cleaned with isopropyl alcohol and a lint-free cloth.*

The Anatel Anatel A643a UV Lamp Replacement Kit is designed for on-site maintenance and contains the following parts:

- Ultraviolet Lamp Assembly
- Air Filters (2 each)
- 5/64" Hex Driver (Allen Wrench)
- *UV Lamp Replacement Kit Instructions*

Additional equipment required to perform the replacement procedure is:

- Long Phillips Screwdriver (5" minimum)
- Small Flat-Bladed Screwdriver
- 7/16" and 9/16" Open-End Wrenches

**CAUTION:**

*The UV Lamp contains mercury vapor. When replacing it, dispose of the expired Lamp in accordance with the applicable local regulations. Anatel does accept used Lamps for disposal. Repackage and return them (at user's expense) to:*

*Hach Ultra Analytics, Inc.*
*5600 Lindbergh Drive*
*Loveland, Colorado 80538 U.S.A.*
*Attn: UV Lamp Recycling*

Replace the UV Lamp when any of the following conditions occur:

- If **Code 42: UV Lamp** appears in the Controller display after pressing Enter.
- If **Code 42: UV Lamp** appears in the Controller display when changing the Analyzer's operational mode.
- If **Code 52: UV Lamp** appears in the Controller display.
- If **Code 33: Check UV Lamp** appears in the Controller display.
- If, each day, the message (**Code 42**)

  **URGENT: UV LAMP NEEDS REPLACEMENT**
  **CONSULT YOUR MANUAL OR CALL THE**
  **HACH ULTRA ANALYTICS, INC. SERVICE DEPT. @ 541.472.6500**

  is output to the local printer shortly after midnight.
- If, after each analysis, **Code 52 UV Failing** is output to the local printer. Additionally the message, URGENT: U.V. LAMP NEEDS REPLACEMENT CONSULT YOUR MANUAL OR CALL THE ANATEL SERVICE DEPT. @ 800-866-7889.
- If **Code 53: UV Lamp Bad** appears in the Controller display.
- If the time required for sample oxidation increases suddenly and does not return to normal.

The following alarm messages also may indicate a deteriorated UV Lamp, requiring that it be replaced:

- **Code 31: See Guide**
- **Code 32: See Guide**
- **Code 53: UV Lamp Bad**

These messages continue until the UV Lamp is replaced and the Anatel A643a's internal counter is reset.

### 13.4.1 UV Detect Technology

An A643a analyzer equipped with UV Detect will automatically monitor the output of the UV lamp and alert when the UV output is indicative of a failing lamp or if the lamp has failed completely and can no longer support proper oxidation. Code 52 indicates a failing lamp. Code 53 indicates a failed lamp.

#### Failing Lamp Indications in TOC Analysis Mode:

When Code 52 is indicated by UV Detect, the analyzer UV lamp should be replaced as soon as possible. UV Detect will generate a Code 52 when the UV output from the lamp has reached a level that indicate a failing lamp. At this level of UV output the analyzer will continue to oxidize adequately, but lamp life is extremely limited.

When a failing lamp is detected the analyzer will display **Code 52 UV Lamp** on the C80 controller alarm status screen and the associated LED for the analyzer will blink Red. If a printer is connected to the analyzer **Code 52 UV Failing** will be printed following each TOC analysis, and the following message will be printed every eight hours - Urgent: U.V. lamp needs replacement consult your manual or call the Anatel Service Dept. @ 800-866-7889.

**Note:**
*Under Code 52 the analyzer will continue to perform TOC analysis, but the lamp life is limited and should be replaced as soon as possible.*

#### Bad Lamp Indications in TOC Analysis Mode:

When Code 53 is indicated by UV Detect the analyzer lamp has failed and must be replaced. Code 53 is an indication that the UV lamp has failed and no longer supports proper analyzer operation.

Under a Code 53 condition the lamp is no longer outputting adequate levels of UV light to support proper sample oxidation. TOC analysis is no longer supported and the C80 display will display **53-UV Lamp Bad**.

When a bad lamp is detected the analyzer will display **Code 53 UV Lamp** on the C80 controller alarm status screen and the associated LED for the analyzer will blink Red. If a printer is connected to the analyzer **Code 53 UV Lamp Bad** will be printed following each attempt at a TOC analysis, along with the following message - Urgent: U.V. lamp needs immediate replacement, consult your manual or call the Anatel Service Dept. @ 800-866-7889.

### 13.4.2 Replacing the UV Lamp

**CAUTION:**
*In hot water (>50 °C) applications, allow the instrument to cool for 15 minutes before proceeding with the UV Lamp Replacement procedure.*

To replace the UV Lamp:

1) Turn the Anatel A643a Analyzer **OFF** and disconnect the AC power cord from its supply source.
2) Stop sample water flow to the instrument.
3) The UV Lamp is located at the Water I/O end of the Anatel A643a. Disconnect the water inlet (9/16" nut) and outlet (7/16" nut) tubing. It is not necessary to remove the inlet prefilter assembly from the **WATER IN** port.

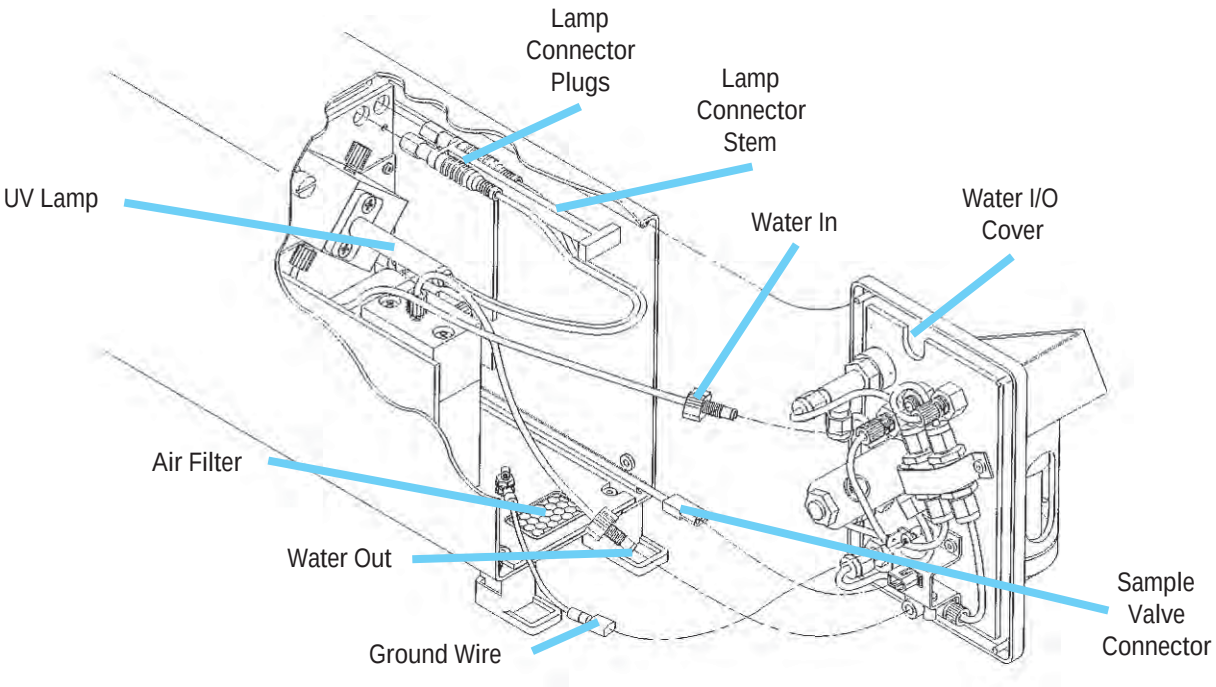


*Fig 13-6 :* Anatel A643a UV Lamp Replacement Diagram

4) The UV Lamp is located at the Water I/O end of the A643a TOC Analyzer. While holding the **Water I/O Cover**, remove it as outlined in “Preparatory Maintenance Procedures” on page 157 to access the UV lamp assembly.
5) Continue to support the **Water I/O Cover** and disconnect the Ground Wire spade connector. Then squeeze the tabs on the Sample Valve Connector to disconnect the Sample Valve cable. Also unscrew the **WATER IN** and **WATER OUT** tubing connection nuts. Separate the **Water I/O Cover** from the instrument. Place the **Cover** aside with the metal bracket down to prevent damaging components.

6) Loosen the two Phillips head screws holding the UV lamp bracket to the Analyzer's cell assembly about 1-1/2 turns. Do not remove the screws.

*Fig 13-7 :* Loosening the UV Lamp Bracket

7) Pull the UV lamp straight out of the housing and remove it from the cell assembly.

*Fig 13-8 :* Pulling the UV Lamp Connector Plug

8) Place your fingers behind the tabs of the UV Lamp Connector stem and, with your thumb braced against the enclosure, pull the plugs straight out of the receptacles.

**Note:**

*If the instrument uses the prior UV Lamp Assembly design which incorporates Adapter Plugs rather than the UV Lamp Connector Stem, the Adapter Plugs could remain in their receptacles when the UV Lamp leads are disconnected. Remove the extenders by pulling each Adapter Plug straight out of its connector using a pair of needle-nosed pliers.*

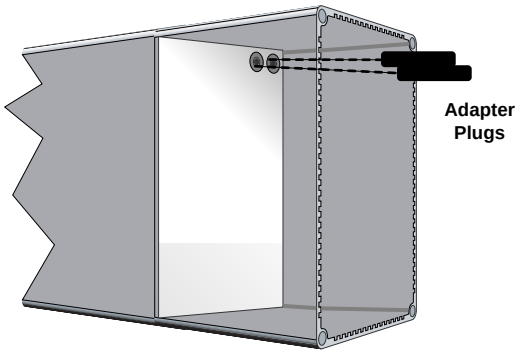


*Fig 13-9 :* Prior UV Lamp Assembly Design with Adapter Plugs

9) Insert the new UV Lamp Assembly from the Replacement Kit into the housing in the cell.

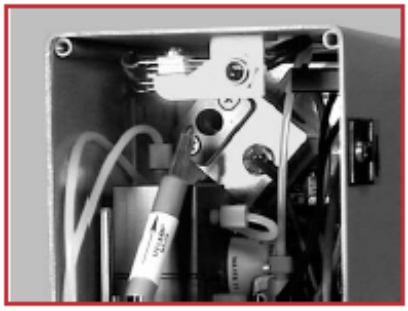

*Fig 13-10 :* Inserting the New UV Lamp Assembly

10) Turn the UV Lamp so that its arrow aligns with the center of the upper bracket screw as shown.

*Fig 13-11 :* Aligning the Arrow with the Bracket Screw

11) Holding the UV Lamp with the arrow aligned and tighten the Phillips-head screws about 1-1/2 turns to secure it in the cell housing.

12) Align the two UV Lamp Connectors and stem with the receptacles and press straight against the stem to seat the plugs.

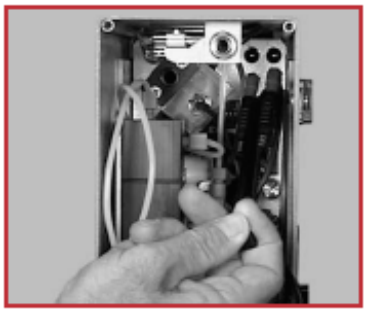

*Fig 13-12 :* Inserting the UV Lamp Connector

13) Exchange the Air Filter in the bottom of the instrument enclosure with a new one from the Replacement Kit (refer to the accompanying *Kit Instructions* to replace the second Air Filter.
14) Hold the **Water I/O Cover** to support it while reconnecting the the inlet and outlet tubing to the **Water In** and **Water Out** ports. Screw the compression nuts finger-tight.
15) Align the cable pins and reconnect the Sample Valve Connector. Also reconnect the Ground Wire.
16) Tuck the wires and tubing inside the Analyzer enclosure and replace the Water **I/O Cover.**
17) Tighten the four 5/64" hex bolts evenly to seal the **Water I/O Cover** on the enclosure—*overtightening the hex bolts may break the seal.*
18) Reconnect the sample water supply tubing to the instrument's **Water In** port and the drain tubing to the **Water Out** port.
19) Plug the AC power cord into its supply and turn the Anatel A643a Analyzer **ON**.

The Analyzer's internal counter tracks UV lamp usage. It must be reset each time a new lamp is installed in order to accurately report when light intensity has diminished below recommended levels.

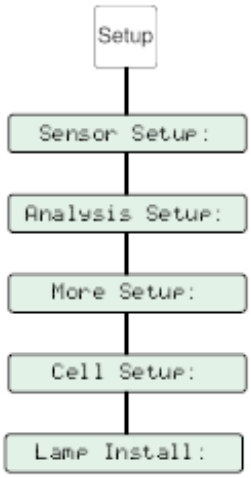


*Fig 13-13 :* Lamp Setup

To reset the instrument's UV Lamp counter:

20) Select the appropriate Analyzer in any View and press **Setup** to access its submenu.
21) Specify **Sensor Setup** and press **Enter**.
22) Specify **Analysis Setup** and press **Enter**.
23) Specify **More Setup** and press **Enter**.
24) Specify **Cell Setup** and press **Enter**.
25) Specify **Lamp Install** and press **Enter**.
26) Press **Enter** to confirm the new Lamp installation.

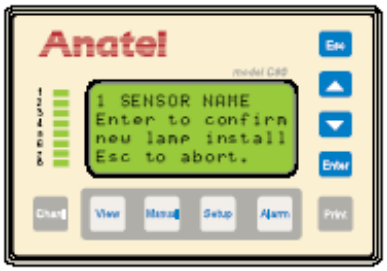


*Fig 13-14 :* Resetting the Lamp Counter

27) Press **Esc** repeatedly to exit the screen and return to the main menu.

## 13.5 Air Filter Cleaning

**Note:**
*Replacement Kit: P/N FG7013501*

Each Anatel A643a Analyzer is equipped with air filters which can become clogged over time, reducing performance and stressing components. The filters should be checked periodically and cleaned when necessary to guarantee unobstructed air flow through the instrument. The frequency of air filter cleaning depends on the ambient environment in which the instrument is located. Dirtier air demands more frequent filter cleaning.

To service the Anatel A643a's air filters:

1) Remove both the Water I/O and Electronics Covers as described in the preparatory procedures in "Preparatory Maintenance Procedures" on page 157.
2) Locate the two air filters on the bottom of the Analyzer enclosure, one positioned at each end of the instrument.

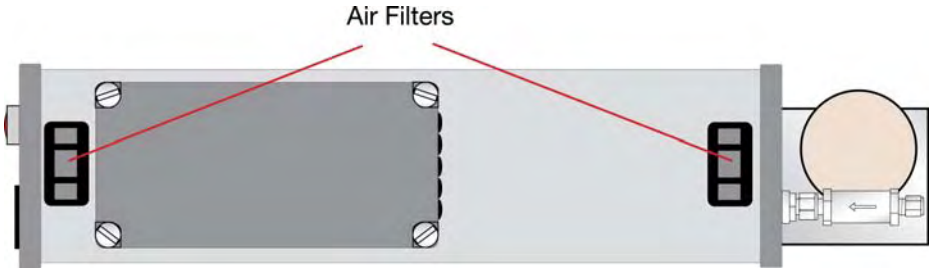


*Fig 13-15 :* Anatel A643a Air Filters

3) Remove and rinse out the two air filters. Allow them to dry completely before reinstalling them in the Analyzer.
4) Replace the two Analyzer covers.
5) Restore the sample water supply and re-establish power to the Analyzer.

## 13.6 Lithium Battery Replacement

**Note:**
*Replacement Kit: P/N FG5005601*

The Anatel A643a's lithium battery maintains all non-volatile (user-entered) parameters to prevent them from being erased from memory during an AC power loss. Although it possesses up to a 5-year life, the battery will eventually have to be replaced. **Code 11: Check Battery** indicates when the lithium battery is dead and must be replaced to ensure its backup capabilities. The battery replacement kit includes the lithium battery and a cable tie to secure it in position.

**CAUTION:**
*Any logged data will be lost and a* **Code 4** *will be reported when the battery is replaced. Print the data log as described in* "Printouts" on page 117 *to ensure a copy of the data.*

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Removing the existing battery will erase the Anatel A643a's parameter settings. Print them (see "Printouts" on page 117) if they differ from the factory settings so they can be restored after the battery is replaced. It also will be necessary to recalibrate the instrument following this procedure (see "Calibration and Validation" on page 81).

**CAUTION:**
*The A643a TOC Analyzer contains sensitive electronic components: take proper precautions to avoid potential damage due to electrostatic discharge (ESD).*

To check or replace the instrument's lithium battery:

1) Remove the Analyzer's Electronics Cover as outlined in "Preparatory Maintenance Procedures" on page 157.
2) Remove the Power Supply Assembly from the enclosure, being careful not to disconnect its DC power cable from the circuit board backplane.
3) Remove the 26-pin ribbon cable from the upper processor board and move it out of the way. On Access 643P portable instruments, also disconnect the 6-conductor flexible cable to the display module from the processor board.

*Fig 13-16 :* 26-Pin Connectors

4) Release the 26-pin ribbon cable from its connector on the lower I/O board.
5) Firmly grasp underneath the 26-pin connector block and gently pull on it to slide both boards out of the enclosure. They do not have to be removed from the enclosure entirely.

*Fig 13-17 :* Lithium Battery

6) Check the battery with a voltmeter. A voltage of 3.2 to 3.6 VDC is normal; less than 3.0 VDC and the lithium battery should be replaced.

**Note:**
*When replacing the battery, ensure that the positive (+) indicator on the battery is inserted at the positive end of battery holder.*

To replace the battery:

7) Cut the plastic cable tie and remove the old battery. Place the new battery in its holder, making sure to observe polarity.
8) Secure the battery in its holder with the new cable tie that is supplied with it.
9) Firmly but gently slide the boards back into the enclosure until they seat in their connectors.

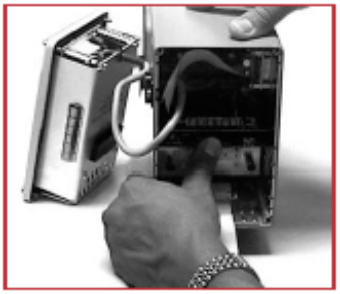

*Fig 13-18 :* Replace Battery

10) Reconnect the lower 26-pin cable and secure it in place in its connector by latching the tabs. The solid red line (designating Pin #1) should be positioned on the right side of the connector. Also tuck the ribbon cable back so that it does not obstruct the air filter located in the bottom of the enclosure.

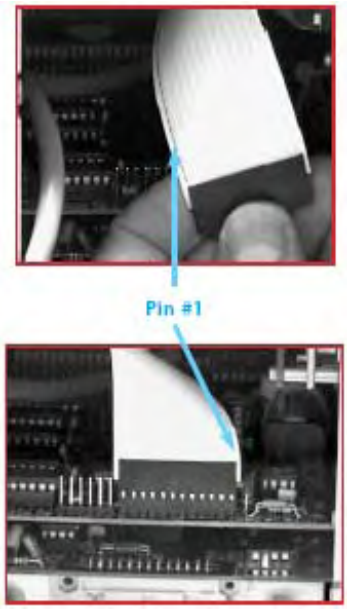


*Fig 13-19 :* Pin #1

11) Position the DC power cable on the right side of the flexible ribbon cable before reconnecting it to the processor board. For Access 643P Analyzers, the connector is the leftmost set of pins at the end of the processor board; for Anatel A643a Analyzers, it is the rightmost set of pins. In either case, the black dotted line (indicating Pin #1) on the ribbon cable should be on the right side.
12) Tuck the DC power cable in front of the flexible cable to prevent it from contacting exposed blades of the fan assembly and replace the Electronics Cover. Make sure the DC cable is not pinched between the power supply and the circuit boards.
13) Restore AC power to the Sensor. The Controller initially will report **Code 10** and **Code 11: Check Battery** when the Analyzer is first turned **ON**. This display is normal and should be ignored.
14) Referring to the printout and “Anatel A643a Setup” on page 51, restore any parameter settings that differ from the factory defaults, including the access password if one was specified.
15) Set the Analyzer’s internal clock as described in “System Time” on page 22.
16) Recalibrate the instrument as described in “TOC Calibration” on page 82.

**CAUTION:**
*Properly dispose of expired batteries. Lithium batteries present a fire, explosion and burn hazard—**do not** attempt to incinerate, recharge or disassemble them.*

## 13.7 Inlet Filter Replacement

**Note:**
*Replacement Kit: P/N FG7017201*

The Anatel A643a's 15 micron Inlet Filter prevents potential particulate contamination from entering the instrument. It should be checked yearly or if sample flow appears restricted. A replacement Strainer Element (P/N FG7017301) is available from Hach Ultra.

**CAUTION:**
*Always disconnect the instrument from its power source before attempting to access internal components.*

To replace the 15 Micron Inlet Filter:

1) Disconnect the A643a TOC Analyzer's AC power cord from its supply source.
2) Turn off the (user-supplied) isolation valve or otherwise stop sample flow to the instrument.
3) Disconnect the sample tubing from the instrument by loosening the **WATER IN** compression nut using a 9/16" wrench. Set the sample tubing aside for reassembly later.

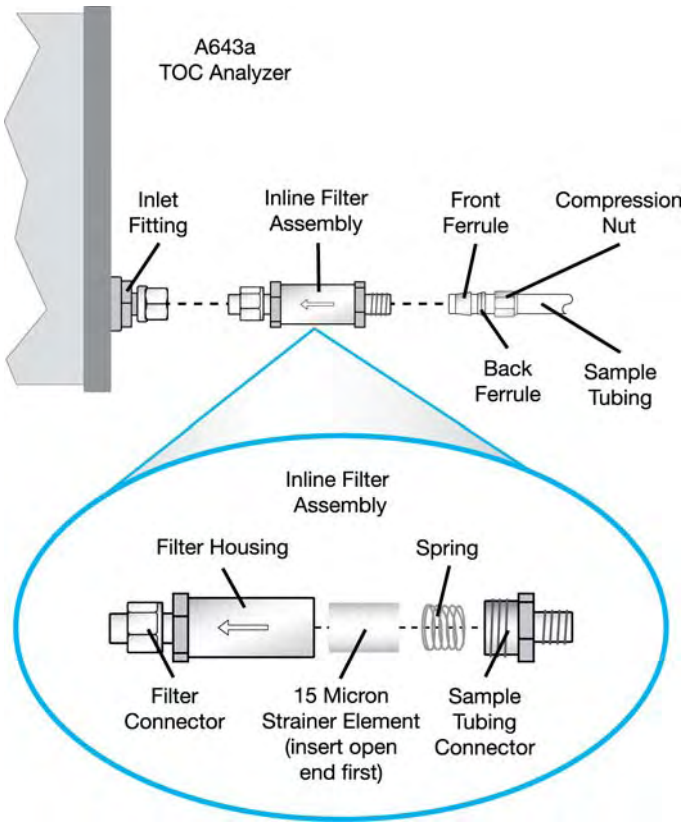


*Fig 13-20 :* Inline Filter Assembly

4) Unscrew the nut from the inlet (threaded) end of the Filter and remove the ferrule and collar that are held inside the nut (see Note).

**Note:**
*If the nut, ferrule and collar are not found as described in step 4, then step 4 through step 7 have already been performed at Anatel. In this case, the Inlet Filter appears as shown. Skip to step 8.*

5) Slide the nut on the outlet end of the Filter with the threads facing out.
6) Slide the collar on the outlet end of the Filter so that it fits inside the nut. The flat edge of the collar should face down inside the nut.

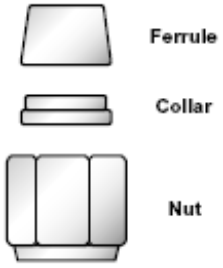


*Fig 13-21 :* Collar Position

7) Slide the ferrule on the outlet end of the Filter so that the narrow side of the “cone” faces up.
8) While gently but firmly pressing the filter housing toward the instrument, hand-tighten the Filter nut (with the collar and ferrule inside) onto the **WATER IN** bulkhead fitting.
9) Mark the surface of the Filter nut that is facing up with a pen or piece of tape to gauge how much to tighten the nut.
10) While continuing to press the Filter toward the instrument, tighten the nut one and a quarter full turns using the 9/16" wrench. Use the mark made on the nut in step 9 to determine when the full 1-1/4 turns are completed.The pressure fuses the collar, ferrule and nut together and locks them on the Filter housing.

**CAUTION:**
*Do not overtighten fittings, as leaks may result.*

11) Connect the sample tubing to the inlet end of the Filter with the compression nut using the 9/16" wrench.
12) Restore power and sample flow to the A643a TOC Analyzer and check for leaks. Tighten fittings as necessary.

The inline Filter is now installed. The 15 micron strainer element inside the filter housing should be checked yearly and replaced if sample flow appears to be restricted.

## 13.8 Printer Paper Replacement

**Note:**
*P/N FG 5005001 (25 rolls)*

The Seiko Instruments Model DPU-414 thermal printer is integral to the Anatel A643a–P and available as a desktop printer for local use with the Anatel A643a Analyzers. Refer to the Seiko *Operation Manual* for detailed information on the DPU-414 Printer. The *Manual* is provided with stand-alone printers and included in the Anatel A643a–P Installation Kits.

The appearance of a red stripe along the edges of the paper is an indication that the roll is getting low. The printer’s red OFFLINE LED flashes when the paper roll runs out.

**Note:**
*If paper has run out and the Anatel A643a has sent data to the printer, the green ONLINE LED also flashes. The data are output with their time and date stamps when the new paper roll is installed and the printer is placed back on-line.*

To replace the printer paper roll:

1) Cut the lead end of the paper roll so that the edge is straight.

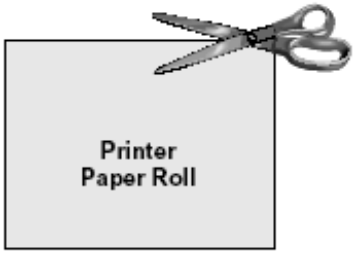


*Fig 13-22 :* Printer Paper Roll

2) Turn the power to the printer ON.
3) Open the transparent Paper Cover by lightly pushing up on the front of it, then towards the back of the printer.
4) Push the top of the paper into the inlet at the bottom of the Paper Holder until the auto-loader catches it and feeds about 10 cm past the serrated Paper Cutter.
5) Keep pressing the PAPER FEED switch until the paper feeds smoothly. When the paper is loaded correctly, the OFFLINE lamp stops blinking, but remains illuminated to indicate the printer is still in the OFFLINE mode.
6) Close the Paper Cover and push down on it to snap it into place.
7) Press the ONLINE button to restore normal operation. Any data accumulated after the previous roll expired are now printed.

# 14 Troubleshooting

## 14.1 General Information

In addition to the standard self-tests conducted by the Anatel A643a during its analyses, an extended diagnostic and reporting facility is incorporated to inform the user about the nature of a problem. Alarm Codes, in conjunction with user-initiated diagnostic tests, serve to isolate the source of the problem.

The checksum value of the Analyzer's controlling EPROM and its current firmware version may be displayed by pressing the **Chnl Key** twice. This ROM checksum is routinely calculated as part of the instrument's power-up diagnostics and is the same checksum value that would be produced by a device programmer. The ROM checksum and firmware version are also available on the Sensor Factory Configuration printout (see "Printouts" on page 117).

## 14.2 Alarm Codes

Functional range and logic checks are reviewed continuously to determine the functional status of each instrument during every analysis. If one or more alarms is detected, the Controller's display and the faulty Anatel A643a's corresponding LED begin flashing (see "Alarm Reporting" on page 105). The appropriate Code is logged for display and output to the printer. Any reported problems fall into two code classifications: hardware and water chemistry.

**Hardware alarms (Codes 1-99)** are indicative of either an electromechanical or analytical failure of the Analyzer. These alarms could result from such conditions as an exhausted UV lamp, a faulty solenoid valve or a hardware malfunction.

Computational results are still reported, and a recovery is attempted by initiating a new analysis cycle. If the recovery is successful, the red Channel LED returns to green (although the alarm is logged for display on the Controller and output to the associated printer) and normal operation resumes.

If the recovery is unsuccessful, attempts persist and the results of the most recent successful analysis are displayed. The Controller display and the Channel LED continue to flash red until acknowledged by pressing the **Alarm Key**. Once acknowledged, the relevant Code is displayed and the Controller stops flashing. But the Channel LED is not restored to green until a successful analysis cycle is completed. If an alarm occurs during a diagnostic test, the Analyzer will not attempt another measurement until the displayed alarm is acknowledged by pressing the **Alarm Key**. After the problem has been corrected, the diagnostic test may be re-initialized.

Each instrument maintains a log consisting of the Code number, the total number of occurrences of that particular type of alarm and a time stamp of its initial occurrence. The log is erased whenever power is cycled on the instrument or when the **ME** command is issued (see "Mode Set Commands" on page 149).

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*Table 14-1 :* Anatel A643a Alarm Codes

| **ElectroMechanical Alarm Codes —** | | |
|---|---|---|
| *Code* | *Instrument Display* | *Indication* |
| 1 | See Guide | Possible ROM performance issue. Call the Anatel Service Department. |
| 2 | See Guide | Possible RAM performance issue. Call the Anatel Service Department. |
| 3 | See Guide | Possible electronic timing issue.Check for electronic emissions from adjacent equipment or environment which may cause data transfer problems. If issue persists, call the Anatel Service Department. |
| 4 | See Guide | Possible disruption to the data log, which may be caused by a hardware performance issue or removal of the battery. Check the battery. If issue persists, call the Anatel Service Department. |
| 5 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 6 | See Guide | Possible hardware performance issue involving power to the network.Call the Anatel Service Department. |
| 7 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 8 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 9 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 10 | See Guide | Possible hardware performance issue or battery has been removed. Check the battery. If the issue persists, call the Anatel Service Department. |
| 11 | Check Battery | The lithium battery has expired. Replace the battery and recalibrate the instrument. |
| 12 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 13 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 14 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 15 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 16 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 17 | Check DAC | Possible hardware performance issue. Check the wiring connections to the DAC module (refer to “Analog Outputs” on page 121). If the issue persists, call the Anatel Service Department. |
| 18 | Check Network | Possible hardware performance issue). Check the network wiring connections (refer to “Network Installation” on page 39). If the issue persists, call the Anatel Service Department. |
| 19 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 20 | Duplicate ID | Two instruments have been assigned the same Channel ID. Check the instrument IDs and ensure they are unique. If issue persists, check the network wiring connections (refer to “Network Installation” on page 39). If the issue continues, call the Anatel Service Department. |
| 137 | Check Network | Check to ensure the network positive and negative wires are not reversed at the connector block (refer to “Network Installation” on page 39). If the issue persists, call the Anatel Service Department. |

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*Table 14-1 :* Anatel A643a Alarm Codes (Continued)

| **Analysis Alarm Codes—** | | |
|---|---|---|
| *Code* | *Instrument Display* | *Indication* |
| 21 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 22 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 23 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 24 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 25 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 26 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 27 | Conductivity Range | Water has drained from the analysis cell or the current sample vial is dry. Ensure that water is flowing normally through the instrument and it is in the correct orientation. If the issue persists, call the Anatel Service Department. |
| 28 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 29 | Water Conditions | Water has drained from the analysis cell or the current sample vial is dry. Ensure that water is flowing normally through the instrument and it is in the correct orientation. If the issue persists, call the Anatel Service Department. TOC detection limits may be too low for current water conditions. If the issue persists, call the Anatel Service Department. |
| 30 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 31 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 32 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 33 | Check UV Lamp | Replace the UV lamp. |
| 34 | Water Conditions | Possible hardware performance issue or TOC detection limits may be too high for current water conditions. |
| 35 | Water Conditions | Possible hardware performance issue or TOC detection limits may be too low for current water conditions. |
| 36 | Water Conditions | Current water conditions interfere with the TOC measurement. |
| 37 | Water Temp | Sample water temperature < 5 °C or possible hardware performance issue. A heat exchanger may be required. If issue persists, call the Anatel Service Department. |
| 38 | Water Temp | Sample water temperature >95 °C or possible hardware performance issue. A heat exchanger may be required. If issue persists, call the Anatel Service Department. |
| 39 | Conductivity Range | Conductivity of the water sample is too high for TOC measurement. Water has drained from the analysis cell or the current sample vial is dry. Ensure that water is flowing normally through the instrument and it is in the correct orientation. If the issue persists, call the Anatel Service Department. |
| 40 | Conductivity Range | Conductivity of the water sample is too low for TOC measurement. Water has drained from the analysis cell or the current sample vial is dry. Ensure that water is flowing normally through the instrument and it is in the correct orientation. If the issue persists, call the Anatel Service Department. |
| 42 | UV Lamp | Replace the UV lamp. |

*Table 14-1 :* Anatel A643a Alarm Codes (Continued)

| | | |
|---|---|---|
| 44 | Sys Suitability | The system suitability test should be repeated. |
| 45 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 46 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 47 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 48 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 49 | See Guide | Possible hardware performance issue. Call the Anatel Service Department. |
| 50 | Test Interrupt | A calibration or “grab sample” test was interrupted by a power loss. Check the vial or sample vessel and ensure proper operation. |
| 51 | Change Password | The 90-day limit has expired and the Password(s) must be changed (see “Password Security” on page 54). |
| 52 | UV Lamp Failing | UV Detect indicates that the UV lamp is degrading and the life of the lamp is extremely limited. Replace UV lamp as soon as possible. |
| 53 | UV Lamp Bad | UV Detect indicates that the UV lamp has failed and must be replaced immediately. |

## 14.3 Troubleshooting

With the exception of Codes **4**, **10**, **11** and **18**, the **Electromechanical Alarms** are not userserviceable. A **Code 4** alarm, if caused by changing the lithium battery, will result in lost data that cannot be recovered. A **Code 10** alarm can be corrected by restoring the factory default parameters (see “Factory Defaults” on page 51), then modifying them as necessary. A **Code 11: Check Battery** can be corrected by replacing the battery (see “Lithium Battery Replacement” on page 166). A **Code 18** or **Code 137** alarm indicates faulty communications; check A-Net wiring and contact Anatel if the problem persists.

The following alarms warrant a general check to verify that the isolation valve is open and the instrument’s sample valve is functional. This is done by watching the output of the drain line through an entire analysis. Flow should be unrestricted during the **Sample Time**, there should be absolutely no flow (watch for dripping from the drain tubing) during oxidation, and there should be no bubbles evident in the drain line at the start of a new analysis. In the case of alarms **34–36**, an hour or more of self-cleaning is recommended (see “Self-Cleaning Mode” on page 155).

| Code | Corrective Action |
|---|---|
| 27/29 | Check the water supply to the instrument for unobstructed, bubble-free flow or sample vial empty. |
| 32/33 | Check UV lamp connections; replace the UV lamp assembly if necessary. |
| 34 | If TOC is greater than 1000 ppb or the Analyzer has been idle for a long period prior to analysis, place the instrument in the Self-Clean Mode for at least one hour before attempting another analysis. If the problem persists, it is either a hardware problem or an unsuitable application; contact Anatel. |
| 35 | The sample valve is plugged or the UV lamp is going bad. Replace the UV lamp if necessary. |

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| Code | Corrective Action |
|---|---|
| 36 | In some cases, the accuracy of the reported TOC value may be affected by the presence of certain ions. This condition occurs primarily in water with less than 5 megohm-cm resistivity. If it persists, the sample water is unsuitable for Anatel A643a analysis. |
| 37/38 | Temperatures outside the range of 5 °C to 95 °C are considered hardware failures. If not, the sample is beyond the instrument's specifications. |
| 39/40 | An alert that the quality of the sample water is outside the instrument's optimum performance range. Measure the resistivity of the sample water. Large discrepancies in the measurements may be due to a hardware failure; contact Anatel. |
| 41 | Reports a suspended analysis cycle and does not affect instrument operation. |
| 42 | Replace the UV lamp (see "UV Lamp Maintenance" on page 158). |
| 44–50 | Repeat the test. For an alarm "Code 50," remove the vial, install the sample vessel and acknowledge to continue. Contact Anatel if failure continues. |
| 52 | Replace UV lamp as soon as possible. UV Detect has measured UV output that indicate a the UV lamp is beginning to fail. |
| 53 | Replace UV lamp immediately. UV Detect has measured UV output below adequate levels. |

**CAUTION:**
*When quitting a calibration or validation test after a reported failure* **(Codes 44–50)***, press the* **Manual Key** *and remove sample vial, replacing it with the sample vessel as prompted. This precaution ensures that the sample vial won't accidentally be blown off the sample needle by pressure applied from an on-line water source.*

During an analysis, the TOC and/or conductivity (or resistivity) must fall within an acceptable range depending on the chemical being measured. A screen identifying the chemical and the failure value is displayed if the range is exceeded.

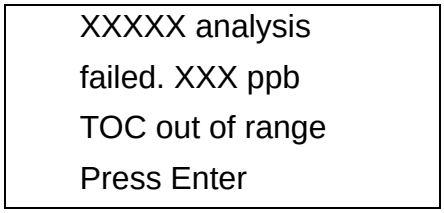


*Fig 14-1 :* Failure Identified

Possible causes for this alarm condition are:

- Contamination of the vial and/or sample assembly.
- A blockage or restriction in the sample delivery line, air inlet filter or inlet check valve.
- A restriction in the drain line.

The following limits apply to each of the Anatel A643a's Calibration tests. If the limits are exceeded, a message is logged and printed, and the results of the test will not be saved.

| | |
|---|---|
| **Conductivity Calibration Test** | The meter measurement must meet a tolerance of ±0.1 µS/cm. The cell constant also must not deviate from the previous calibration by more than 5%, or the factory calibration by more than 10%. |
| **TOC Calibration Test** | The percent change in slope must not deviate from the factory calibration by more than 15%. |
| **System Suitability Test** | If the calculated response efficiency is above 115% or below 85%, the Analyzer fails the test. A **Code 44: Sys Suitability** is reported every eight hours until a new system suitability is successfully performed. |
| **TOC Validation Test** | The recognized response must be within ±10% of the given standard value. A message is logged if the instrument fails the validation test. |

Any questionable problems should be referred to Anatel and the following information should be included in any correspondence with the factory:

- The instrument's serial number.
- Sample resistivity and temperature.
- Current and historical TOC data.
- Current and historical alarm codes.
- A Setup Printout.
- Process conductivity or resistivity and temperature.
- Current and historical calibration, validation and system suitability results.
- Any other significant changes in operating conditions.

If existing problems warrant equipment return, contact the Anatel Service Department at:

Hach Ultra Analytics, Inc.
5600 Lindbergh Drive
Loveland, Colorado 80538 U.S.A.

| | |
|---|---|
| Voice: | 800-866-7889 |
| | +1-541-472-6500 |
| FAX: | 1-970-663-9761 |
| Support Hot Line: | 800.866.7889<br>541.472.6500 |
| E-mail: | infogp@hachultra.com |
| Website: | www.hachultra.com |

***Do not*** return any equipment to Anatel without a return authorization.

**CAUTION:**
*Drain all water from the Analyzer when taking the instrument out of service (see* "Draining the Instrument" on page 181*). Residual water will freeze inside the unit, expand and damage the measurement cell. Such damage is time-consuming to repair and is not covered by the warranty.*

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### 14.3.1 Draining the Instrument

It is extremely important to drain the Anatel A643a of all water whenever the instrument is removed from its source for two reasons:

- When the Analyzer is removed from service for temporary or long term storage (longer than a month), any water remaining in the measurement cell is a medium for bacteria growth. In addition, elements contained in the sample water will settle and adhere to the instrument components causing contamination. It is strongly recommended that the Analyzer self-clean for an extended period of time when reinstalling it to ensure accurate and stable data.
- Draining the water out of the Analyzer also avoids freeze damage. If the Analyzer is stored or shipped in an extremely cold environment, the water inside the instrument will expand and could severely damage sensitive components. Replacing these components is expensive and will increase the amount of repair time as much as a week.

**Note:**
*Remember that an instrument stored in a warehouse in the winter can be freeze-damaged if water is left inside and a unit shipped from a warm climate to a cold climate is exposed to extreme temperatures en route.*

To purge the Anatel A643a of entrained water:

1) Press the **ON/OFF** button to turn the Analyzer off.
2) Close the (user-supplied) upstream isolation valve to terminate the water supply to the Analyzer.
3) Remove the sample vessel and empty it of any residual water.
4) Disconnect the sample tubing from the **WATER IN** connection. A small amount of water will be present in the instrument and its plumbing. The water drains from this connection due to gravity and its location at the bottom of the Analyzer's measurement cell. Take steps to catch this water when the tubing is disconnected so it doesn't spill onto the work surface.
5) Press the **ON/OFF** button once again to restore power to the Analyzer.
6) Press the **Manual Key** to access its menu selections.
7) Use the **Up** and **Down Keys** to select **Manual Samples** then press **Enter**.
8) Select **Grab Sample** to run a manual measurement and flush the Analyzer of any entrained water.
9) If necessary, press **Esc** and repeat step 6 through step 8. When the water is completely drained, press eto exit this operational mode.

**Note:**
*Once the water is drained from the Analyzer cell, a* **Code 27: Conductivity Range** *may be reported. This is normal due to the dry measurement cell.*

10) Turn the Analyzer off, disconnect it from its power supply, and cap the plumbing connections. The instrument is ready for shipment or storage. For any questions about performing this procedure, call the Anatel Application Specialists for assistance.

## 14.4 Sensor Diagnostics

Diagnostic tests conducted on individual Analyzers can be quite helpful in isolating the source of a reported alarm. The C80 Controller software is equipped with a series of user-initiated diagnostic and reporting capabilities that are designed to facilitate the resolution of detected problems. These internal tests can be conducted to verify the instrument's electronic, analysis and communications components to assure that they are functioning properly. The results of these diagnostic tests are reported on the display as well as on an automatic printout.

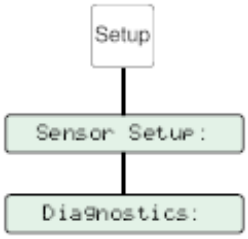


*Fig 14-2 :* Sensor Diagnostics

To perform Anatel A643a diagnostics:

1) With the suspect Analyzer selected in any View, press the **Setup Key** to access its menu selections.
2) Use the **Up** and **Down Keys** to specify **Sensor Setup**.
3) Press **Enter** to display its submenu.
4) Specify **Diagnostics** and press **Enter** to display the available options.
5) Specify the desired diagnostic area and then press **Enter** to display its function.

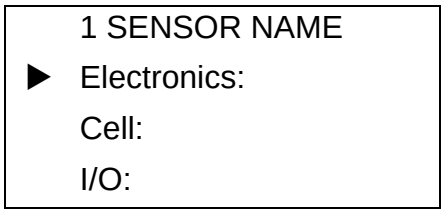


*Fig 14-3 :* Diagnostics Menu

### 14.4.1 Electronics Tests

The Analyzer's electronic diagnostics are divided into Voltage, Memory/Alarm and Display/ Print tests.

To conduct a diagnostic test on any of the Anatel A643a's electronic systems:

1) With the Analyzer's **Diagnostics Menu** displayed, specify Electronics and press **Enter** to access its options. Each of the **Electronics Menu** selections offers two diagnostic options:

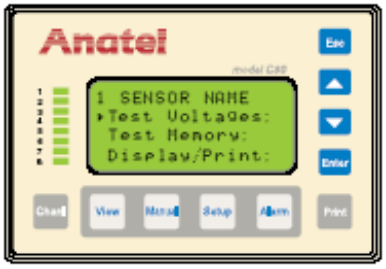


*Fig 14-4 :* Electronics Diagnostic Screen

**Test Voltages**

| | |
|---|---|
| **Voltages** | Is a pass/fail test which compares the current instrument voltages to their nominal baseline levels. |
| **Baselines** | Prints a list of the instrument's baseline voltage values. |

**Memory**

| | |
|---|---|
| **Test Memory** | Verifies that the instrument's RAM is functional. |

**Display/Print**

| | |
|---|---|
| **Display Test** | Verifies operation of the Analyzer's and the Controller's LCD by darkening all of the pixels in the display. |
| **Printer Test** | Confirms all characters are printing. |

2) Press **Enter** to execute the chosen operation. The results of the test are presented on the Controller's display and a printout is generated. Contact Hach Ultra if the Anatel A643a fails any of these tests.
3) Press **Esc** twice to return to the **Electronics Menu** to perform another circuitry test, or press it three times to return to the **Diagnostics Menu**.

### 14.4.2 Cell Tests

These tests facilitate manual control of the Anatel A643a's ultraviolet lamp, as well as its sample valves and pump and calibration resistor. Diagnostics testing interrupts the current TOC analysis; normal analysis resumes upon termination of the test.

To check the status of these two components:

1) With the Analyzer's **Diagnostics Menu** displayed, specify **Cell** and press **Enter** to access its options. The Cell Menu offers three options:

| | |
|---|---|
| **Lamp Test** | Sets the UV lamp to "On" or "Off." |
| **Valves/Pump** | Cycles through the four control states for the three solenoid valves and the internal pump. |
| **Cal Resistor** | Displays the inserted external calibration resistor's value. |

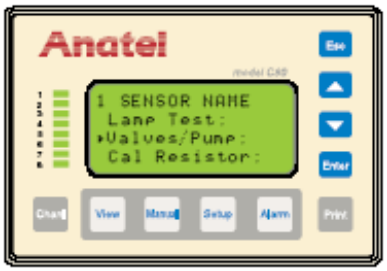


*Fig 14-5 :* Cell Diagnostics Screen

2) Use the **Up** and **Down Keys** to specify the desired diagnostic selection.

**CAUTION:**
*Make sure that the sample vessel is securely installed before initiating the Valves/Pump test.*

3) Press **Enter** to select the component's state. For the Valves/Pump test, the states of the three solenoid valves and pump are shown. There are four possible test settings:
   - On-line Flowing
   - Off-line Flowing
   - On-line No Flow
   - Off-line No Flow

```
1 SENSOR NAME
SV1   SV2  SV3/Pump:
ON    OFF  OFF
   On-line no flow
```

*Fig 14-6 :* Diagnostics Menu

**Note:**
*Solenoid Valve 3 (SV3) and the pump are controlled by the same output and, therefore, share the same state.*

4) Press **Esc** twice to return to the **Cell Menu** to perform the other function, or press it three times to return to the **Diagnostics Menu**.

If the analyzer is equipped with UV Detect technology the following responses will occur as a result of the lamp test, depending on the condition of the UV output.

| | **Good Lamp** | **Failing Lamp** | **Bad Lamp** |
|---|---|---|---|
| **1X 16 Display** | **Lamp ON** | **52-UV Failing** | **53- UV Lamp Bad** |
| C80 controller | 1 Sensor Name Output Test Passed! | 1 Sensor Name Output Test Failed! REPLACE UVlamp | 1 Sensor Name Output Test Failed! REPLACE UVlamp |
| Printer | | Code 52 UV Failing Urgent, U.V. lamp need replacement consult your manual or call the Anatel Service Dept @ 800-866-7885 | Code 53 UV Lamp Bad Urgent, U.V. lamp need replacement consult your manual or call the Anatel Service Dept @ 800-866-7885 |

### 14.4.3 I/O Tests

These diagnostics verify the operation of the Anatel A643a's serial and digital I/O circuits. An external loopback connector is required for these tests and should be attached to the appropriate Analyzer port.

To check operation of the I/O connections:

1) With the Analyzer's **Diagnostics Menu** displayed, specify I/O and press **Enter** to access its options. The **I/O Menu** offers two options:

**RS–232 Test** Runs an individual loopback test on each of the connected serial ports. A jumper must be applied to the RxD and TxD terminals on each of the instrument's serial ports as shown.

**Digital I/O** Verifies the instrument's digital input and output connectors. A jumper must be applied across the Analyzer's digital input and output terminals as shown.

**DAC Out Test** Verifies the instrument's analog output to an optional external DAC module.

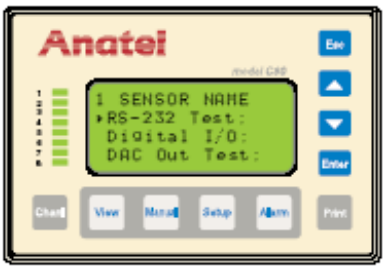


*Fig 14-7 :* I/O Diagnostics Screen

2) Use the **Up** and **Down Keys** to specify the desired communications test.
3) Press **Enter** to execute the test. The results are presented on the Controller display and a corresponding printout is generated. If the instrument fails either of the tests, check the wiring before contacting Anatel for assistance.
4) Press **Esc** repeatedly in order to return to previous display screens.

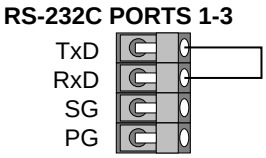


*Fig 14-8 :* RS-232 Loopback Wiring

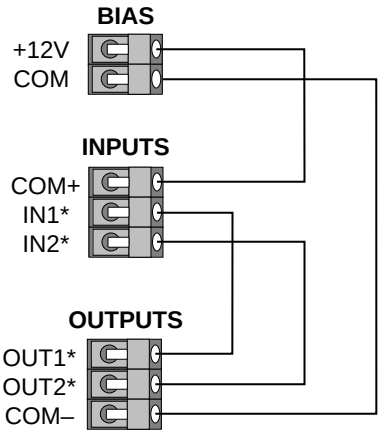


*Fig 14-9 :* Digital I/O Loopback Wiring

### 14.4.3.1 DAC Output Test

The analog signal that the Anatel A643a sends to an optional external DAC module can be verified over the chosen output range. Simply attach a multimeter to the module's input terminals to monitor the accuracy of the instrument's display.

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To test the DAC output:

1) With the Analyzer's I/O **Diagnostics Menu** displayed, specify **DAC Out Tes**t and press **Enter**.

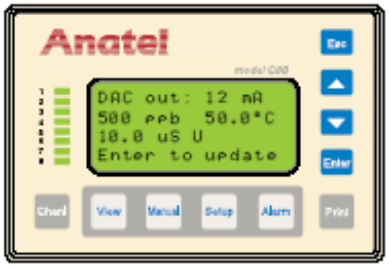


*Fig 14-10 :* DAC Output Test Screen

2) Use the **Up** and **Down Keys** to specify the desired mA output. The available selections are within the minimum and maximum values over the specified range (4–20 or 0–20) in 1 mA increments.
3) With the appropriate mA output showing on the Controller, press **Enter** and the TOC, temperature and conductivity readings proportional to the chosen analog output are displayed. The displayed readings should reflect those observed at the external DAC module.
4) Repeat the procedure to verify the DAC output over its entire range, if desired.

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# Appendix A: Service Procedures

## A.1 Return Procedures

To return the A643a TOC Analyzer for service, first obtain a returned material authorization number (RA#). The RA# is necessary for any instrument that requires repair or calibration by an authorized service center. Include the RA# on the shipping label when the instrument is returned.

While the RA# process is described in this section, for the most up-to-date RA# process information, including copies of all required forms, call Hach Ultra at 800.866.7889 or +1 541.472.6500.

To return an instrument for credit, please contact the local sales representative.

**WARNING**

*The following actions must be performed when returning any unit for any reason to prevent personal injury and/or damage to the unit.*

- Before shipping or storing the unit, run a test without attaching a sample vial to purge the unit of all liquid.
- All analyzers returned for repair or replacement must be thoroughly cleaned with all process material removed.
- Sludge contains bacteria that could be hazardous to Hach Ultra personnel. If a contaminated unit is received, Hach Ultra reserves the right to have the unit removed and destroyed by a hazardous material disposal team at the shipper's expense.

## A.2 Technical Support Information

Technical Support Engineers are available to provide high quality advice and recommendations for applications, product operation, measurement specifications, hardware and software, factory and customer site training.

Please provide name, company, phone, fax, model number, serial number and comment or question.

**Global Headquarters**
Service Department
6, route de Compois, C.P. 212,
CH-1222 Vésenaz, Geneva, Switzerland
Tel 41 22 594 64 00 Fax 41 22 594 64 88
www.hachultra.com

Call +1 (541) 472-6500
Toll Free (800) 866-8854 (US/CA)
Fax +1 (541) 474-7414
6:00 AM to 5:00 PM Pacific Time
Monday through Friday
Email: TechSupportGP@hachultra.com

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# Appendix B: Specifications and Accessories

## B.1 Performance Specifications

The Anatel A643a TOC Analyzer is specifically designed for use in applications that monitor ultrapure water with a typical conductivity less than 0.2 microsiemens/cm (as high as 5.0 µS/cm for pH neutral waters) compensated to 25 °C.

At a minimum, the Anatel A643a System consists of a single Analyzer and a C80 Controller. The maximum configuration may contain up to 8 Analyzers and 8 Controllers in addition to a host computer and associated input/output devices.

**Note:**
*Anatel A643a Specifications are subject to change without notice.*

### PERFORMANCE

| **TOC Mode** | |
|---|---|
| Operating Range: | 1 to 1000 ppb as carbon |
| Resistivity: | 0.01 to 18.2 M.-cm |
| Conductivity: | 0.05 to 150 µS/cm (@ 25 °C) |
| Display Resolution: | 1 ppb |
| Online Repeatability†: | ±1% or 1ppb (whichever is greater) |
| Maximum Input Conductivity: | 0.2 µS/cm for all waters<br>1.0 µS/cm for all neutral waters<br>5 µS/cm for water with $CO_2$ as the sole conductive species |
| Ambient Operating Temperature:<br>Anatel A643a–S Analyzer:<br>Anatel A643a–P Analyzer: | <br>15 °C to 40 °C (59 °F to 104 °F)<br>15 °C to 35 °C (59 °F to 95 °F) |
| Sample Water Temperature: | 5 °C to 65 °C (41 °F to 149 °F)** |
| Sample Inlet Flow Rate: | 60 mL/min to 300 mL/min |
| Sample Inlet Pressure: | 10 psi to 100 psi (69 to 690 kPa) |

**Note:**
*† Repeatability of reading on an individual instrument.*
*** Sample water temperature specification stated without external heat exhanger. For sample water over 65 °C a CX-20 heat exchanger is highly recommended.*

| Conductivity (Purge) Mode | |
|---|---|
| Conductivity Mode: | Temperature Compensated to 25 °C or Uncompensated |
| Conductivity Range: | 0.05 to 150 µS/cm (@ 25 °C) |
| Display Resolution: | 0.01 µS/cm |
| Resistivity Range: | 0.01 to 18 M.-cm (@ 25 °C) |
| Display Resolution: | 0.1 to 14.9 M.-cm,<br>1.0 M.-cm from 15 to 18 M.-cm |
| Conductivity Accuracy‡: | 2% over Full range<br>(Uncompensated) |

**Note:**
*‡ Repeatability of reading from instrument-to-instrument*

| Calibration & Validation | |
|---|---|
| **TOC** | |
| Up to Four-Point Calibration: | 0 ppb C (blank), 250 ppb C,<br>500 ppb C, 750 ppb C (all sucrose) |
| One- to Three-Point Validation: | 250 ppb C, 500 ppb C,<br>750 ppb C (sucrose) |
| System Suitability: | 500 ppb C (sucrose),<br>500 ppb C (1-4,benzoquinone) Reagent Blank |
| **Conductivity** | |
| One-Point Calibration, Cell Constant: | 100 µS/cm solution |
| One-Point Validation of Meter: | 61.9 K. resistor |

## PHYSICAL

| General | |
|---|---|
| Installation Category: | II, IEC 1010 |
| Pollution Degree: | 2, IEC 664 |

| A-Net Network Capacities | |
|---|---|
| Type: | RS-485 |
| Maximum Sensors: | 8 |
| Maximum C80 Controllers (any configuration): | 8 |
| Maximum Network Length: | 1 km (3,000 ft) |
| Network Cabling: | Shielded Twin-axial, Twist-Lock BNC |

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### B.1.1 Anatel A643a–S Analyzer

**Note:**
*P/N FG1002701*

The Anatel A643a–S is the basic component in the TOC Analysis System.

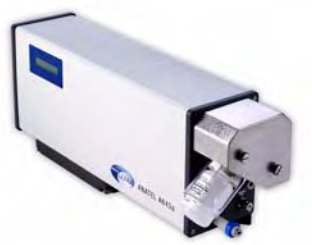

*Fig B-1 :* Anatel A643a–S TOC Analyzer

| **Display** | |
|---|---|
| Main: | 1-line x 16-character Super-Twist LCD |
| Backlighting: | Yellow LED |
| Character Height: | 0.163” |

| **Physical** | |
|---|---|
| Operating Temperature: | 15 °C to 40 °C (59 °F to 104 °F) |
| Maximum Relative Humidity: | 100% RH (non-condensing) |
| Maximum Altitude: | 4,000 m (13,125 ft) |
| Size<br>(including sample vessel assembly): | 193 mm H x 489 mm W x 119 mm D<br>(7.6” H x 19.25” W x 4.7” D) |
| Weight: | 6.58 kg (14.5 lb) |
| Analysis Cell Volume: | 0.4 mL |
| Power: | 100 to 240 VAC ±10%, 50/60 Hz |
| Power Consumption: | 2 Amps max. @ 120 VAC,<br>1 Amp max. @ 230 VAC |
| Fuse: | 3 Amp, 250 VAC Fast-Blow |
| Power Cord:<br>100 to 120 VAC Main<br><br><br><br>208 to 230 VAC Main | <br>Rating: 125 VAC, 10 Amp<br>Foil Shield 100%, Braid Shield 85%<br>Connectors: IEC 320–C13 and NEMA 5–15P<br><br>Rating: 250 VAC, 10 Amp<br>Foil Shield 100%, Braid Shield 85%<br>Connectors: IEC 320–C13 and CEE 7/7or CEI 23–16/VII<br>(or like, depending on country) |

| I/O Connections | |
|---|---|
| Analog: | Opto-isolated 4-20 mA output<br>Non-isolated 12 VDC output @ 1/2 Amp max. |
| Digital I/O: | Two opto-isolated inputs<br>Two opto-isolated outputs |
| Serial Interfaces: | RS485 opto-isolated Network<br>RS232 Data Acquisition<br>RS232 Printer<br>RS232 Diagnostics |

## B.1.2 Anatel A643a–P Analyzer

**Note:**
*P/N FG1002801*

The Anatel A643a–P combines a C80 Controller, handle, feet, the standard Analyzer and a 40-column thermal printer to provide a complete and integrated portable TOC analysis system.

*Fig B-2 :* Anatel A643a–P TOC Analyzer

| Display — | |
|---|---|
| Main: | 4-line x 16-character Super-Twist LCD |
| Backlighting (adjustable): | Yellow LED |
| Character Height: | 0.163” |

| Physical | |
|---|---|
| Operating Temperature: | 15 °C to 35 °C (59 °F to 95 °F) |
| Maximum Relative Humidity: | 100 % RH (non-condensing) |
| Maximum Altitude: | 4,000 m (13,125 ft) |
| Size<br>(including sample vessel assembly): | 193 mm H x 489 mm W x 119 mm D<br>(7.6” H x 19.25” W x 4.7” D) |
| Weight: | 8.85 kg (19.5 lb) |

| Physical | |
|---|---|
| Analysis Cell Volume: | 0.4 mL |
| Power: | 100 to 240 VAC ±10%, 50/60 Hz |
| Power Consumption: | 2 Amps max. @ 120 VAC,<br>1 Amp max. @ 230 VAC |
| Fuse: | 3 Amp, 250 VAC Fast-Blow |
| Power Cord:<br>100 to 120 VAC Main:<br><br><br>208 to 230 VAC Main — | <br>Rating: 125 VAC, 10 Amp<br>Foil Shield 100%, Braid Shield 85%<br>Connectors: IEC 320–C13 and NEMA 5–15P<br><br>Rating: 250 VAC, 10 Amp<br>Foil Shield 100%, Braid Shield 85%<br>Connectors: IEC 320–C13 and CEE 7/7 or CEI 23–16/VII (or like, depending on country) |

| I/O Connections | |
|---|---|
| Analog: | Opto-isolated 4-20 mA output<br>Non-isolated 12 VDC output @ 1/2 Amp max. |
| Digital I/O: | Two opto-isolated inputs<br>Two opto-isolated outputs |
| Serial Interfaces: | RS485 opto-isolated Network<br>RS232 Data Acquisition<br>RS232 Printer<br>RS232 Diagnostics |

### B.1.3 C80 Controller

**Note:**
*P/N FG1000201 (120 VAC, 60 Hz)*
*P/N FG1000301 (230 VAC, 50 Hz)*

The Model C80 Controller provides multiple Sensor display, individual instrument setup, system alarm indication and printer control functions for up to 8 Sensors via an RS-485 Network.

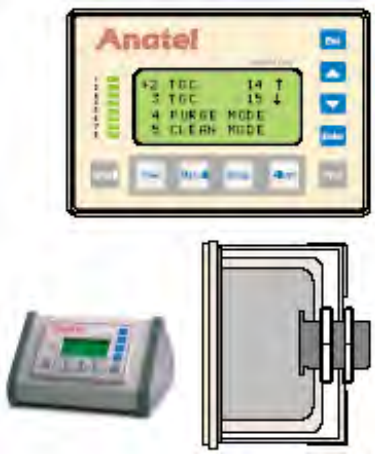


*Fig B-3 :* C80 Controller

| **Displays** | |
|---|---|
| Main: | 4-line x 16-character Super-Twist LCD |
| Channel: | 8 Bi-color (red/green) LEDs |

| **Physical** | |
|---|---|
| Operating Temperature: | 0°C to 40°C (32°F to 104°F) |
| Maximum Relative Humidity: | 90% RH |
| Maximum Altitude: | 4,000 m (13,125 ft) |
| Power: | 9 VDC Power Pack<br>(120 VAC ±10%, 60 Hz standard,<br>230 VAC ±10%, 50 Hz optional) |
| Power Consumption: | 7.6 W max. |
| Case: | ABS front panel with Lexan overlay |
| Size: | 120 mm L x 81 mm W x 48 mm D<br>(4.7” L x 3.2” W x 1.9”D)<br>2.5” total depth behind panel<br>(allow 4–5” to avoid crimping) |
| Weight: | 0.75 kg (1.5 lb) |
| Mounting: | Panel |

| **Connections** | |
|---|---|
| Communications: | Shielded Twin-axial, Twist-Lock BNC |

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## B.2 Accessories

### B.2.1 Thermal Printer

**Note:**
*P/N FG2009401*

The Seiko Instruments Model DPU-414 Type II is a 40-column thermal printer. It can operate as a standalone reporting device with the Anatel A643a–S and is integrated into the design of the Anatel A643a–P.

The Anatel A643a–P printer's onboard NiCad battery is not field-replaceable: contact Anatel for replacement. The battery can be recharged, however, by turning the printer "OFF" and the A-643a–P "ON" for eight hours.

*Fig B-4 :* Thermal Printer

| **Print** | |
|---|---|
| Method: | Thermal Serial Dot-Matrix |
| Format: | 9 dots high x 7 dots wide |
| Speed: | 52.5 characters per second (cps) |
| Width: | 89.6 mm |
| Paper Size: | 112 mm, 40-column |
| Buffer: | 7400 characters |

| **Physical** | |
|---|---|
| Temperature Range: | 0 °C to 40 °C (32 °C to 104 °C) |
| Humidity: | 30 to 80% RH (non-condensing) |
| Power (via wall transformer): | 120 VAC, 60 Hz Standard<br>230 VAC, 50 Hz Optional |
| NiCad Battery (643P only): | 4.8 VDC, 1.5 Amp |
| Maximum Power Consumption: | Negligible |

| Physical | |
|---|---|
| Dimensions: | 160 mm W x 170 mm L x 66.5 mm D<br>(6.3” W x 6.7” L x 2.6” D) |

| Connections | |
|---|---|
| Interface: | RS232 Serial, 1200 Baud |

To order these materials, contact a local Hach Ultra representative or contact the factory at 800-866-7889 or +1-541-472-6500.

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# Appendix C: Certifications

## C.1 Overview

This section contains the Declaration of Conformity certificate. For more information, contact a local Hach Ultra representative or contact the factory at 800-866-7889 or +1-541-472-6500.

# DECLARATION OF CONFORMITY

DECLARATION DE CONFORMITE, ÜBEREINSTIMMUNGSERKLÄRUNG, DICHIARAZIONE DI CONFORMITÀ, DECLARACION DE CONFORMIDAD

**MODEL:**
Modèle, Modell, Modello, Modelo

Anatel Access 643 Total Organic Carbon (TOC) Analyzer model(s):
A643a-S with C80 Controller and DPU-414 Thermal Printer
A643a-P
TOC600 with C80 Controller and DPU-414 Thermal Printer

**PART NO.:**
Référence, Teilnummer,
Numero de referimento, Referencia:

FG1002701 with FG1000302 and FG2009401
FG1002801
FG1100600 with FG1000302 and FG2009401
*Above model part numbers may have "-UV" for UV light detector option*

**THIS PRODUCT COMPLIES WITH THE FOLLOWING EUROPEAN COMMUNITY DIRECTIVES**

Ce produit est conforme aux directives de la Communauté Européenne suivantes
Dieses Produkt enspricht den nachstehend aufgeführten Richtlinien der Europäischen Union
Questo prodotto è conforme alle seguenti direttive della Comunità Europea
Este producto cumple con las directivas siguientes de la Comunidad Europea

Low Voltage Directive 73/23/EEC, 93/68/EEC
Electromagnetic Compatibility Directive 2004/108/EC

**THE FOLLOWING STANDARDS WERE USED TO VERIFY COMPLIANCE WITH THE DIRECTIVES:**

Les normes suivantes ont été appliquées pour vérifier que ce produit soit conforme aux directives
Die folgenden Normen wurden zur Prüfung der Übereinstimmung mit diesen Richtlinien angewendet
Sona state usate lo seguenti norme per verificare la conformità alle direttive
Las normas siguientes han sido utilizadas para verificar que el producto cumpla con las directivas

Emissions:
EN 61000-3-2: 00 Harmonic Current Emissions Limits
EN 61000-3-3: 95 Voltage Fluctuation and Flicker Limits
EN55011: 98 (Class B emissions limits)
EN 61326: 98 (Class B) RF Emissions

Immunity:
EN 61326: 98 (Annex B) Controlled Environment Equipment
EN 61000-4-2: 95 (ESD), EN 61000-4-3: 97 (EM)
EN 61000-4-4: 95 (Burst), EN 61000-4-5: 95 (Surge)
EN 61000-4-6: 97 (Conducted RF), EN 61000-4-11: 94 (Voltage Interrupts)
ENV 50204: 95

Electrical Safety:
EN 61010-1: 01

**Year CE Mark Originally Affixed to Product:** 2004
Année de l'application originale du marquage CE au produit
Jahr der ersten CE Markierung des Produktes
Anno del marchio CE iniziale del prodotto
Año de la primera aplicación de la marca CE al producto

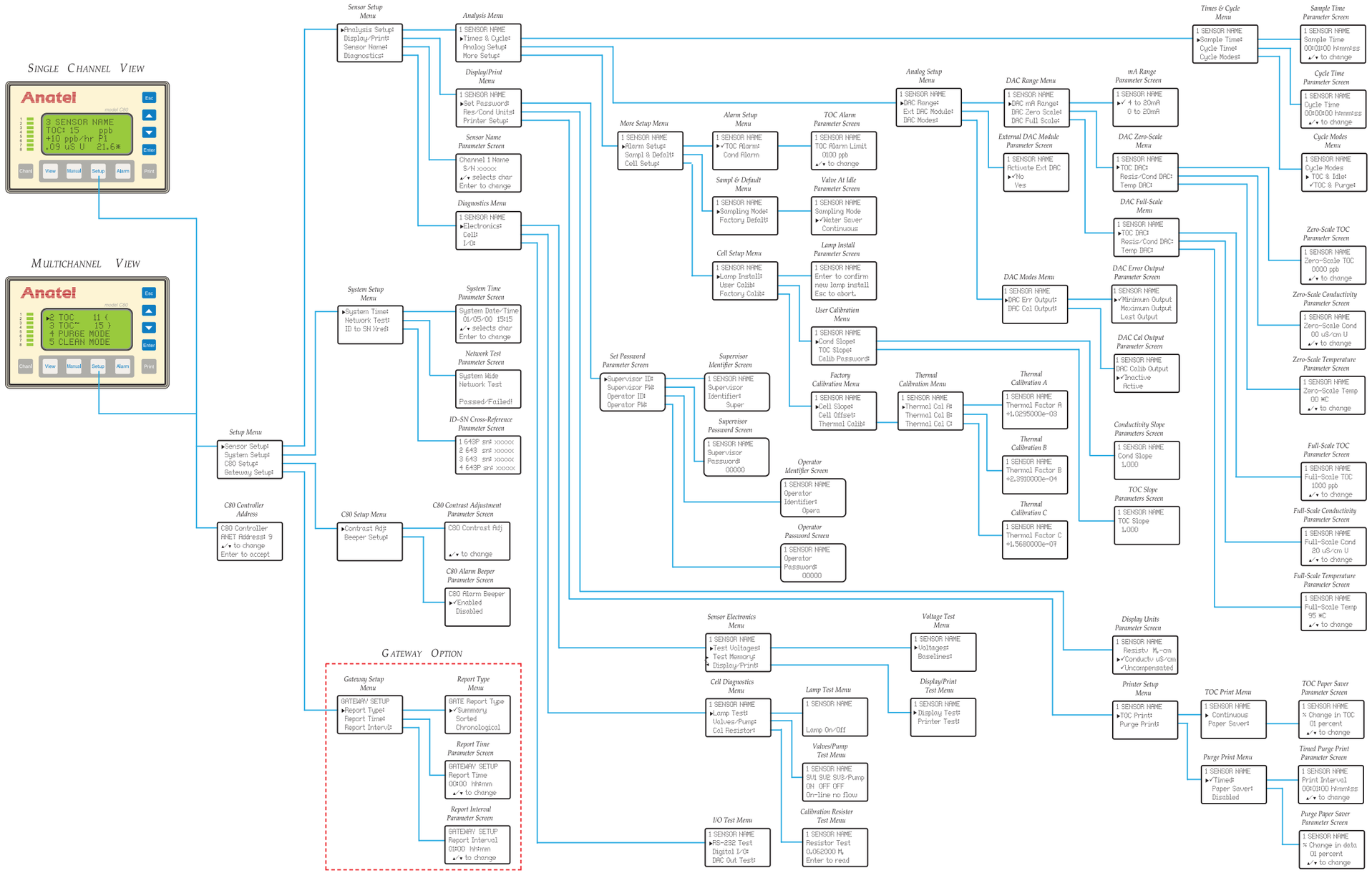
Matt Roberts
Director of Engineering Services

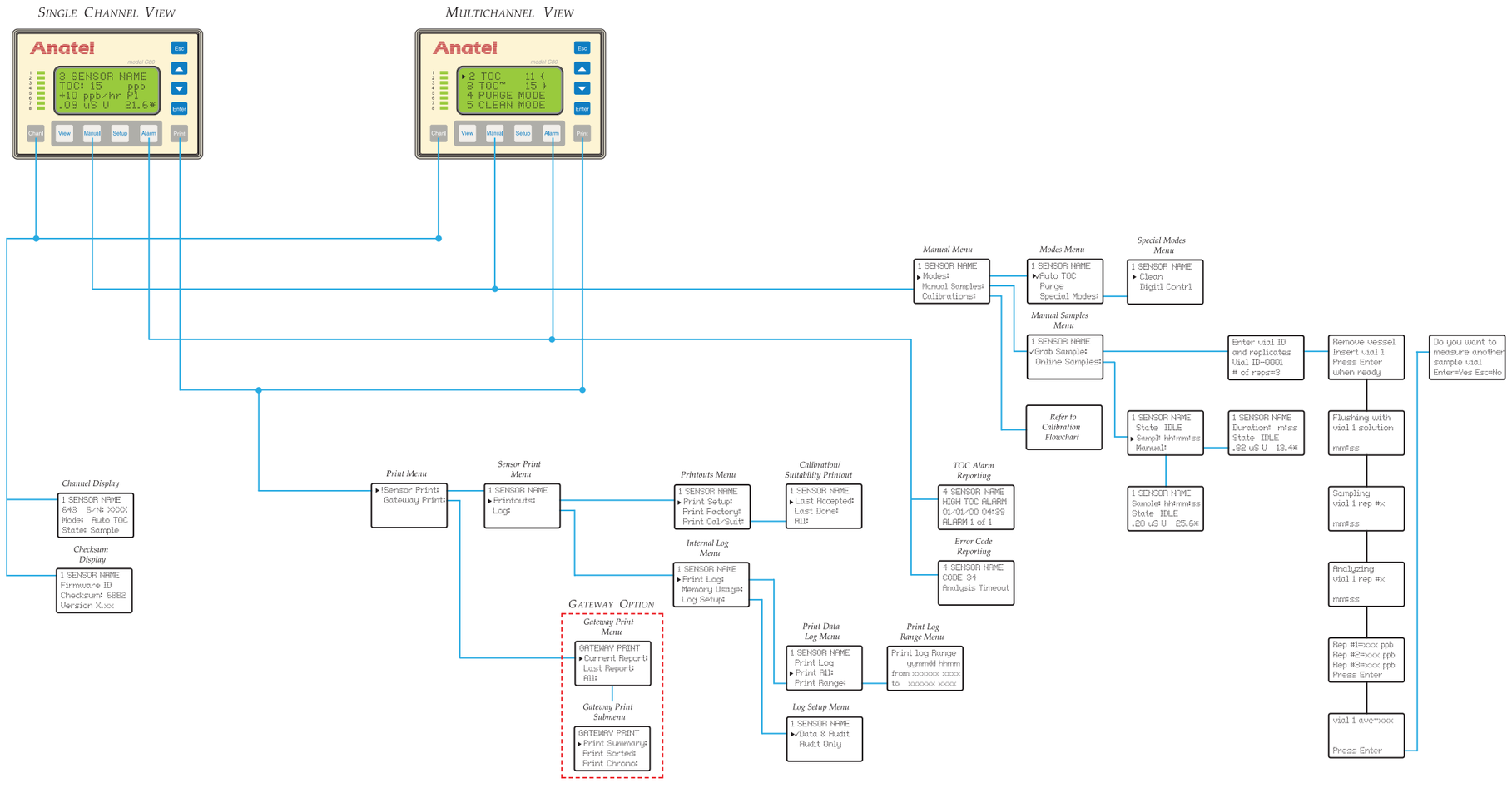
9-10-2006
**Date**
Date, Datum, Data, Fecha

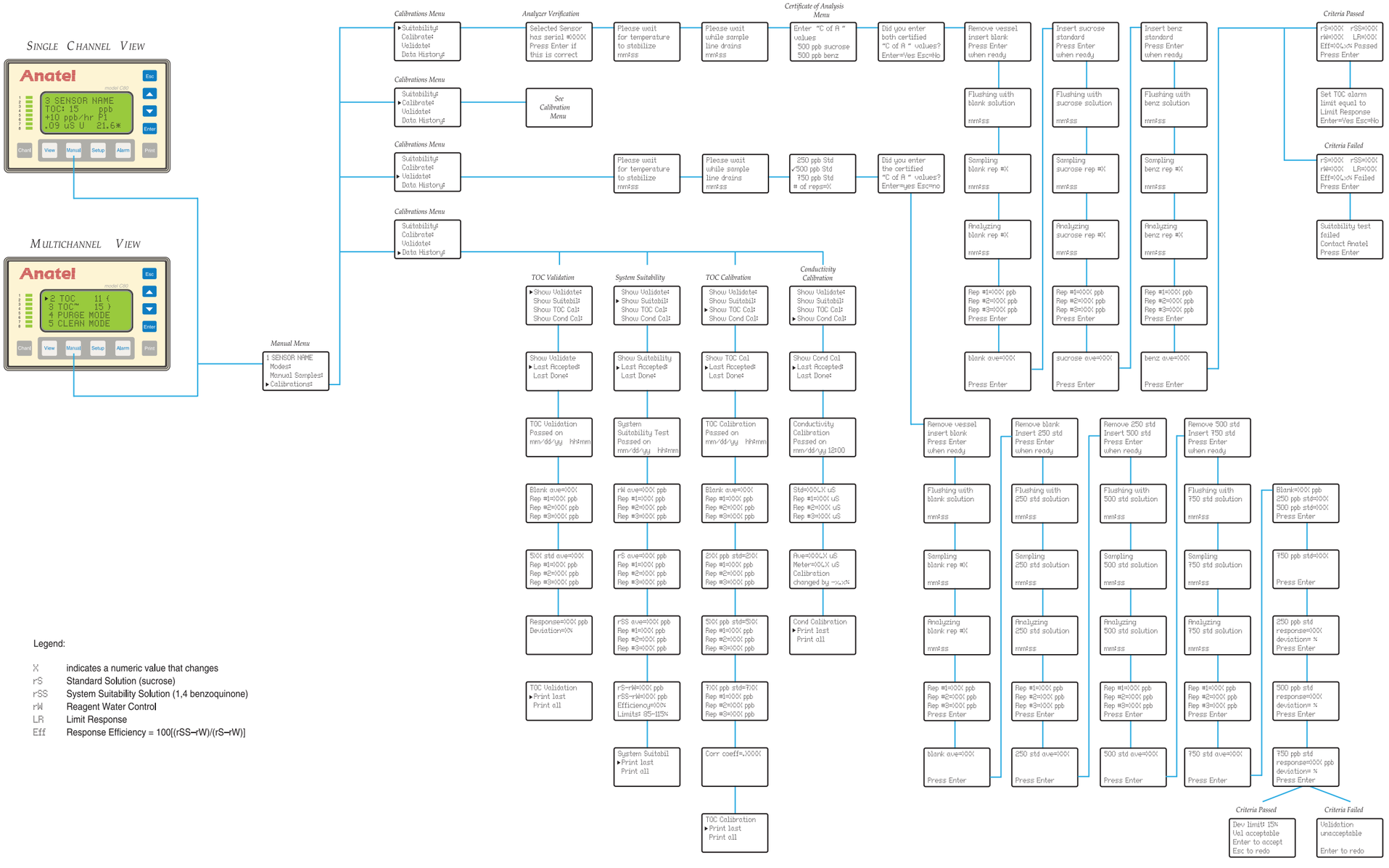
HACH®
Be Right™

**Anatel Corporation | 5600 Lindbergh Drive | Loveland, Colorado 80539 | 970.669.3050 |**

# Appendix D: Anatel A643a Menu Flowcharts

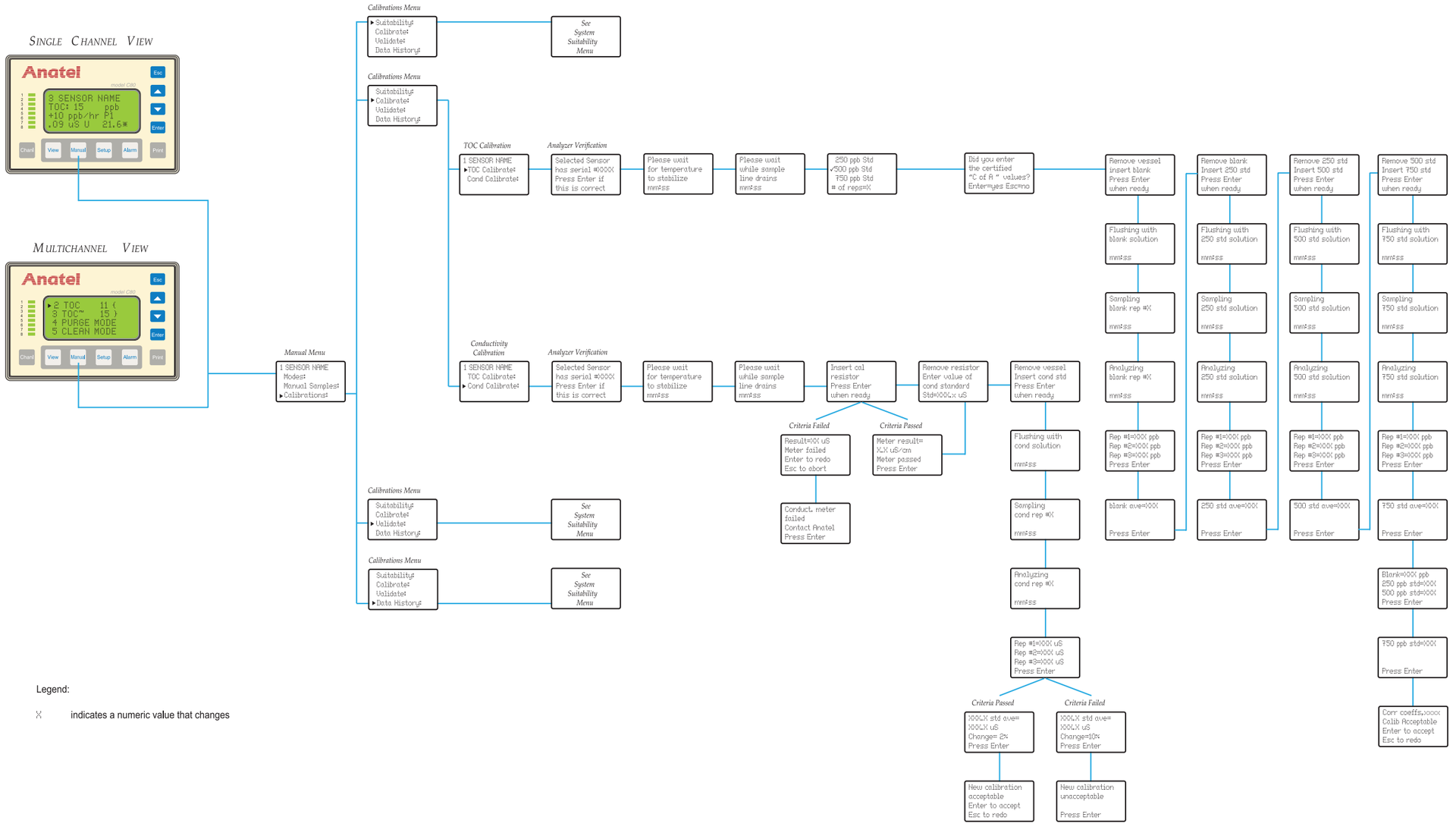



SINGLE CHANNEL VIEW
MULTICHANNEL VIEW
Anatel
model C80
Esc
Enter
Chan1
View
Manual
Setup
Alarm
Print
3 SENSOR NAME
TOC: 15 ppb
+10 ppb/hr P1
.09 uS U 21.6*
2 TOC 11 (
3 TOC~ 15 )
4 PURGE MODE
5 CLEAN MODE
Channel Display
1 SENSOR NAME
643 S/N: XXXX
Mode: Auto TOC
State: Sample
Checksum Display
1 SENSOR NAME
Firmware ID
Checksum: 6BB2
Version X.xx
Print Menu
!Sensor Print:
Gateway Print:
Sensor Print Menu
1 SENSOR NAME
Printouts:
Log:
Printouts Menu
1 SENSOR NAME
Print Setup:
Print Factory:
Print Cal/Suit:
Calibration/ Suitability Printout
1 SENSOR NAME
Last Accepted:
Last Done:
All:
Internal Log Menu
1 SENSOR NAME
Print Log:
Memory Usage:
Log Setup:
GATEWAY OPTION
Gateway Print Menu
GATEWAY PRINT
Current Report:
Last Report:
All:
Gateway Print Submenu
GATEWAY PRINT
Print Summary:
Print Sorted:
Print Chrono:
Print Data Log Menu
1 SENSOR NAME
Print Log
Print All:
Print Range:
Print Log Range Menu
Print log Range
yymmdd hhmm
from xxxxxx xxxx
to xxxxxx xxxx
Log Setup Menu
1 SENSOR NAME
Data & Audit
Audit Only
Manual Menu
1 SENSOR NAME
Modes:
Manual Samples:
Calibrations:
Modes Menu
1 SENSOR NAME
Auto TOC
Purge
Special Modes:
Special Modes Menu
1 SENSOR NAME
Clean
Digitl Contrl
Manual Samples Menu
1 SENSOR NAME
Grab Sample:
Online Samples:
Refer to Calibration Flowchart
Enter vial ID and replicates
Vial ID=0001
# of reps=3
Remove vessel
Insert vial 1
Press Enter when ready
Do you want to measure another sample vial
Enter=Yes Esc=No
1 SENSOR NAME
State IDLE
Sample: hh:mm:ss
Manual:
1 SENSOR NAME
Duration: mi:ss
State IDLE
.82 uS U 13.4*
Flushing with vial 1 solution
mm:ss
1 SENSOR NAME
Sample: hh:mm:ss
State IDLE
.20 uS U 25.6*
Sampling
vial 1 rep #x
mm:ss
Analyzing
vial 1 rep #x
mm:ss
Rep #1=xxx ppb
Rep #2=xxx ppb
Rep #3=xxx ppb
Press Enter
vial 1 ave=xxx
Press Enter
TOC Alarm Reporting
4 SENSOR NAME
HIGH TOC ALARM
01/01/00 04:39
ALARM 1 of 1
Error Code Reporting
4 SENSOR NAME
CODE 34
Analysis Timeout




Legend:

| | |
|---|---|
| X | indicates a numeric value that changes |
| rS | Standard Solution (sucrose) |
| rSS | System Suitability Solution (1,4 benzoquinone) |
| rW | Reagent Water Control |
| LR | Limit Response |
| Eff | Response Efficiency = 100[(rSS–rW)/(rS–rW)] |




Legend:

X indicates a numeric value that changes

# Appendix E: Material Data Safety Sheets

There are some inherent hazards associated with using the Anatel 643a TOC Analyzers. 1,4-benzoquinone, for instance, is one of the reagents that is used for system suitability testing of the instrument. This chemical produces hazardous waste byproducts. The resulting effluent is potentially dangerous both personally and environmentally.

**CAUTION:**
*In the event of instrument failure, the sample discharge may contain 1,4-benzoquinone, a hazardous substance.*

Exercise extreme care and use established handling practices when working with chemicals. All chemicals should be considered hazardous—*avoid direct contact with skin or clothing.* Refer to Section 2.3.2 for recommendations on properly plumbing the instrument; ***Anatel 643a wastes must be disposed of in accordance with all applicable local regulations.***

The attached Material Safety Data Sheets (MSDS) are furnished to provide users with the chemical properties and precautionary procedures for the reagents and calibration standards recommended for use in the Anatel 643a. Anatel cannot be responsible for the ultimate suitability or regulatory compliance of the chemicals used.

**Note:**
*Hach Ultra cannot address all health and safety issues associated with using the Anatel 643a Analyzer. Inherent dangers include the handling of hazardous chemicals. It is strongly recommended that you read the Operator Manual thoroughly before installing or operating the instrument. If you have any questions regarding the Anatel 643a, contact:*

| | | |
|---|---|---|
| Hach Ultra Analytics, Inc. | Voice: | 800-866-7889 |
| 5600 Lindbergh Drive | | +1-541-472-6500 |
| Loveland, Colorado 80538 U.S.A. | Fax: | 1-970-663-9761 |
| | Support Hot Line: | 800.866.7889 |
| | | 541.472.6500 |
| | E-Mail: | infogp@hachultra.com |
| | Website: | www.hachultra.com |

**Global Headquarters**
Service Department
6, route de Compois, C.P. 212,
CH-1222 Vésenaz, Geneva, Switzerland
Tel 41 22 594 64 00
Fax 41 22 594 64 88

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Sucrose ($C_{12}H_{22}O_{11}$)

# MATERIAL SAFETY DATA SHEET (MSDS)

The following information is believed to be correct, but does not attempt to be comprehensive. This data should be used only as a guide in handling the chemical material. Anatel shall not be held liable for any damage resulting from handling or contact with this product.

All chemicals should be considered hazardous — *direct physical contact should be avoided.*

## SECTION I PRODUCT IDENTIFICATION

| | |
|---|---|
| Common Name: | Sucrose (sugar) |
| Chemical Name: | alpha-D-Glucopyranoside, beta-D-fructofuranosyl- |
| Chemical Family: | A Disaccaride |
| Molecular Formula: | $C_{12}H_{22}O_{11}$ |
| CAS Number: | 57-50-1 |
| RTECS Number: | WN6500000 |
| Therapeutic Category: | Pharmaceutic aid (flavor, tablet excipient) |

## SECTION II INGREDIENT INFORMATION

| | |
|---|---|
| Principle Components: | Sucrose |
| Percent: | Pure Material |
| Exposure Limits: | ACGIH: TWA 10 mg/m³ (total dust)<br>OSHA: 15 mg/m³ (total dust) |

## SECTION III HEALTH HAZARD INFORMATION

| | |
|---|---|
| Usual Adult Dose: | N/A |
| Adverse Effects: | Since this material is a common food, it is non-toxic and the only adverse effect of ingestion is an increased incidence of tooth decay. Possible allergic reaction to material if inhaled, ingested or in contact with skin. |
| Overdose Effects: | N/A |
| Acute: | Possible eye, skin gastrointestinal and/or respiratory tract irritation. |
| Chronic: | Possible hypersensitization. |
| Inhalation: | May cause irritation. Remove to fresh air. |
| Eye: | May cause irritation. Flush with copious quantities of water. |
| Skin: | May cause irritation. Flush with copious quantities of water. |
| Ingestion: | May cause irritation. Flush out mouth with water. |
| Medical Conditions Aggravated by Exposure: | Hypersensitivity to the material, diabetes mellitus, glucose-galactose malabsorption syndrome, fructose intolerance, or sucrase-isomaltase deficiency. |
| Cross Sensitivity: | N/A |
| Pregnancy Comments: | N/A |
| Pregnancy Category: | N/A |

## SECTION IV FIRST AID MEASURES

| | |
|---|---|
| General: | Remove from exposure. Remove contaminated clothing. Persons developing serious hypersensitivity (anaphylactic) reactions must receive immediate medical attention. If person is not breathing, give artificial respiration. If breathing is difficult, give oxygen. Obtain medical attention. |
| Overdose Treatment: | N/A |

Anatel
5600 Lindbergh Drive
Loveland, Colorado 80538 U.S.A.

Voice: 1-970-663-9760
Support Hot Line: 1-877-4 ANATEL
(1-877-426-2835)

Anatel

## SECTION V TOXICOLOGICAL INFORMATION

| | | | |
|---|---|---|---|
| Oral Rat: | LD50: 29,799 mg/Kg | Oral Mouse: | LD50: N/A |
| Irritancy Data: | N/A | Target Organ(s): | N/A |
| Listed as a Carcinogen: | NTP: No OSHA: No | | |
| | IARC: No Other: No | | |

## SECTION VI FIREFIGHTING MEASURES

| | | | |
|---|---|---|---|
| Flash Point: | N/A | Upper Flammable Limit: | N/A |
| Auto-Ignition Temperature: | N/A | Lower Flammable Limit: | N/A |

Extinguishing Media: Water spray, dry chemical, carbon dioxide or foam as appropriate for surrounding fire and materials.

Fire and Explosion Hazards: This material is assumed to be combustible. As with all dry powders, it is advisable to ground mechanical equipment in contact with dry material to dissipate the potential buildup of static electricity.

Firefighting Procedures: As with all fires, evacuate personnel to a safe area. Firefighters should use self-contained breathing equipment and protective clothing.

## SECTION VII PHYSICAL HAZARDS

Conditions to Avoid: N/A.

Incompatibilities: Oxidizing agents

Decomposition Products: When heated to decomposition, material emits acrid smoke and irritating fumes. Emits toxic fumes under fire conditions.

Stable: Yes

Hazardous Polymerization: No

## SECTION VIII HANDLING/SPILL/DISPOSAL MEASURES

Handling: As a general rule, when handling USP Reference Standards, avoid all contact and inhalation of dust, mists, and/or vapors associated with the material. Wash thoroughly after handling.

Storage: Store in tight container as defined in the USP-NF. This material should be handled and stored per label instructions to ensure product integrity.

Spill Response: Wear approved respirator, chemically-compatible gloves and protective clothing. Wipe up spillage or collect spillage using a high-efficiency vacuum cleaner. Avoid breathing dust. Place spillage in appropriately labeled container for disposal. Wash the spill site.

Disposal: Dispose of waste in accordance with all applicable Federal, State and local laws.

## SECTION IX EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection: When working with small quantities in a well-ventilated area, respiratory protection may not be required. The use of an approved dust mask is recommended.

Ventilation: No special ventilation requirements.

Gloves: Rubber

Eye Protection: Safety Glasses

Protective Clothing: Protect exposed skin

## SECTION X PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Colorless crystals or white crystalline powder; odorless.

| | | | |
|---|---|---|---|
| Melting Point: | 160 – 186 °C | Boiling Point: | N/A |
| Solubility in Water: | Soluble | Reactivity in Water: | N/A |
| Specific Gravity: | 1.587 | % Volatile by Volume: | N/A |
| Vapor Pressure: | N/A | Vapor Density: | N/A |
| Evaporation Rate: | N/A | | |

# MATERIAL SAFETY DATA SHEET (MSDS)

The following information is believed to be correct, but does not attempt to be comprehensive. This data should be used only as a guide in handling the chemical material. Anatel shall not be held liable for any damage resulting from handling or contact with this product.

Poison and Corrosive — *this material may be fatal if inhaled, swallowed or absorbed through the skin.*

## SECTION I PRODUCT IDENTIFICATION

| | |
|---|---|
| Common Name: | 1,4-Benzoquinone (p-Benzoquinone; 1,4-Benzoquine; Quinone; para-Quinone) |
| Chemical Name: | 2,5-Cyclohexadiene-1,4-dione |
| Chemical Family: | N/A |
| Molecular Formula: | $C_6H_4O_2$ |
| CAS Number: | 106-51-4 |
| RTECS Number: | DK2625000 |
| Therapeutic Category: | N/A |

## SECTION II INGREDIENT INFORMATION

| | |
|---|---|
| Principle Components: | 1,4-Benzoquinone |
| Percent: | Pure Material |
| Exposure Limits: | ACGIH: TWA 0.1 ppm (0.4 mg/m$^3$)<br>OSHA: TWA 0.1 ppm (0.4 mg/m$^3$) |

## SECTION III HEALTH HAZARD INFORMATION

| | |
|---|---|
| Usual Adult Dose: | N/A |
| Adverse Effects: | Adverse effects from exposure may include severe irritation, headache, nausea or vomiting, difficult breathing, bluish or yellowish discoloration of the skin, greenish or brownish discoloration of the urine, seizures, coma and death. Possible allergic reaction to material if inhaled, ingested or in contact with skin. |
| Overdose Effects: | N/A |
| Acute: | Corrosive to eyes, skin, gastrointestinal tract and respiratory tract. |
| Chronic: | Possible hypersensitization and damage to the eyes. |
| Inhalation: | Causes severe irritation. Avoid inhalation! Remove to fresh air. |
| Eye: | Solid or vapors may cause serious visual disturbances including corneal ulceration. Avoid Contact! Flush with copious quantities of water for 15 minutes. |
| Skin: | Causes irritation, dermatitis and may cause burns. Avoid contact! Immediately flush with copious quantities of soap and water. |
| Ingestion | Causes severe irritation and may be fatal if swallowed! Flush out mouth with water. This material is readily absorbed from the gastrointestinal tract. |
| Medical Conditions Aggravated by Exposure: | Hypersensitivity to the material, eye defects and skin disease. |
| Cross Sensitivity: | N/A |
| Pregnancy Comments: | N/A |
| Pregnancy Category: | N/A |

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## SECTION IV FIRST AID MEASURES

**General:** Remove from exposure. Remove contaminated clothing. Persons developing serious hypersensitivity (anaphylactic) reactions must receive immediate medical attention. If person is not breathing, give artificial respiration. If breathing is difficult, give oxygen. Obtain medical attention.

**Overdose Treatment:** Following oral overdose, the following treatment is recommended:

1. To minimize irritation, dilute with milk or water. Induction of vomiting is *not* recommended.
2. Gastric lavage may be performed if ingestion was recent.
3. Administer charcoal slurry, aqueous or mixed with saline cathartic or sorbitol.
4. For seizures, administer diazepam IV bolus (5 to 10 mg initially, which may be repeated every 15 minutes up to 30 mg).
5. For methemoglobinemia, administer 1 to 2 mg per Kg of body weight of 1% methylene blue slowly intravenously (Meditext 1966).

## SECTION V TOXICOLOGICAL INFORMATION

**Oral Rat:** LD50: 130 mg/Kg **Oral Mouse:** LD50: N/A
**Irritancy Data:** N/A **Target Organ(s):** N/A
**Listed as a Carcinogen:** NTP: No OSHA: No
IARC: No Other: Not classifiable as to its carcinogenicity to humans.

## SECTION VI FIREFIGHTING MEASURES

**Flash Point:** 38 – 93 °C **Upper Flammable Limit:** N/A
**Auto-Ignition Temperature:** 560 °C **Lower Flammable Limit:** N/A
**Extinguishing Media:** Water spray, dry chemical, carbon dioxide or foam as appropriate for surrounding fire and materials.
**Fire and Explosion Hazards:** This material is assumed to be combustible. As with all dry powders, it is advisable to ground mechanical equipment in contact with dry material to dissipate the potential buildup of static electricity. The moist material self-heats and decomposes exothermically above 60 °C.
**Firefighting Procedures:** As with all fires, evacuate personnel to a safe area. Firefighters should use self-contained breathing equipment and protective clothing.

## SECTION VII PHYSICAL HAZARDS

**Conditions to Avoid:** Material is stable from a safety point of view, but may darken on standing. Avoid exposure to light, moisture and heat.
**Incompatibilities:** Strong oxidizing agents will cause violent reaction with this material. Contact with reducing agents and strong bases also should be avoided. 1,4-Benzoquinone will attack some forms of plastic, rubber and coatings.
**Decomposition Products:** When heated to decomposition, material emits acrid smoke and fumes. Emits toxic fumes under fire conditions.
**Stable:** Yes
**Hazardous Polymerization:** No

## SECTION VIII HANDLING/SPILL/DISPOSAL MEASURES

| | |
|---|---|
| **Handling:** | As a general rule, when handling USP Reference Standards, avoid all contact and inhalation of dust, mists, and/or vapors associated with the material. Wash thoroughly after handling. |
| **Storage:** | Store in tight, light-resistant container as defined in the USP-NF. This material should be handled and stored per label instructions to ensure product integrity. Keep refrigerated. |
| **Spill Response:** | Wear approved respirator, chemically-compatible gloves and protective clothing. Wipe up spillage or collect spillage using a high-efficiency vacuum cleaner. Avoid breathing dust. Place spillage in appropriately labeled container for disposal. Wash the spill site. |
| **Disposal:** | Dispose of waste in accordance with all applicable Federal, State and local laws. |

## SECTION IX EXPOSURE CONTROLS/PERSONAL PROTECTION

| | |
|---|---|
| **Respiratory Protection:** | Use a NIOSH-approved respirator if it is determined to be necessary by an industrial hygiene survey involving air monitoring. In the event that a respirator is not required, an approved dust mask should be used. |
| **Ventilation:** | Recommended |
| **Gloves:** | Rubber |
| **Eye Protection:** | Safety Glasses |
| **Protective Clothing:** | Protect exposed skin |

## SECTION X PHYSICAL AND CHEMICAL PROPERTIES

| | | | |
|---|---|---|---|
| **Appearance and Odor:** | Dark yellow-green crystalline powder; irritating odor resembling chlorine. | | |
| **Melting Point:** | 115 – 116 °C | **Boiling Point:** | Sublimes |
| **Solubility in Water:** | Slightly soluble | **Reactivity in Water:** | N/A |
| **Specific Gravity:** | 1.318 | **% Volatile by Volume:** | N/A |
| **Vapor Pressure:** | 0.1 mm Hg @ 25 °C | **Vapor Density:** | 3.7 |
| **Evaporation Rate:** | N/A | | |

# Appendix F: Glossary

Several of the terms used throughout this Operator Manual have specific meaning within high-purity water applications. These unique terms include:

| | |
|---|---|
| **Conductivity** | A measure of the ability to conduct current through water. Conductivity, very low with high-purity deionized water, is the reciprocal of resistivity and is measured in microsiemens per centimeter (µS/cm). |
| **High-Purity Water (HPW)** | A term that differentiates between simple deionized water and the purer water required for more critical processes. High-purity implies water that is low in potential contaminants such as ions, microorganisms, organics and particles. |
| **Megohm (MW)** | A measurement of 1,000,000 ohms. |
| **Microsiemens (µS)** | A unit of conductance in the metric system equivalent to one millionth of an ampere per volt (1 µS = 1 M.). |
| **Organic** | Organic chemicals which include carbon atoms in complex molecules, but do not include carbonate ($CO_2$, $HCO_3$, $CO_3$) or cyanide (CN) related compounds. Oxygen is very common in organics and they almost always include hydrogen. |
| **Oxidation** | The loss of electrons by a chemical species, typically with oxygen. Organic carbon, for example, oxidizes to carbon dioxide and water. |
| **Parts per billion (ppb)** | A term used to report trace chemical analyses. It refers to the concentration of the element or compound present within one billion parts of water. One microgram per liter (µg/L) is equal to 1 ppb). |
| **Resistivity** | Resistance, measured in megohmcentimeters (MΩ-cm), to the flow of electrical current through high-purity water. Resistivity is a means of continuously measuring the purity of the water and is the reciprocal of conductivity. |
| **Temperature Compensation** | Conductivity and resistivity of electric current in water depend on the temperature of the water. The lower the temperature, the lower the conductivity and the higher the resistivity. Conductivity and resistivity measurements typically are normalized to 25°C. In other words, they reflect the values they would report at a sample temperature of 25 °C using a model based on sodium chloride in water. |
| **Total Organic Carbon (TOC)** | A measurement of the organics present in water based on it carbon content. High-purity water measures TOC in parts per billion (ppb). This term is used interchangeably with total *oxidizable carbon.* |

# Annex

## Tables and illustrations

# User Notes

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