GE Water & Process Technologies
Analytical Instruments

Sievers 500 RL On-Line Total Organic Carbon Analyzer

Operation and Maintenance Manual

Firmware Version 1.33 or later

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Identification Records

Default Administrator User ID: ADMIN

Default Administrator Password: GEAI

Analyzer serial number: _____
(This is located on the side of the Analyzer.)

Date of receipt and installation of Analyzer: _____
(This is the warranty start date.)

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Revision History

Document Version	Software Version/Enhancement	Date
DLM 74000 Rev. A	1.0	September 2005
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US 6,271,043

US 6,228,325

US 5,976,468

US 5,902,751

US 5,837,203

US 5,820,823

US 5,798,271

US 5,750,073

US 5,443,991

US 5,132,094

EP 0 897 530

FR 0 897 530

GB 0 897 530

DE 697 02 516 0-08

and other patents pending

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Warnings

English

Warning
 This symbol on the instrument indicates that the user should refer to the manual for operating instructions

Warning
 The vial port contains sharp needles designed to pierce the septa of sample vials. Do not put fingers or inappropriate materials into the vial port.

Warning
 Water in the **iOS** System may be hot. Before inserting a vial into the **iOS** System, slide the door open and wait 30 seconds to allow sample to completely drain. Inserting a vial before draining can result in potentially hot water spray projecting upward out of the **iOS** System.

Warning

This symbol indicates the protective earth terminal (ground) for the Analyzer.

Warning

This symbol indicates that to comply with European Union Directive 2002/96/EC for waste electrical and electronic equipment (WEEE), the Analyzer should be disposed of separately from standard waste.

Warning

This symbol on the instrument indicates that the user should refer to the manual for instructions on filling the DI water cartridge, as found in the Installation and Maintenance chapters.

Warning

This is a Safety Class I product. It must be must be attached to a grounded power source. To avoid damage to the Analyzer and the chance of injury, make sure the Analyzer is connected to a power line of the proper voltage.

Warning

Any operation requiring access to the inside of the Analyzer, including installation of maintenance items, could result in injury. To avoid potentially dangerous shock, turn off power and disconnect from the power supply before opening the Analyzer.

Warning
The UV lamp and the display screen contain mercury and may be considered hazardous material in your local area. Dispose of these items in accordance with federal, state, or local government regulations.

Warning
Should the UV lamp become broken or damaged it should be handled in accordance with your organization's toxic waste handling procedure and disposed of in accordance with federal, state, or local government regulations.

Warning
To protect against accidental exposure to ultra-violet radiation, do not operate the UV lamp outside of its protective housing. The UV lamp housing may be hot; use extreme caution whenever touching the UV lamp housing.

Warning
Always stop analysis before turning off the Analyzer.

Warning
This is a Class A product. In a domestic environment, this product may cause electromagnetic interference in which case the user may be required to take adequate measures to correct the interference.

Warning
To avoid false TOC readings and possible damage to the Analyzer, always make sure the sample inlet is open and the DI water cartridge is filled before starting analysis. Always close the door of the Standard **iOS** System when not sampling from a vial.

Warning
Make sure the DI water cartridge is full, particularly when running samples with high TOC or high salt concentrations. Always “clean-up” the Analyzer by running low-TOC DI water after running high TOC or salt samples.

Warning
If this instrument is used in a manner not specified by GE Analytical Instruments, the protection provided by the instrument may be impaired.

Warning
The glass window in the UV reactor indicates proper lamp operation and should not be viewed too closely (closer than 6 inches) or for extended periods (greater than 1 minute). Protective eyewear is recommended.

Warning
Consult the MSDS that accompanies each standards set to identify proper disposal techniques.

Warning
To protect the Analyzer from damage, always drain the water from the Analyzer prior to shipping.

Español

Advertencia
 Este símbolo del instrumento indica que el usuario debe consultar el manual para ver las instrucciones de manejo

Advertencia
 El sistema **iOS** y el puerto del vial contienen dos agujas afiladas diseñadas para perforar los tabiques de los viales que contienen las muestras. No coloque los dedos ni ningún material que no sea adecuado en el sistema **iOS** ni en el puerto del vial.

Advertencia
 El agua del sistema **iOS** puede estar caliente. Antes de insertar un vial en el sistema **iOS**, abra la puerta deslizándola y espere durante 30 segundos a que la muestra se vacíe por completo. Si inserta un vial antes de que se vacíe es posible que agua potencialmente caliente se proyecte fuera del sistema **iOS**.

	Advertencia
	Este símbolo indica el terminal de protección a tierra (masa) del analizador.

Advertencia
Toda operación que requiera el acceso al interior del analizador, incluida la instalación de los elementos de mantenimiento, puede causar daños personales. Para evitar descargas potencialmente peligrosas, apague el analizador y, si es posible, desconéctelo de la fuente de alimentación antes de abrirlo.

Advertencia
La lámpara UV y la pantalla de visualización contienen mercurio, por lo que es posible que se consideren materiales peligrosos en su zona local. Deseche estos elementos de acuerdo con la normativa federal, del estado o del gobierno local.

Advertencia
Si se rompiese la lámpara UV o resultase dañada, deberá tratarse de acuerdo con el procedimiento de tratamiento de residuos tóxicos de la organización y desecharse de acuerdo con la normativa federal, del estado o del gobierno local.

Advertencia
Como protección frente a la exposición accidental a la radiación ultravioleta, no maneje la lámpara UV fuera de su alojamiento protector.

Advertencia
Este producto es de clase de seguridad I. Debe conectarse a una fuente de alimentación con toma de masa.

Advertencia
Si este instrumento se utiliza de una manera no especificada por GE Analytical Instruments USA, la protección ofrecida por el instrumento puede verse reducida.

Advertencia
Detenga siempre el análisis antes de apagar o desconectar el analizador.

Advertencia
Asegúrese de que el depósito de agua DI está lleno, en especial al procesar muestras con altas concentraciones de sal o carbono orgánico total (TOC). “Limpie” siempre el analizador procesando agua DI con bajos niveles de TOC después de procesar muestras con niveles altos de sal o de TOC.

Advertencia
Este producto es de clase A. En entornos domésticos, puede producir interferencias electromagnéticas en cuyo caso puede que se le requiera al usuario que tome las medidas oportunas para corregir la interferencia.

Advertencia
Para evitar falsas lecturas de TOC y posibles daños al analizador, asegúrese siempre de que la entrada de muestras está abierta y de que el depósito de agua DI está lleno antes de iniciar el análisis.

Français

Avertissement
 Ce symbole placé sur l'instrument indique que l'utilisateur doit se rapporter au manuel pour les instructions de fonctionnement.

Avertissement
 Le système **iOS** et le porte-fiole contiennent deux aiguilles acérées conçues pour percer les septa des fioles. N'introduisez ni vos doigts, ni aucun objet dans le système **iOS** System ou le porte-fiole.

Avertissement
 L'eau contenue dans le système **iOS** peut être brûlante. Avant d'insérer une fiole dans le système **iOS**, ouvrez la porte en la faisant coulisser et attendez 30 secondes que l'eau s'écoule complètement. L'insertion d'une fiole avant le séchage complet peut entraîner une projection d'eau chaude en dehors du système **iOS**.

	Avertissement
	Ce symbole spécifie la borne de protection (mise à la terre) de l'analyseur.

Avertissement

Toute opération nécessitant d'accéder à l'intérieur de l'analyseur, y compris l'installation d'éléments de maintenance, peut entraîner des blessures. Afin d'éviter tout choc électrique potentiellement dangereux, mettez l'analyseur hors tension et, si possible, débranchez-le de la prise d'alimentation avant de l'ouvrir.

Avertissement

La lampe UV et l'écran contiennent du mercure et peuvent ainsi être considérés comme des éléments dangereux dans votre secteur. Jetez ces éléments conformément aux réglementations locales en vigueur.

Avertissement

Si la lampe UV venait à être cassée ou endommagée, elle devrait être remplacée conformément à la procédure en vigueur dans votre entreprise pour le remplacement de produits toxiques.

Avertissement

Afin d'éviter toute exposition accidentelle aux rayons ultra-violets, ne sortez pas la lampe UV de sa coque de protection.

Avertissement

Ce produit est de sécurité – classe I. Il doit être relié à une source d'alimentation mise à la terre.

Avertissement
Si cet instrument est utilisé de manière non conforme à ce qui est spécifié par le groupe GE Analytical Instruments aux USA, la protection fournie par l'instrument risque d'être réduite.

Avertissement
Arrêtez toujours l'analyse avant de mettre l'analyseur hors tension ou de le débrancher.

Avertissement
Assurez-vous que le réservoir d'eau DI est plein, tout particulièrement lors de l'utilisation d'échantillons comportant des concentrés fortement salés ou à TOC élevé. Nettoyez toujours l'analyseur à l'aide d'eau DI à faible TOC après avoir utilisé des concentrés salés ou à TOC élevé.

Avertissement
Ce produit fait partie de la classe A. Dans un environnement domestique, il peut entraîner des interférences électromagnétiques. Dans ce cas, l'utilisateur doit prendre les mesures appropriées pour corriger ces interférences.

Avertissement
Afin d'éviter les mesures TOC erronées et d'éventuels dommages de l'analyseur, assurez-vous toujours que l'entrée de l'échantillon est ouverte et que le réservoir d'eau DI est plein avant de commencer l'analyse.

Deutsch

Warnung
 Dieses Symbol auf dem Instrument zeigt an, dass der Benutzer die Bedienungsanleitung beachten sollte.

Warnung
 Das **iOS**-System und der Vial-Port enthalten zwei scharfe Nadeln, mit denen die Septa der Proben-Vials durchstochen werden. Bringen Sie Ihre Finger oder ungeeignete Materialien nicht mit dem **iOS**-System oder dem Vial-Port in Berührung.

Warnung
 In den Analyzer kann das Wasser im **iOS**-System heiß sein. Bevor Sie das Vial in das **iOS**-System einsetzen, öffnen Sie die Tür und warten Sie 30 Sekunden, damit die Probe vollständig ablaufen kann. Das Einsetzen eines Vial, bevor das Wasser abgelaufen ist, könnte dazu führen, dass heißes Sprühwasser aus dem **iOS**-System herausspritzt.

	Warnung
	In Analyzers gibt dieses Symbol schützenden Erdungskontakt (Boden) für das Analysegerät an.

Warnung
Jeder Betrieb, der Zugriff auf das Innere des Analysegeräts erfordert, einschließlich Installation von Wartungsteilen, kann zu Verletzungen führen. Um gefährliche Verletzungen durch einen Stromschlag zu vermeiden, schalten Sie den Strom ab und trennen Sie, wenn möglich, das Analysegerät vor dem Öffnen vom Stromnetz.

Warnung
Die UV-Lampe und der Display enthalten Quecksilber und können regional als Gefahrgut angesehen werden. Entsorgen Sie diese Objekte gemäß den staatlichen oder regionalen Vorschriften.

Warnung
Sollte die UV-Lampe zerbrochen oder beschädigt sein, sollte sie gemäß den Vorschriften Ihres Unternehmens im Umgang mit Giftmüll gehandhabt und gemäß den staatlichen oder regionalen Vorschriften entsorgt werden.

Warnung
Betreiben Sie die UV-Lampe zum Schutz vor unbeabsichtigter ultravioletter Strahlung nicht außerhalb des schützenden Gehäuses.

Warnung
Dies ist ein Produkt der Sicherheitsstufe I. Es muss an eine geerdete Stromquelle angeschlossen werden.

Warnung

Wenn dieses Instrument in einer Art und Weise verwendet wird, die nicht von GE Analytical Instruments USA festgelegt ist, kann der durch dieses Instrument gebotene Schutz beeinträchtigt werden.

Warnung

Beenden Sie stets die Analyse, bevor Sie das Analysegerät ausschalten oder den Stecker herausziehen.

Warnung

Stellen Sie sicher, dass der DI-Wasserbehälter voll ist, besonders wenn Proben mit hohem Gesamtkohlenstoffgehalt (TOC) oder hohen Salzkonzentrationen analysiert werden. „Reinigen" Sie stets das Analysegerät, indem Sie DI-Wasser mit geringem Gesamtkohlenstoffgehalt durchlaufen lassen, nachdem Sie Proben mit hohem Gesamtkohlenstoffgehalt oder hoher Salzkonzentration verwendet haben.

Warnung

Dies ist ein Produkt der Klasse A. In einer häuslichen Umgebung kann das Produkt elektromagnetische Störungen verursachen. In diesem Fall muss der Benutzer möglicherweise entsprechende Maßnahmen ergreifen.

Warnung

Stellen Sie vor dem Beginn der Analyse stets sicher, dass der Probeneinlauf offen und der DI-Wasserbehälter gefüllt ist, um falsche Gesamtkohlenstoffmesswerte und mögliche Schäden am Analysegerät zu verhindern.

Italiano

Avvertenza
 Questo simbolo posto sullo strumento indica che l'utente deve consultare il manuale per istruzioni sul funzionamento.

Avvertenza
 Il sistema **iOS** e il sito per vial presentano due aghi creati per bucare le vial con campioni. Non mettere le dita o materiali non adatti nel sistema **iOS** o nel sito per vial.

Avvertenza
 L'acqua nel sistema **iOS** può essere calda. Prima di inserire una vial nel sistema **iOS**, aprire lo sportello e attendere secondi, in modo da consentire al campione di scolare completamente. Inserire una vial prima che sia trascorso questo tempo può portare alla fuoriuscita di uno spruzzo di acqua calda diretto verso l'alto dal sistema.

Avvertenza
Qualsiasi funzionamento che richieda accesso all'interno dell'analizzatore, inclusa l'installazione di componenti per la manutenzione, può portare a lesioni. Per evitare uno shock potenzialmente pericoloso, spegnere l'analizzatore e, se possibile, scollegarlo dall'alimentazione prima di aprirlo.

Avvertenza
La lampada UV e il display contengono mercurio. Questo elemento può essere considerato materiale pericoloso nell'area di utilizzo dell'apparecchio. Smaltire questi componenti nel rispetto delle normative di governo locali o nazionali in vigore.

Avvertenza
Se la lampada UV dovesse danneggiarsi o rompersi, maneggiarla come indicato dalla procedura di gestione delle sostanze tossiche e smaltirla nel rispetto delle normative di governo locali o nazionali in vigore.

Avvertenza
Per proteggersi da esposizione accidentale a radiazioni ultraviolette, non utilizzare la lampada UV al di fuori del relativo alloggiamento di protezione.

Avvertenza
Questo è un prodotto che rientra nella classe di sicurezza I. Deve essere collegato a una sorgente di alimentazione con messa a terra.

Avvertenza
Se lo strumento viene utilizzato in modo diverso da quello specificato da GE Analytical Instruments USA, la protezione fornita dallo strumento può risultare compromessa.

Avvertenza
Interrompere sempre l'analisi prima di spegnere o scollegare l'analizzatore.

Avvertenza

Accertarsi che il serbatoio di acqua deionizzata sia pieno, in particolare quando si utilizzano campioni con concentrazioni di TOC (Total Organic Carbon, Carbonio Organico Totale) o di sale elevate. “Pulire” sempre l’analizzatore facendovi scorrere acqua deionizzata con basso livello di TOC dopo aver utilizzato campioni con contenuto elevato di sale o di TOC.

Avvertenza

Questo è un prodotto di Classe A. Se utilizzato in un ambiente domestico può generare interferenza elettromagnetica. In tal caso, l’utente deve prendere le misure necessarie per eliminare tale interferenza.

Avvertenza

Per evitare letture di TOC non corrette e possibili danni all’analizzatore, accertarsi sempre che l’ingresso del campione sia aperto e il serbatoio di acqua deionizzata sia pieno prima di iniziare l’analisi.

日本語

警告
 機器上のこの記号は、ユーザーがマニュアルの操作手順を参照すべきであることを示します。

警告
 iOS システムおよびバイアルポートには、サンプルバイアルの隔膜に刺し通すための2本の先の鋭いニードルが含まれています。指や不適切な物質を iOS システムやバイアルポートに入れないようにしてください。

警告
 500 オンライン分析装置およびポータブル分析装置では、iOS システム内の水が加熱している場合があります。バイアルをiOSシステムに挿入する前に、ドアをスライドして開き、30 秒間待ち、サンプルが完全に排水されるようにしてください。排水前にバイアルを挿入すると、iOS システムから熱水が噴出するおそれがあります。

	警告
	500 オンライン分析装置では、この記号は分析装置用の保護アース端子（グランド）を示します。

警告

保守部品を取り付ける際など、分析装置の内部にアクセスする操作では、負傷につながるおそれがあります。感電を避けるために、分析装置を開く前に電源を切り、可能であれば、電源コードを抜いてください。

警告

UV ランプおよび表示画面には水銀が含まれており、地域によっては危険物質と見なされる場合があります。これらの部品は、連邦、州、または地方自治体の規制に従って破棄してください。

警告

UV ランプが壊れたり、損傷したりした場合には、組織の有毒廃棄物処理手順に従って処理し、連邦、州、または地方自治体の規制に従って破棄してください。

警告

不測の紫外線放射被爆を防ぐために、UV ランプは保護ハウジングから出して操作しないでください。

警告

これは安全基準クラス I の製品です。アース付き電源に接続する必要があります。

警告

GE Analytical Instruments USA が指定した方法以外の方法でこの装置を使用すると、装備されている保護機能が作動しないおそれがあります。

警告

分析装置の電源を切るか、電源コードを抜くときは、必ず分析を停止してください。

警告

DI 貯水槽が満杯になっていることを確認してください。特に、TOC または塩分の濃度が高いサンプルを使用する場合に重要です。TOC または塩分の濃度が高いサンプルを使用した後は、TOC の濃度が低い DI 水で必ず分析装置を洗浄してください。

警告

これはクラス A 製品です。家庭環境では、この製品によって電磁波干渉が発生するおそれがあります。そのような場合は、ユーザー自身で適切な対策を講じて干渉を回避する必要があります。

警告

TOC 値の誤った読み取りおよび分析装置の損傷を避けるために、サンプル注入口が開いており、DI 貯水槽が満杯になっていることを必ず確認してから分析を開始してください。

中文

警告
 仪器上标有此符号表示用户应参考手册上的操作说明

警告
 **iOS** 系统和试剂瓶槽包含两个锐利的针头，用于刺穿试样试剂瓶的封口膜。请不要将手指或其它不适当的物品放入 **iOS** 系统或试剂瓶槽。

警告
 在 500 联机及便携式分析仪中，**iOS** 系统中的水为热水。在将试剂瓶插入 **iOS** 系统之前，请将门滑开并等待 30 秒，以使试样完全流尽。若在未流尽时插入试剂瓶可能导致热水从 **iOS** 系统上部溅出。

警告
 在 500 联机分析仪中，此符号表示分析仪的保护性接地端（地线）。

警告
任何需要接触分析仪内部的操作，包括安装维修件，均可能导致人身伤害。为避免可能的电击伤害，在打开分析仪之前，请关闭电源开关并断开仪器与电源的连接（如果可能）。

警告
紫外线灯和显示屏含有水银，在您所在的地区可能被视为危险材料。处理这些材料时，请遵循国家、州 / 省或地方政府的相关规定。

警告
如果紫外线灯破损或损坏，应根据您所在组织机构的有毒废料处理程序以及国家、州 / 省或地方政府的相关规定进行处理。

警告
为预防在紫外线放射下暴露导致伤害，请勿将紫外线灯置于保护罩之外。

警告
本产品为 I 类安全产品。本产品必须连接具有接地端的电源。

警告
如果本仪器未按照 GE Analytical Instruments USA 的规定使用，仪器提供的保护措施可能会失效。

警告
在关闭或断开分析仪电源之前，必须停止分析。

警告
请确保 DI 水容器中装满水，特别是在测试高 TOC 或高盐浓度的试样时尤其如此。在测试完高 TOC 或高盐浓度的试样后，请务必使用低 TOC 的 DI 水清洗分析仪。

警告
本产品为 A 类产品。在家庭环境中，本产品可能导致电磁干扰，用户可能需要采取适当措施以减少干扰。

警告
为避免 TOC 读数错误或损坏分析仪，在开始分析前必须保证试样进口打开且 DI 水容器已满。

Chapter 1. Introduction

The Sievers® 500 RL On-Line TOC Analyzer from GE Analytical Instruments is a high-sensitivity Analyzer used to measure the concentration of total organic carbon (TOC), total inorganic carbon (TIC), and total carbon (TC = TOC + TIC) in water samples (for patent information, see the section called "Trademarks and Patents" on page 14).

The Analyzer is based on the oxidation of organic compounds to form carbon dioxide (CO_2) using UV radiation. Carbon dioxide is measured using a sensitive, selective membrane-based conductometric detection technique as described by Godec et al. (R. Godec et al., "Method and Apparatus for the Determination of Dissolved Carbon in Water," U.S. Patent No. 5,132,094). For each TOC measurement, the concentration of inorganic carbon species (CO_2, HCO_3^-, and CO_3^{-2}) is determined and, after oxidation of the organic compounds, the total carbon (TC) content of the sample is measured. The concentration of the organic compounds is then calculated from the difference between the concentrations of TC and total inorganic carbon (TIC), generally referred to simply as inorganic carbon (IC).

(TOC = TC - IC)

®Trademark of General Electric Company; may be registered in one or more countries.

The Analyzer can be used to monitor water samples ranging from high-purity water containing <0.5 parts per billion (ppb) TOC to water samples containing up to 2.5 parts per million (ppm) TOC. The Analyzer is easy to operate, with extremely low maintenance, and no special training or chemical knowledge is required. The Analyzer is calibrated at the factory, and calibration remains stable for approximately one year. For configurations with a Super **iOS** or Standard **iOS**, recalibration and validation can be easily performed at the customer's site. Note that on configurations with a Sample Inlet Block rather than an **iOS** System, not all menu options may be relevant or available on your Analyzer.

This manual describes typical operational requirements and recommended procedures that are valid for most applications. Special conditions in operating environments may require modifications to the recommendations in this manual. Specific instructions provided by GEAI service or technical support personnel supersede the information provided in this manual.

Chapter 2. System Description

System Specifications*

Total Organic Carbon

Linear range	0.03 – 2,500 ppb TOC
Accuracy	±5% of measurement
Precision	±0.03 ppb ≤ 50 ppb ±1% > 50 ppb
Analysis Modes	Grab, On-line, On-line Averaged, On-line Timed
Analysis Time	6 minutes for continuous on-line measurements
Ozone Compatibility	50 ppb O_3 continuous 200 ppb O_3 for 2 hours daily
Sample Flow Rate (nominal)	Analysis mode: 0.25 mL/min Fast Flush (between samples): 0.5 mL/min
External Flow Rate:	Minimum 50 mL/min
Sample Temperature	1 °C to 95 °C (34 °F to 203 °F) (withstands short-term steam exposure)**
Sample Pressure	Up to 100 psig
Interferences	Insensitive to organic heteroatoms
Calibration Stability	Typically stable for 12 months

Display Readout	3 significant digits

Conductivity

Raw Conductivity Range	0.01 - 35 µS/cm
Conductivity Accuracy	±0.005 µS/cm ≤ 0.25 µS/cm ±1% > 0.25 µS/cm
Conductivity Precision	<0.25% RSD
Maximum Sample Conductivity	25 µS/cm at neutral pH

Instrument

Power requirements	100-240 ±10% VAC, 100 watt, 50/60 Hz
Fuses	No user-replaceable fuses
Normal Operating Environment	Intended for indoor use only
Ambient Temperature	10 °C to 40 °C (50 °F to 104 °F)
Maximum Relative Humidity	Up to 95%, noncondensing
Maximum Altitude	2,000 m (7,546 ft)
Inputs	One isolated binary input
Outputs	Serial (RS-232) port, USB, parallel printer port, three 4–20 mA ports, four alarms ports
Installation/Overvoltage Category	II (protects against transients present in Category II power)
Safety Certifications	CE, ETL listed. Conforms to UL Std. 61010-1. Certified to CSA C22.2 No. 61010-1.
Pollution Degree	2 (normally only non-conductive pollution)
Display	Backlit Quarter-VGA touchscreen display
Size	41.9 cm height x 48.3 cm width x 27.4 cm depth (16.5 in x 19.0 in x 10.8 in)
Weight	16.9 kg (37.2 lbs)
IP Rating	IP 45

*Note: Stated analytical performance is achievable under controlled laboratory conditions that minimize operator and standards errors.

****iOS*** and Super ***iOS*** only. For more information, see page 110.

System Overview

The Sievers 500 RL On-Line TOC Analyzer consists of five major subsystems:

1. Sample inlet system and sample pump, including the Integrated On-Line Sampling (**iOS**) System or Super iOS System.
2. Oxidation reactor
3. Measurement module, comprising:
   - CO_2 transfer manifold
   - Sample conductivity cell
4. Fluidics module, comprising:
   - DI (Deionized) water cartridge (including resin bed)
   - DI water pump
5. Electronics subsystems, comprising:
   - Microprocessors and circuit boards
   - Data outputs

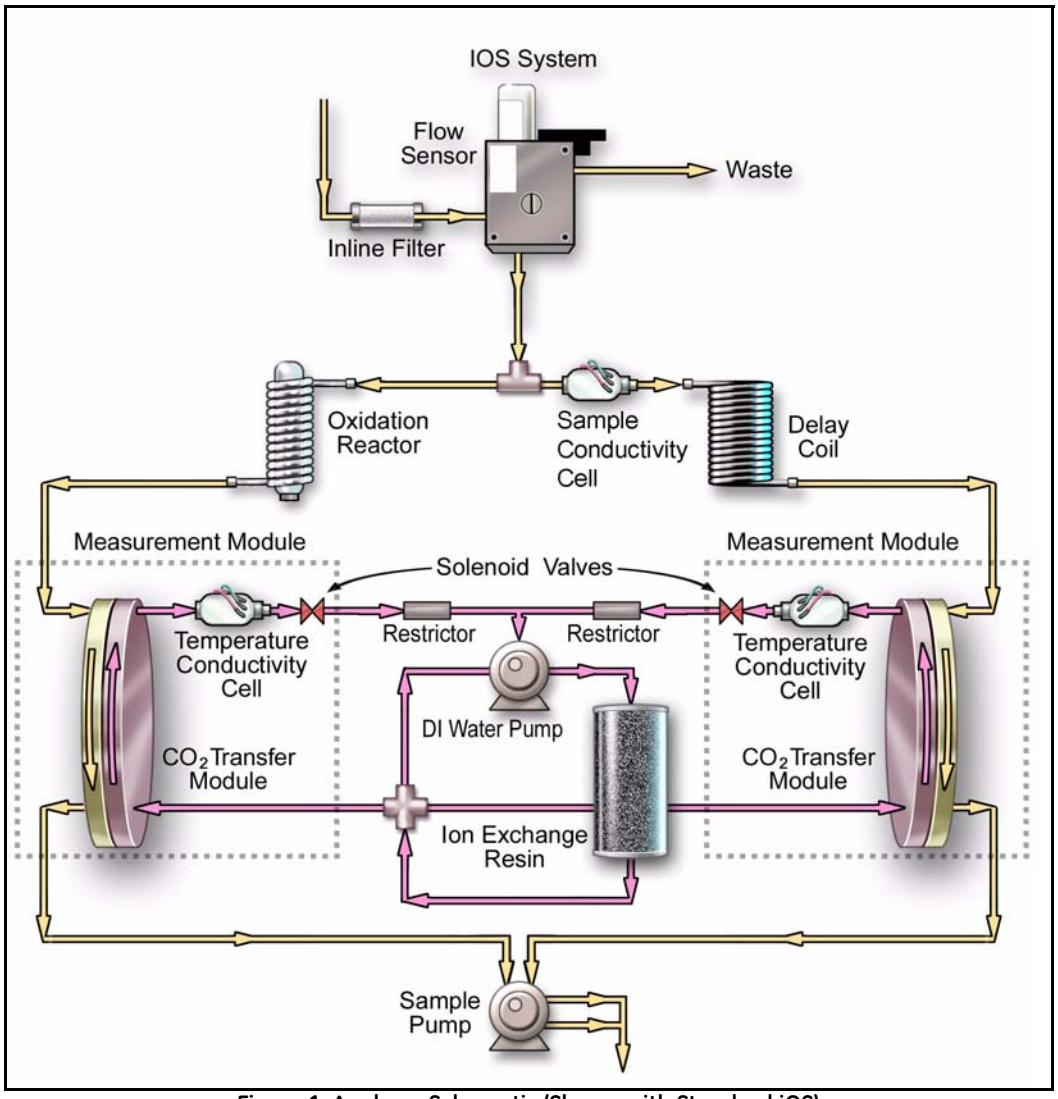

Figure 1: Analyzer Schematic (Shown with Standard iOS)

A brief description of each major Analyzer component follows.

Sample Flow Path

The Sievers 500 RL On-Line TOC Analyzer is available in three primary configurations: with the Super **iOS**, offering four vial ports and on-line monitoring; with the standard **iOS**, offering one vial port and on-line monitoring; and with the Sample Inlet Block, offering on-line monitoring only.

Discrete samples can be measured by the Sievers 500 RL On-Line TOC Analyzer by inserting a filled 40 mL sample vial into the **iOS** System. Continuous monitoring is accomplished by plumbing a sample line to the inlet of the **iOS** System or the Sample Inlet Block. The stream splitter divides the sample stream into two equal but separate flows. One stream is processed for the measurement of IC; the other is processed for measurement of TC.

The TC stream passes to an oxidation reactor where the sample is exposed to UV light, which oxidizes the organic compounds in the sample, converting them to CO_2. The reactor is a spiral quartz tube wrapped around the UV lamp. The UV lamp emits light at 185 and 254 nm resulting in the formation of powerful chemical oxidizing agent in the form of hydroxyl radicals produced by the photolysis of water (eq. 1):

$$H_2O + h\nu\ (185\ nm) \rightarrow OH\cdot + H\cdot \qquad (1)$$

The hydroxyl radicals (OH·) will completely oxidize organic compounds, converting the carbon atoms of the organic compound into CO_2.

$$\text{Organic Compounds} + OH\cdot \rightarrow CO_2 + H_2O \qquad (2)$$

The IC stream passes through a delay coil, which is designed to make the total transit time of the IC stream through the Analyzer the same as the transit time of the TC stream through the Analyzer.

When the TC stream exits the oxidation reactor and the IC stream exits the delay coil, each stream moves to the CO_2 transfer manifold. The CO_2 transfer manifold is a patented design, utilizing a gas-permeable membrane that allows the transfer of CO_2 across the membrane. The membrane separates the sample side of the Analyzer from the DI side. The DI side of the Analyzer is a closed loop, and consists of two conductivity cells—one for the TC stream and one for the IC stream—a DI water pump, DI water reservoir, and ion exchange resin (resin bed).

CO_2 from the sample passes through the membrane into the DI water supplied by the integrated DI Loop, while interfering compounds and other oxidation by-products are blocked by the membrane and remain on the sample side. The CO_2 forms carbonic acid upon reaction with water, and the carbonic acid disassociates into hydrogen ions and bicarbonate ions:

$$CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H^+ + HCO_3^- \qquad (3)$$

DI water is continuously pumped through the DI side of the Analyzer, collecting the H^+ and HCO_3^- ions and H_2CO_3 and CO_2 molecules from the CO_2 transfer modules, delivering it to the conductivity

cell for measurement. Then the ion exchange resin removes the HCO_3^- and H^+. The water is then pumped back to the CO_2 transfer module to repeat the sequence.

The TC and IC conductivity cells each contain a thermistor, and all conductivity readings are temperature corrected. The CO_2 from the TC and IC sample streams are measured by the respective conductivity cells, and the conductivity readings are used to calculate the concentration of TC and IC. Once the values are measured, TOC is calculated as the difference:

$$TOC = TC - IC \quad (4)$$

Additional System Components

Microprocessor Controller and Electronics

Six proprietary electronic board assemblies monitor and control Analyzer functions:

- **System board** including the 32-bit microprocessor, 1 MB of program memory, 1 MB of data memory, battery-backed nonvolatile memory for operator settings, digital I/O, QVGA color graphics controller, stepper motor controllers, printer output, RS-232 (serial) port, and interface to USB storage devices
- **Analog-to-digital conversion board** with integrated signal conditioning circuits for three conductivity and four temperature measurements
- **Color LCD QVGA display** with touch panel
- **Passive interconnect board**
- **ID board** with nonvolatile memory for system specific coefficients
- **I/O board** with interfaces to external devices, via binary input, four alarms, and three 4-20 mA outputs

Data Outputs

The Analyzer has serial (RS-232), USB, and printer ports, allowing flexibility for exporting and printing data. Real-time and historical data can be transferred from the Analyzer via the serial port to a computer using communication software such as HyperTerminal (for details, see “Using HyperTerminal” on page 197). Historical data can be transferred from the Analyzer via the USB port

to a USB flash storage device (provided) and then transferred to any computer that supports USB. The Sievers 500 RL On-Line TOC Analyzer also has three analog outputs (4-20 mA) which can be customized to track specific data values, four alarms, and two binary ports.

Note: *The Analyzer cannot be directly connected to a computer via the USB port. Rather, the Analyzer's USB port can only be connected to a USB storage device, such as a USB flash memory drive.*

Chapter 3. Installation

Overview

This chapter provides installation instructions for the Sievers 500 RL On-Line TOC Analyzer and will help familiarize you with Analyzer design and function. An interior overview diagram is available in the "Maintenance" chapter on page 154. If you need additional assistance, contact GE Analytical Instruments Technical Support at 800.255.6964. Installation and training by a qualified service technician also can be provided.

Warning
Original packing materials must be saved! ***If for any reason the Analyzer must be returned, it*** **must** ***be packed in the original carton to ensure that no damage occurs during shipment. There will be a charge if the Analyzer must be repackaged for return shipment. Insure the Analyzer for the return shipment.***

Note: Do not start the Analyzer until the DI water cartridge has been filled with DI water.

Step 1: Unpack and Inspect the Analyzer

Open the shipping box and remove the Analyzer from the packaging. You may find it easiest to open the box and remove the accessories tray, and then set the box on its side before removing the Analyzer from the box.

Next, verify that all items are present:

1. Sievers 500 RL On-Line TOC Analyzer
2. *Operation and Maintenance Manual*
3. *Validation Support Package* (VSP) Volume I
4. *Sievers 500 RL Quick Start Guide*
5. Accessories included:
    - 1/4" sample inlet tubing with in-line filter (60 micron)
    - 25/32" clamp for 3/4" waste tubing
    - 3/4" OD tubing for waste line
    - Ferrite suppressor for use with 230 V configurations
    - 9/16" open-end wrench
    - Double-ended screwdriver
    - John Guest tool
    - Stainless steel metric tubing converter (1/4-in-to-6-mm tube)
    - Water bottle (250 mL) with nozzle for filling DI water reservoir
    - Tray (for draining DI water cartridge)
    - USB flash memory drive
    - PVC conduit connector ("strain relief" hubs) for conduit wiring
    - Sealing washer for PVC conduit connector
    - Terminal ring for AC conduit ground wire, 16-14 American Wire Gauge (AWG)
    - Grounding wrist strap
    - Keys (2)
    - Adhesive clips (2), for double-ended screwdriver and John guest fitting removal tool.

6. Certificate of Calibration
7. DataGuard activation key (optional)

Additional Installation Equipment

To install the Sievers 500 RL On-Line TOC Analyzer, the following equipment also is required:

- Mounting hardware to support the Analyzer (see “Step 3: Select a Location for the Analyzer” on page 57)
- Insulated wire, 22-12 AWG, rated to 300 Volts for analog and alarm outputs (optional; see “Installing the Analog Outputs and Alarms” on page 60)
- Analog (4-20 mA) recorder (optional)
- Insulated wire (18-12 AWG, rated to 300 Volts) for AC power conduit (see “Connecting to a Power Supply” on page 58)
- An external circuit breaker or switch that disconnects both poles of the supply voltage, rated appropriately

Step 2: Complete the Identification Records

Complete the Identification Records section on “Identification Records” on page 2 by recording the date of receipt and the Analyzer serial number (found on the side of the Analyzer).

Step 3: Select a Location for the Analyzer

The Sievers 500 RL On-Line TOC Analyzer is designed to be mounted on a wall or support stand. Allow a minimum of **5 cm** clearance between the back of the Analyzer and the wall for heat dissipation; allow **30.5 cm** of clearance on the sides, top, and bottom of the analyzer for the plumbing and electrical connections. Additionally, this clearance provides for the proper circulation for temperature and humidity control. When selecting the location, mount the Analyzer so that the display screen is approximately at eye-level. Diagrams showing Analyzer dimensions and clearances are provided in "Appendix A: Analyzer Dimension Diagrams" on page 189.

Hardware for mounting the Analyzer on a wall or instrument rack is not included in the accessories kit. Hardware should be selected based on site-specific circumstances. Mounting hardware must

be able to support four times the weight of the unit; thus you should install mounting bolts capable of supporting 67.6 kg (148.8 lbs).

Avoid direct sunlight and extreme temperatures; operating at elevated temperatures greater than 40 °C (104 °F) prevents proper operation, and operating at low temperatures, 10 °C (50 °F), can cause errors in the measurements. The Sievers 500 RL On-Line TOC Analyzer withstands the hazards of industrial process environments, and the Analyzer enclosure is rated IP 45.

Note The Analyzer accessories kit contains two adhesive clips that can be used to store the double-ended screwdriver and John Guest fitting removal tool inside the Analyzer. If you choose to use the clips, simply remove the paper backing from each clip and then firmly press the clip to the desired location inside the Analyzer. Do not attach the clips to any area that could affect analysis; place the clips inside the door or on the right bulkhead.

Step 4: Install Power and Control Wiring

Installation of the power and control wiring requires access to the Analyzer's electrical enclosure. To remove the brass-colored cover, use a Phillips screwdriver to loosen the two set screws, then gently pull the cover away from the Analyzer.

Connecting to a Power Supply

Installation of the Sievers 500 RL On-Line TOC Analyzer requires an external source of AC power connected to the enclosure using a water-tight conduit connector. The electrical connection should be performed by a qualified electrician. The Analyzer does not have an internal circuit breaker. An external switch or circuit breaker is required, and should be installed near the Analyzer and be clearly marked as the disconnecting device for the Analyzer.

Note: Before installing any wiring inside the Analyzer, put on a grounding strap for ESD protection.

Route the AC power conduit through the lower pass-through port on the left side of the bulkhead, labeled **AC INLET**. Remove the pass-through cap by loosening the wing nut that secures the cover from inside the Analyzer. Metallic conduit is required for the Analyzer to meet CE Mark electrical requirements.

Secure the PVC conduit connector ("strain relief" hub) and washer to the conduit and the Analyzer bulkhead. AC connections inside the Analyzer are made to the top of the terminal strip (see Figure), with the line (brown/black wire) connected to the left port and neutral (blue/white wire) connected to the right port. Connect the grounding conductor (green and yellow wire) to the ground stud. A terminal ring for 16-14 AWG wire is provided in the accessories kit; if you use wire of a different gauge, you must provide an appropriate terminal ring.

Wire should be 18-12 AWG, rated to 300 Volts. Strip length should be 8 mm (.33 in). When connecting the wire to the terminal block, use a small flathead screwdriver (such as the one provided in the accessories kit) to loosen the screws on the terminal block; insert the wires and then tighten the screws. After connecting the wire, pull on each connection gently to make sure the connection is secure.

If you are also installing wiring for alarms or 4-20 mA outputs, proceed to the next section. Otherwise, close and latch the Analyzer door and proceed to "Step 5: Installing the Printer, USB, and Serial Connections" on page 65.

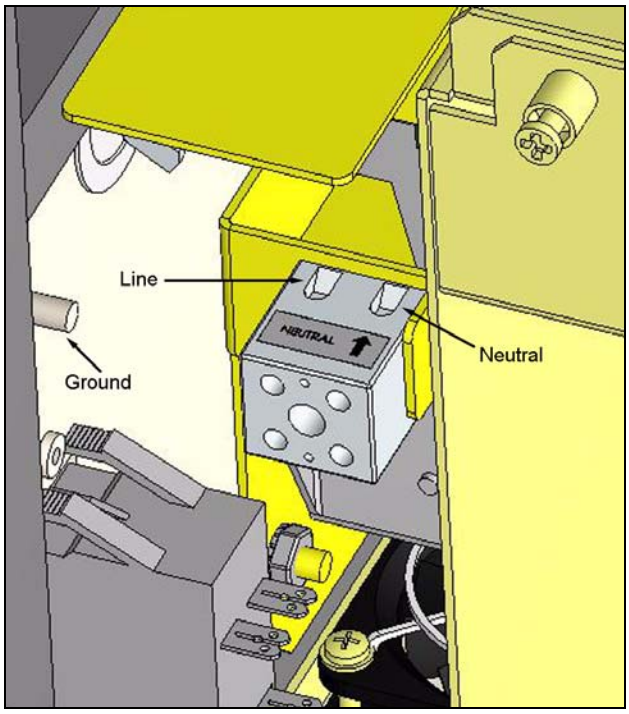

Figure 2: Wiring AC Power

Installing the Analog Outputs and Alarms

The Analyzer offers four alarm and three 4-20 mA outputs, via three terminal blocks that are arranged horizontally in the electrical enclosure. Consult Tables 1 through 3 below for a list of functions on each terminal block. The output and alarm connections should be installed by a qualified electrician.

Route the cables to the terminal strips through the pass-through port on the left side of the bulkhead, labeled **CONTROL**. Remove the pass-through cap by opening the Analyzer's front panel and loosening the wing nut that secures the cover from inside the Analyzer. Secure the PVC conduit connector ("strain relief" hub) and washer to the conduit and the Analyzer bulkhead in the normal manner. Wire should be 22-12 AWG, rated to 300 Volts. Strip length should be 8-9 mm (.33 in). To attach the output connections, first remove the terminal block from the I/O board by firmly grasping the terminal block and pulling it straight out from the board (note the orientation of the terminal block before removing). Completely loosen the screw for each pin you are connecting, insert the wire, tighten the screw, and then gently pull on each connection to make sure the connection is secure. Then, replace the terminal blocks.

Starting from the left, the terminal blocks are as follows:

1. The first terminal block (TB2) is for two alarm outputs and binary inputs.
2. The second terminal block (TB1) is for two additional alarm outputs.
3. The third terminal block (TB3) is for serial and three 4-20 mA analog outputs.

Power isolation level is 240 VAC rms for all terminal blocks, except for the 24 V power (TB2, pins 9 and 10) and the Reserved pins on all terminal blocks. The maximum load for the alarm ports is 30 VDC at 1.0 A. The maximum 4-20 mA load is 600 ohms.

Table 1: Alarm Outputs (TB2)

Pin Number	Output
10	*24 V (ground, for binary input)*
9	*24 V (+ output, for binary input)*
8	*Remote -*
7	*Remote +*
6	*Alarm 2 (NO*)*
5	*Alarm 2 (NC*)*
4	*Alarm 2 (Common)*
3	*Alarm 1 (NO*)*
2	*Alarm 1 (NC*)*
1	*Alarm 1 (Common)*

* NC = normally closed, NO = normally open

Table 2: Alarm Outputs (TB1)

Pin Number	Output
8	*Reserved*
7	*Reserved*
6	*Alarm 4 (NO*)*
5	*Alarm 4 (NC*)*
4	*Alarm 4 (Common)*
3	*Alarm 3 (NO*)*
2	*Alarm 3 (NC*)*
1	*Alarm 3 (Common)*

* NC = normally closed, NO = normally open

Table 3: Serial and 4-20 mA Outputs (TB3)

Pin Number	Output
12	*4-20 mA 1 (- Output)*
11	*4-20 mA 1 (+ Output)*
10	*4-20 mA 2 (- Output)*
9	*4-20 mA 2 (+ Output)*
8	*Reserved*
7	*Reserved*
6	*Reserved*
5	*4-20 mA 3 (- Output)*
4	*Serial (In)*
3	*Serial (Out)*
2	*Serial (ground)*
1	*4-20 mA 3 (+ Output)*

Wiring the 4-20 mA Connection

The data from the Analyzer may be recorded using the 4-20 mA outputs located on TB3. The analog output is verified at the factory prior to shipping. Wiring connections are shown in Figure .

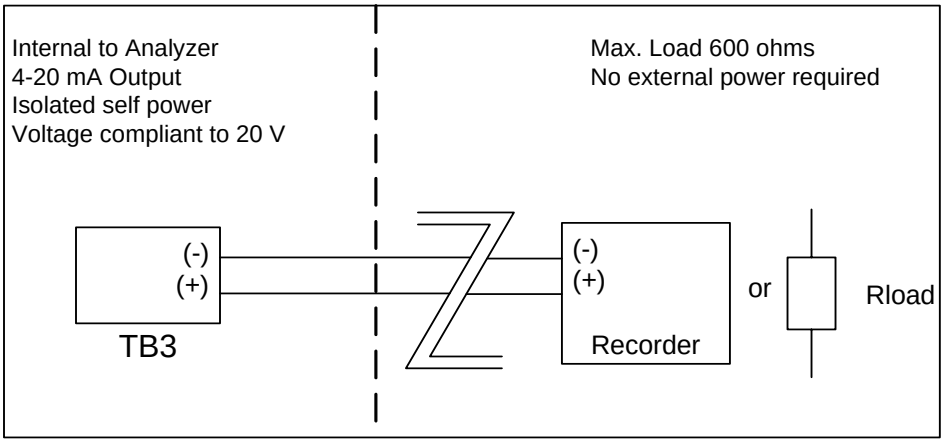

Figure 3: Wiring Diagram for the 4-20 mA Connection

Wiring the Remote Start (Binary Input) Connection

The 500 RL On-Line Analyzer remote start (binary input) connection can be wired in a variety of ways and is intended to execute a start/stop command to the Analyzer from a remote location, such as a Process Logic Control (PLC) System or Center. Wiring examples are shown in Figure 4 and Figure 5.

Note that binary input must be activated in the Analyzer firmware later. It is important to confirm the correct signal strength before setting binary input to **On**, to avoid unexpectedly starting or stopping analysis. For more information on activating binary input, see "Activating Binary Input" on page 94.

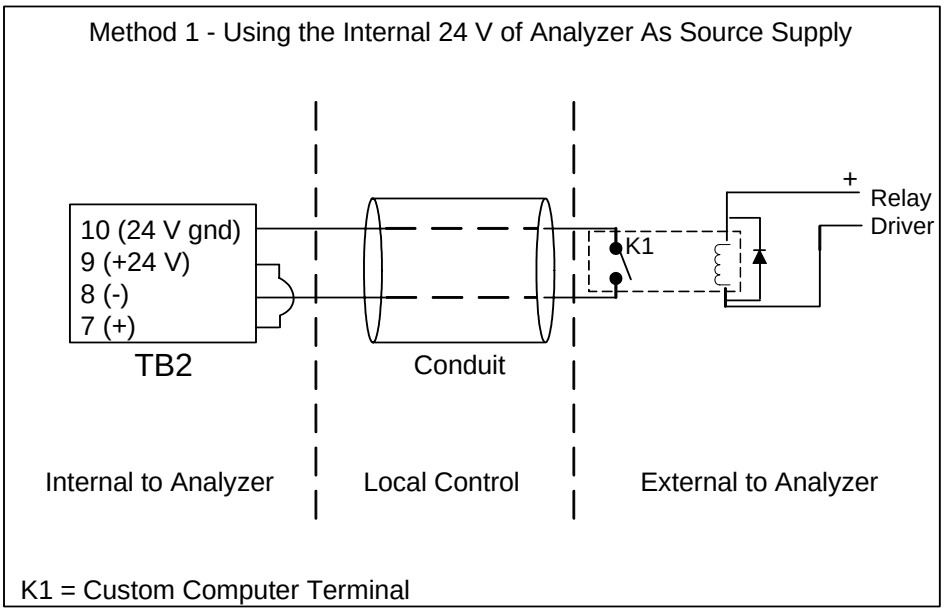

Figure 4: Wiring Option for Binary Input Using Analyzer's Internal Supply

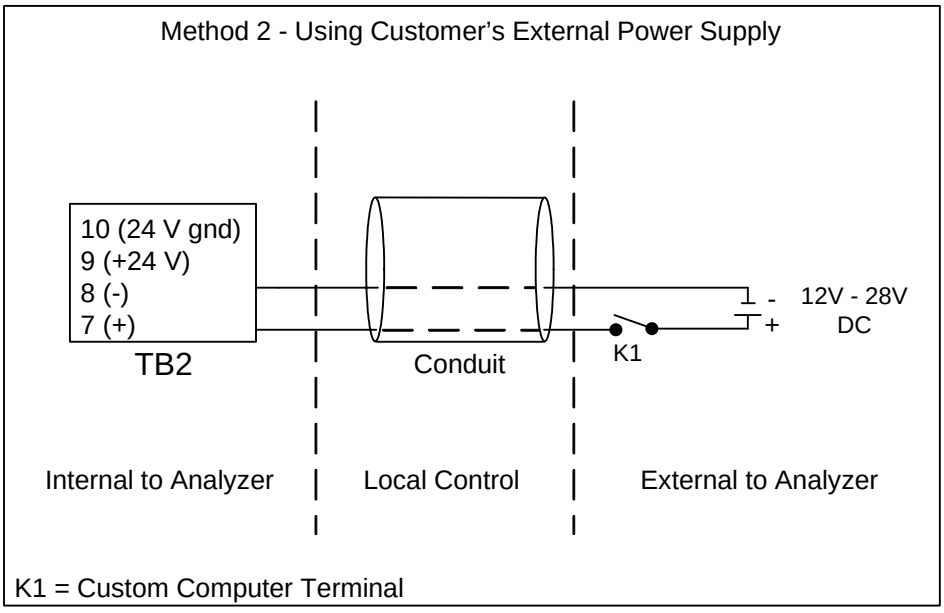

Figure 5: Wiring Option for Binary Input Using External Supply

Step 5: Installing the Printer, USB, and Serial Connections

If you have not already done so, replace the electrical enclosure cover by securing the two set screws with a Phillips screwdriver. Then, close and latch the Analyzer front panel.

Before installing the printer cable, USB flash drive, or serial cable, you must first remove the cover plate from the Analyzer. Loosen the two thumb screws on the cover plate and remove the plate.

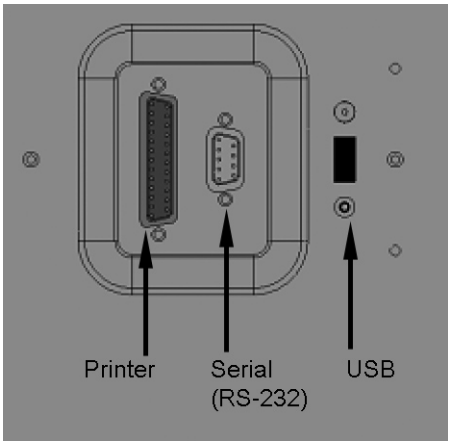

Figure 6: Input and Output Connectors

Installing the Printer

The Analyzer has a 25-pin parallel (Centronics) printer port for connecting an optional printer. The printer must be IBM compatible or Epson FX 850 compatible. GE Analytical Instruments sells Epson, Seiko, and Citizen printers for use with the Analyzer.

To install the printer, follow these steps:

1. Connect the printer's power converter to a grounded power source and plug the cable in to the back of the printer.
2. Connect the printer cable to the port labeled **Printer** on the Analyzer and secure with the captive screws.
3. Connect the other end of the printer cable to the printer and snap the clips into place.
4. Consult the instructions that come with the printer for additional setup help. Load the paper, and make sure the printer is ready to print (depending on the printer model, press **SEL** or **Online** so that the green light is illuminated).

Installing the USB Connection

The USB port is solely intended to provide data transfer to a USB flash memory drive. The flash memory drive can then be used with your computer's USB port to transfer exported data for import into a spreadsheet or database program. The Analyzer cannot be directly connected to a computer via the USB port.

Due to significant variance among USB devices, not all USB flash memory devices are compatible with the Analyzer.

To attach the USB flash memory drive, simply slide it into the USB port on the Analyzer (see Figure 6 on page 65). Note that the drive must be oriented properly to slide in.

Installing the Serial Connection

The serial connection is optional and provides an additional means of capturing data from the Analyzer. Serial cables are available at many computer and office supply retail stores. To install the serial connection:

1. Connect the male end of the serial cable to the port on the Analyzer labeled **Computer RS232** (see Figure 6 on page 65) and tighten the captive screws.
2. Connect the other end (female end) of the cable to the serial port on your PC, again connecting the captive screws.

Note: For long distance connections (up to 1,000 feet or 305 meters), GE Analytical Instruments recommends use of either a RS-232 current loop converter or a RS-422 converter. Companies such as B&B Electronics manufacture both kinds of converter.

Step 6: Connect the Sample Inlet and Outlet Ports

The flow from the water source should be disabled until the sample inlet system is completely installed and the Analyzer is ready to begin analysis.

The Analyzer is designed to measure water from a continuous sample flow in On-Line mode; the **iOS** System or Super **iOS** System can be used to sample from vials when the Analyzer is operated in Grab mode. When taking measurements from vials (for example, for calibration and verification of the Analyzer), no plumbing change is required, as 40-mL vials are simply inserted into the **iOS** System, or vials are inserted into the Super **iOS** System.

Follow these steps to configure the sample inlet and outlet ports:

1. Connect the 1/4" Teflon tubing with the in-line filter to the sample inlet on the **iOS** or Super **iOS** System or the Sample Inlet Block, depending on your Analyzer configuration. Tighten 1/4 turn past finger-tight with a 9/16" open-end wrench. Do not over-tighten the nut.

Warning
Operation of the Analyzer without the in-line filter on the sample inlet line will damage the Analyzer and void the warranty. To avoid damaging the Analyzer, install the filter and replace the filter element as needed.

Warning
To avoid false TOC readings and possible damage to the Analyzer, always make sure the sample is flowing through the inlet System and the DI water cartridge is filled before starting analysis.

2. Connect the 3/4" OD waste line tubing to the waste outlet on the sample inlet system or the Sample Inlet Block by sliding the tubing over the barb fitting.
3. Place the hose clamp over the waste line and tighten, to secure the connection to the waste outlet.
4. Route the waste tubing to an appropriate waste outlet. Note that the waste is gravity-drained, and thus the waste tubing cannot be routed above the level of the waste outlet barb.
5. After water flow to the sample inlet system has been established, the flow rate should be adjusted so that flow out of the waste line is between 50 -300 mL/min. The flow rate is controlled by a needle valve, which is adjusted by the screw on the sample inlet system. Turn the screw clockwise to decrease flow, and turn the screw counter-clockwise to increase flow.

Note: Setting a water flow rate that exceeds 300 mL/min may result in poor system suitability verification data or any measurements taken from sample water in vials. Excessive flow also will not allow the sample pump to draw sample properly.

Note: The iOS System door may be taped closed for safety during transport. Remove the tape before proceeding.

Step 7: Fill the DI Water Cartridge

Fill the DI water cartridge with DI water, using the squeeze bottle provided in the accessories kit.

1. Fill the water bottle with DI water.
2. Open the Analyzer's front panel (you will need the key from the accessories kit to open the bottom latch).
3. Locate the DI water cartridge at the center of the Analyzer (see Figure 7)

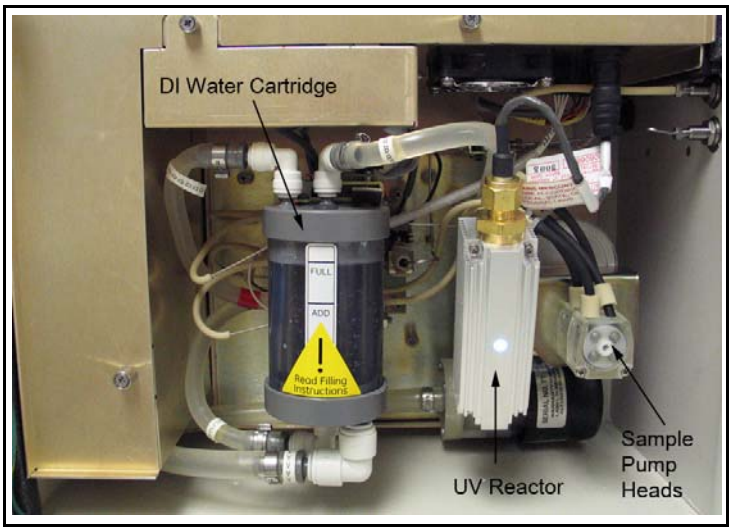

Figure 7: Locating The DI Water Cartridge

4. Lift the spring clip (see Figure 8 on page 69) at the top of the DI water cartridge, and rotate the cartridge clockwise (as viewed from the top) so it slides out of the retaining hooks.

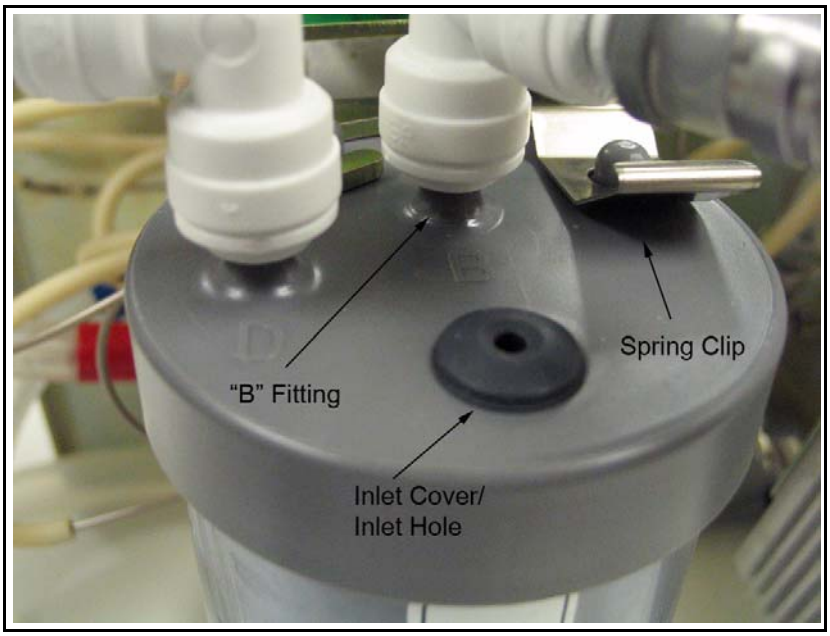

Figure 8: Filling the DI Water Cartridge

5. Remove the John Guest fittings labeled "B" and "D" from the barbs on the top of the DI water cartridge. To loosen a fitting, use the John Guest tool from the accessories kit to push up on the bottom ring on the fitting, so that the ring moves toward the fitting (see Figure 9). Note that the tool is not used like a wrench to turn the fitting, but rather is only used to press in on the bottom ring of the fitting. You may want to rest the tool on the small post when you release the fitting, as shown in see Figure 9.

Warning
To avoid scratches, do not use a metal tool to remove the John Guest fittings on the DI water cartridge. Always use the John guest tool provided in the Analyzer's accessories kit.

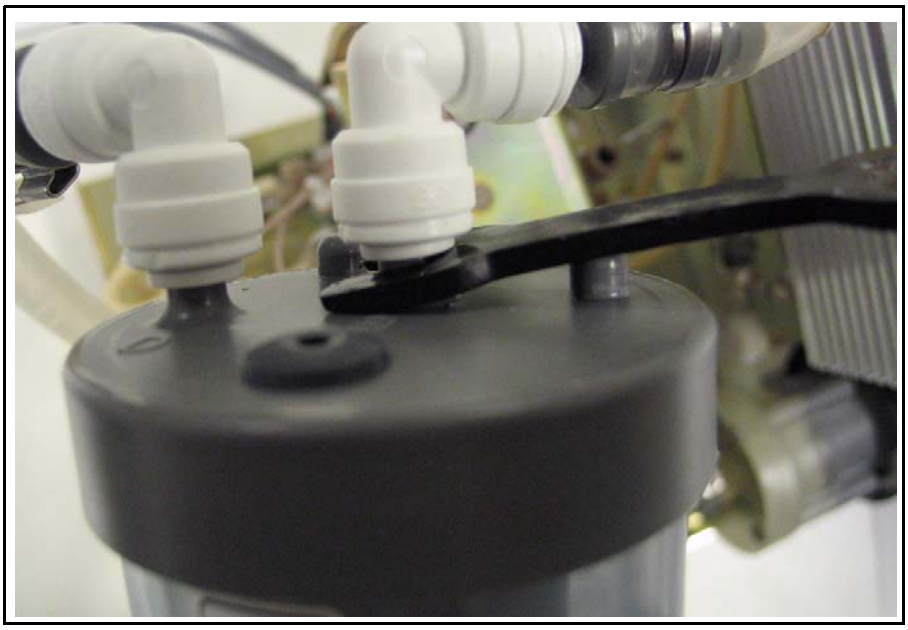

Figure 9: Removing the John Guest Fitting

6. Remove the rubber inlet cover from the top of the DI water cartridge.
7. Slide the water bottle nozzle into the inlet hole. Make sure the tubing that connects to Port "B" is positioned higher than the DI water cartridge, and then gently squeeze the water bottle. Be sure to fill the reservoir until the water reaches the **Full** line.
8. Connect the fitting labeled "D" to the barb labeled "B" on top of the DI water cartridge.
9. Slide the DI water cartridge into the bracket and rotate it into the retaining clip until it snaps into place. The cartridge must be level as you rotate it inward, and the bottom of the cartridge must be perpendicular to the bracket.
10. Visually check for leaks from the reservoir after the DI water cartridge has been filled.
11. Turn on the Analyzer using the main power switch. This will start the DI pump. Check for large air bubbles in all the tubing that connects to the DI water cartridge. If large air bubbles are present, tap or manipulate the tubing to work the air bubbles out.
12. Keep the Analyzer powered on for 2 minutes.
13. After 2 minutes, turn the Analyzer off.
14. Lift the spring clip at the top of the DI water cartridge, and rotate the cartridge clockwise (as viewed from the top) so it slides out of the retaining hooks.

15. Remove the John Guest fitting labeled “B” from the barb on the top of the DI water cartridge.
16. Connect the fitting labeled “B” to the barb labeled “B” on the top of the cartridge.
17. Connect the fitting labeled “D” to the barb labeled “D” on the top of the cartridge.
18. Slide the DI water cartridge into the bracket and rotate it into the retaining clip until it snaps into place.
19. Add water to the DI water cartridge, if necessary.
20. Replace the rubber inlet cover.
21. Turn the Analyzer on and wait 1 minute.
22. Check the level of the DI water cartridge. If the water level has dropped below the **Full** line, remove the rubber inlet cover from the top of the cartridge, add more water, and replace the inlet cover.
23. Close the Analyzer’s front panel.
24. Push the **Main** button and then press the **Menu** button.
25. Continue to Step 8. Note that even if you choose to skip Step 8, you must complete Step 9, “Rinsing the Analyzer,” prior to putting the Analyzer on-line.

Step 8: Configure Basic Analyzer Settings

Before using the Analyzer, you will need to configure various basic settings. Some of these settings will not need to be changed again, unless you move the Analyzer or reconfigure the operational environment.

Enabling DataGuard or Password Protection (Optional)

The Sievers 500 RL On-Line TOC Analyzer offers two levels of security, one included with the Analyzer and the other available for purchase as an upgrade from GE Analytical Instruments. The Password Protection feature is included with the Analyzer and provides a basic level of security. DataGuard™ is available as an upgrade directly from GE Analytical Instruments and provides support for the electronic signature regulation 21 CFR Part 11. You can enable one of these security features, but not both. (See Chapter 5, "Password Protection and DataGuard" for more information.)

If you purchased the DataGuard firmware feature from GE Analytical Instruments or will be using basic Password Protection, enable the feature now.

If you will not be using DataGuard or Password Protection, proceed to "Setting the Clock and Time Zone" on page 74.

Enabling Password Protection

If you will be using basic Password protection rather than DataGuard, activate the password now by following the steps below. Note that if DataGuard will be activated, there is no need to additionally activate the Password feature and you can proceed to the next section.

1. Select the **DataGuard** tab.
2. Press the **Enable Password** button.

Once Password protection is enabled, you will immediately be required to log in to the Analyzer with the default Administrator User ID and Password:

User ID: ADMIN

Password: GEAI

For security purposes, change the default password. After you have logged in using the default password, follow these steps:

1. Select the **DataGuard** tab.
2. Press the **Change Password** button.
3. Enter the old password (GEAI) and press **Enter**.
4. Enter the new password and press **Enter**.
5. Verify the new password and press **Enter**.
6. Record the new password in a secure location. All users will be required to enter this log in information to access the Analyzer's menus.

Enabling DataGuard

If you are enabling DataGuard, follow these steps:

1. Insert the USB flash drive containing the DataGuard activation into the Analyzer's USB port.

1. Press the **Menu** button, select the **Maintenance** tab, and press the **Advanced** button.
2. Press the **Activate Options** button.
3. Press the **OK** button and wait for the Analyzer to detect the USB flash drive.
4. Press the **Activate** button to enable DataGuard.

Once DataGuard is enabled, you will immediately be required to log in to the Analyzer with the default Administrator User ID and Password:

User ID: ADMIN

Password: GEAI

Proceed to the section “Establishing a New Administrator Account for DataGuard” below to complete the DataGuard activation.

After installation is complete, you can add unique user accounts to the Analyzer. Refer to Chapter 5, "Password Protection and DataGuard" for more information.

Establishing a New Administrator Account for DataGuard

After you log in to the Analyzer for the first time after activating DataGuard, create a new administrator-level account and inactivate the default administrator account to ensure Analyzer security. (Refer to Chapter 5, "Password Protection and DataGuard" for complete DataGuard information.)

1. Press the **Menu** button and select the **DataGuard** tab.
2. Press the **Add User** button.
3. Specify a new User ID for the administrator and press the **Enter** button.
4. Specify the Password for the administrator User ID and press **Enter**.
5. Verify the Password and press **Enter**.
6. Press the **User Level** button and select **Administrator**.
7. Press the **Password Expired** button and select **False**.
8. Press the **Back** button.
9. Press the **Logout** button. You will now use the new administrator account and delete the default account.
10. Press the **Login** button and enter the new User ID and Password you just created.

11. Press the **Menu** button and select the **DataGuard** tab.
12. Press the **Edit User** button.
13. Use the arrow buttons to highlight the default administrator account and press **OK**.
14. Press the **User Status** button and select **Inactive**.
15. Press the **Back** button to return to the **Menu** screen.

Setting the Clock and Time Zone

Set the Analyzer clock to ensure that all TOC measurements reflect the correct date and time:

1. Select the **Maintenance** tab.
2. Press the **Clock** button.
3. Press each date component button, enter the appropriate value, and press the **Enter** button.
4. Press the **Menu** button, press the **Advanced** button, and then press the **Advanced Setup** button.
5. (Optional) Press the **Time Zone** button, and specify the time zone via the two buttons on this screen. Note that the time zone information you enter here does not modify the time to which you set the clock in Step 3 above, but is merely intended to identify the time zone in exported or printed data.
    - **Time Zone** — Allows you to set a text descriptor for the time zone. Usually this is a three-letter code, such as "EST" for Eastern Standard Time or "GMT" for Greenwich Mean Time.
    - **GMT Difference** — Allows you to enter the offset from Greenwich Mean Time. Use the number pad and the **+/-** button to specify the offset. For example, for Eastern Standard Time you should enter `-5.00`.

Naming the Analyzer Location (Optional)

You can assign a name to the Analyzer that displays with printed and exported data. This feature is particularly useful if you have multiple Analyzers at your facility and want to easily distinguish data collected from each unit. To assign a name, follow these steps:

1. Select the **Maintenance** tab.

2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Location** button. Use the keypad to specify a name for the Analyzer and press **Enter**. Press the **Number** button and then the **Alpha** button to toggle between numbers and letters.
5. Press the **Back** button twice to return to the **Maintenance** tab.

Setting the Analyzer Mode

Before starting normal Analyzer operation, confirm that the mode settings match your configuration's needs.

1. Select the **Setup** tab. Confirm that the correct mode is selected.
   - In **On-Line** mode, the Analyzer measures TOC continuously and returns measurement results every 6 minutes.
   - In **On-Line Timed** mode, the Analyzer returns a single TOC measurement at specific times of the day.
   - In **On-Line Averaged** mode, the Analyzer, returns the averaged value of TOC over a specific time interval.
   - In **Grab** mode, the Analyzer draws samples from a vial in the Analyzer's **iOS** or Super **iOS** System (from vial port 1). Grab mode is not available for configurations with the Sample Inlet Block.

   For more information on mode selection, see "Setting the Analyzer Mode" on page 82.
2. Press the **Menu** button to exit and save your settings.

Setting Up the Data History

Before taking measurements, review the **Archive Data** setting to ensure that data is collected in the best way for your environment. When **Archive Data** is set to **On**, the Analyzer will not overwrite the oldest data and prompts you to archive data to free up memory; when **Archive Data** is set to **Off**, the Analyzer will make space for new data in memory by overwriting the oldest data. The data history can accommodate approximately 33,000 entries (at least 90 days of usage).

1. Select the **Data** tab.

2. Press the **Setup History** button.
3. Set **Archive Data** to **On**.

Note: If DataGuard is enabled, data must either be sent to storage or the serial port. See "Using DataGuard" on page 118 for more information.

4. Press the **Menu** button.

Setting Up the Printer (Optional)

If you installed a printer in "Installing the Printer" on page 65, configure the printer port to match the printer.

1. Select the **I/O** tab and press the **Printer** button.
2. Press the **Printer** button and select your printer model, either **Citizen**, **Seiko**, or **Epson**. If you do not have a printer, make sure **No Printer** is selected.
3. Press the **Header Freq.** button and select **First Page** to print a header only on the first page of output or select **All Pages** to print a header on all pages of output.
4. Press the **Print Freq.** button and select how often you would like to print TOC data information.

Exporting and Printing System Settings

Calibration constants and other key parameters are stored in the Analyzer's memory. You should export and print the factory settings for future reference.

To export the system to a configured file and an encrypted file for DataShare 500 software, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **USB I/O** button. Make sure that the USB flash memory drive from the Analyzer's accessory kit is attached to the USB port, then press the **Save System** button. Archive the exported files in a secure location on your computer.
4. Press the **Back** button and then press the **Menu** button.

If you have a printer attached to the Analyzer, you can print these settings for future reference by following these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Print Constants** button.
4. Press each of the five buttons, one at a time, to print the different constants.

Set Up Data I/O

If you installed binary input, alarms, or the 4-20 mA output, configure settings for those features now. Select the I/O tab and configure the appropriate settings. Note that you may need to consult with your remote operations center to determine some values. See page 90 through page 95 for details on configuring these settings.

Note: If the TOC level in your sample water is typically below 50 ppb, schedule a regular TOC Autozero. See "Programming the TOC Autozero" on page 105 for details.

Step 9: Rinsing the Analyzer

Before placing the Analyzer into normal operation, you should rinse the Analyzer for 12 hours by running it in Rinse mode and then letting it run in On-Line mode.

1. Select the **Maintenance** tab.
2. Press the **Advanced** button, then press the **Advanced Setup** button.
3. Press the **Auto Restart** button. Make sure **Rinse Down** is set to **On**. If it is set to **Off**, press the **Rinse Down** button, and then press the **On** button.
4. Press the **Back** button, then press the **Rinse** button.
5. The Analyzer will run in Rinse mode, and then will automatically switch into On-Line mode. Let the Analyzer run for 12 hours. No data will be reported for the Rinse mode.
6. After 12 hours, press the **Stop Analysis** button.
7. Open the Analyzer case and again visually inspect the Analyzer for leaks, especially around the DI water cartridge. If a leak is detected, make sure all fittings are tight and secure. Also

confirm the water level in the DI water cartridge and, if necessary, turn off the Analyzer and add more water.

8. Close the Analyzer case.

The Analyzer is now ready to take valid TOC measurements. If you want to customize additional settings, do so now; consult Chapter 4, "Basic Analyzer Operation" for details.

Step 10: Install DataShare 500 Software

If you have DataShare 500 software to manage from your Analyzer, install it now. Consult the DataShare 500 *Operation and Maintenance Manual,* located on the software CD or at www.geinstsruments.com in The Library > Manuals), for instructions.

Chapter 4. Basic Analyzer Operation

Overview

The Sievers 500 RL On-Line TOC Analyzer utilizes a touch-sensitive color LCD for all menu selection activities. An overview of the menu structure is given in "The Menu Screen" on page 81. An overview of hardware features starts on page 106. Note that on configurations with a Sample Inlet Block rather than an **iOS** System, not all menu options may be relevant or available on your Analyzer.

When the Analyzer is first powered on, the **Startup** screen displays basic GE Analytical Instruments contact information and the firmware version number. The Analyzer then begins initialization to check the status of consumables and prepare for taking measurements. When the Analyzer is done with initialization, the **Main** screen automatically displays. If Password protection is enabled, you *may* be required to log in before starting analysis or proceeding to the **Menu** screen. If Dataguard is enabled, you *will be* required to log in before starting analysis or proceeding to the **Menu** screen.

The Main Screen

The **Main** screen provides the most important status and activity information for the Analyzer and offers you two primary options:

- Press the **Start Analysis** button to initiate TOC measurements with the most current Analyzer settings. Once analysis begins, the button changes to **Stop Analysis**.

- Press the **Menu** button to display the **Menu** screen and change the Analyzer's settings.

Note: *If Password protection is enabled, you may be required to log in before starting analysis or proceeding to the Menu screen. If Dataguard is enabled, you will be required to log in before starting analysis or proceeding to the Menu screen. See "Menu Map — DataGuard (Optional Upgrade)" on page 116 and "Using DataGuard" on page 118 for more information.*

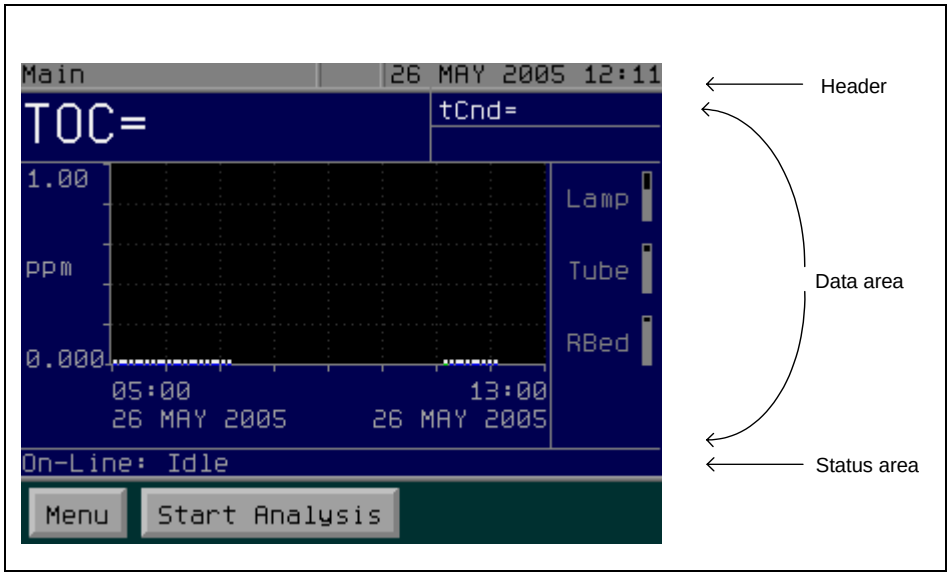

Figure 10: The Sievers 500 RL On-Line TOC Analyzer Main Screen

The **Main** screen is divided into three areas:

1. The Header contains the name of the screen, the date and time, and status icons representing the following conditions:
   - The Key icon (🔑) displays when basic Password security is enabled.
   - The Padlock icon (🔒) displays when DataGuard is enabled.
   - The **W** icon displays when a warning has been issued and the **E** icon displays when an error has been issued. (See "Reviewing Warnings and Errors" on page 98 for more information.)

2. The Data area shows indicators for the status of the Analyzer's primary consumables (see "Displaying Consumables Status" on page 97 for more information). Information about TOC measurements also displays, depending on which mode the Analyzer is in:
   - In the On-Line modes, a trend graph displays on the **Main** screen; to change the scale and specify which readings display on the graph, see "Graphing Data History" on page 87.
   - In Grab mode, a table of data statistics displays on the **Main** screen.
3. The Status area displays information about the current operation mode, the Analyzer's current status (Initializing, Idle, Analyzing, etc.), a countdown timer showing the time remaining in the current analysis, and the repetition and rejection count, if applicable.

Taking TOC Measurements

After you have set the analysis mode and have configured the mode settings (as described in "Setting the Analyzer Mode" on page 82) you are ready to begin taking TOC measurements. Simply press the **Start Analysis** button to begin.

The Menu Screen

The **Menu** screen provides you with access to all Analyzer settings and configuration options. Note that if Password protection or DataGuard is enabled, some options may be available only to certain users. See Figure 21 on page 115 for a menu map that indicates the required User Level to access various settings.

The **Menu** screen contains the five main configuration categories; press a tab to display the available options:

- **Setup** — Set the Analyzer mode and change parameters such as the number of repetitions and the number of rejects.
- **Data** — Display and export historical data stored in RAM.
- **I/O** — Configure the input and output of data from the Analyzer.
- **Maintenance** — Display information about the Analyzer's consumables levels, system information, and error messages. Also perform calibration and system suitability operations.
- **DataGuard** — Configure the access settings and user passwords for your Analyzer.

From any tab under the **Menu** screen, you can press the **Start Analysis** button to initiate TOC measurements.

Setup

Options on the **Setup** tab let you specify preferences and basic operation settings for the Analyzer configuration. If the sample conditions for your application remain relatively constant, you should seldom need to configure the settings here.

Setting the Analyzer Mode

The Sievers 500 RL On-Line TOC Analyzer can operate in up to four different modes, depending on your configuration. To set the Analyzer mode, follow these steps:

1. Select the **Setup** tab (see Figure 11).
2. If you are running the Analyzer with a continuous water source, select an On-Line mode:
   - Select **On-Line** to measure TOC continuously and return measurement results every 6 minutes.
   - Select **On-Line Timed** to display a single TOC measurement at specific times of the day. Press the **Configure** button and specify the hour and minute for the first measurement; then, specify the time interval for successive measurements (**30 Minutes**, **1 Hour**, **4 Hour**, **8 Hour**, **24 Hour**). At each specified interval, the Analyzer displays data for the measurement that occurred at that time.
   - Select **On-Line Averaged** to return the averaged value of the last 10 TOC measurements over a specific time interval. Press the **Configure** button and specify the hour and minute for the first measurement, then specify the time interval. At each specified interval, the Analyzer displays data reflecting the average TOC value since the last specified interval. Also press the **Threshold** button to specify a TOC level above which the Analyzer will switch to **On-Line** mode for the remainder of the interval. When the threshold is exceeded, the Analyzer gives the average value for the interval thus far and then returns measurements every 6 minutes.
3. If you are sampling from a vial in the Analyzer's **iOS** or Super **iOS** System, press the **Grab** button. Follow the instructions under "Grab Mode Measurement Settings" on page 83 for configuring Grab mode. Grab mode is not available for configurations with the Sample Inlet Block.

4. Press the **Menu** button to exit and save your settings.

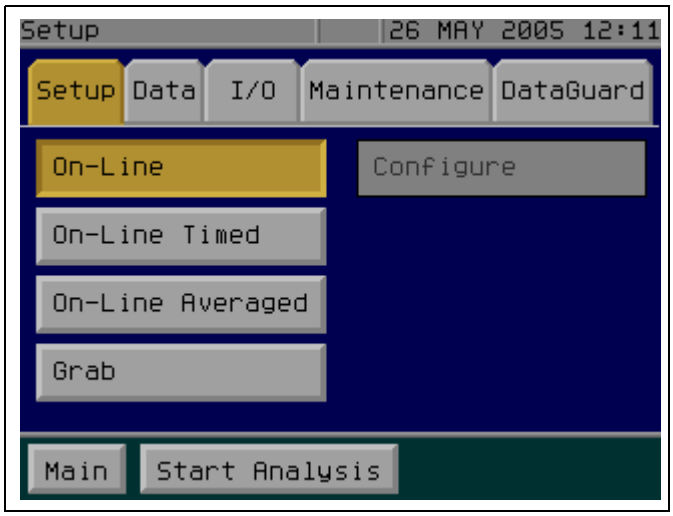

Figure 11: The Setup Tab

Grab Mode Measurement Settings

When selecting Grab mode (available on configurations with an **iOS** or Super **iOS**), you need to specify the number of replicate measurements and rejects as follows:

1. On the **Setup** tab, press the **Configure Mode** button.
2. Press the **Reps** button to set the number of replicate TOC measurements to be made on the sample. When you press the button, a number pad displays. Enter a number and press the **Enter** button to save the value, or press **Cancel** to retain the current setting without making any changes.
3. Press the **Rejects** button. This option determines how many of the replicate measurements will be rejected in calculating average values and standard deviations. When you press the button, a number pad displays. Enter a number and press the **Enter** button to save the value, or press **Cancel** to retain the current setting without making any changes.

In most cases, this first measurement will be close to the actual TOC but may be an outlier. It is best to set the number of rejections to **1** or more to ensure an accurate TOC value. Using at least **4** repetitions allows rejection of the first value and calculation of a standard deviation using the remaining values. If your Analyzer has a Super **iOS**, the vial must be in Port 1.

When measuring in Grab mode, if you use glass vials the sample water must be acidified to a pH of 3. If you use plastic vials, no acidification is required.

Managing Data History

The Analyzer stores the TOC measurement data history in the non-volatile memory. On the **Data** tab (see Figure 12) you can configure the way your Analyzer stores and displays the data history; you also can initiate printing and exporting of the data.

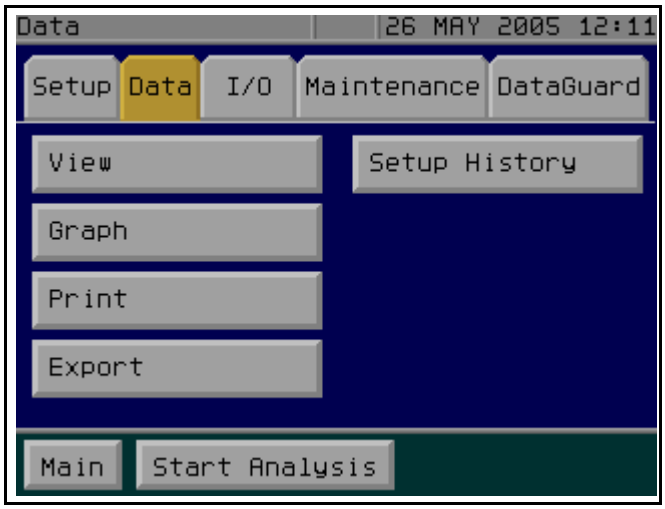

Figure 12: The Data Tab

Setting up Data History

The data history can accomodate approximately 33,000 entries (at least 90 days of usage).

1. Select the **Data** tab.
2. Press the **Setup History** button.
3. Set the **Archive Data** option to **On** or **Off**. When **Archive Data** is set to **On**, the Analyzer will not overwrite the oldest data and prompts you to archive data to free up memory; when

Archive Data is set to **Off**, the Analyzer will make space for new data in memory by overwriting the oldest data.

Note: *If the DataGuard option has been purchased and enabled, Archive Data is set to* **On**. *When the data history is filled, analysis is stopped until the data history is printed or exported. See "Using DataGuard" on page 118 for more information.*

4. If you wish to have data automatically downloaded to a USB flash memory drive, press the **Daily Download** button and select **On**. Then, press the **Download Time** button and enter a time for the download. When activated, every day at the specified time, the Analyzer will automatically download the previous 24 hours of data to the flash memory drive, if it is connected to the Analyzer's USB port.

Archiving Data History

When **Archive Data** is set to **On**, you will be prompted to archive your data when the data history is close to full. If DataGuard is enabled, when the data history is completely full, an error message is issued and the Analyzer stops taking TOC measurement until you archive the data.

To archive your data, follow these steps:

1. Select the **Data** tab.
   - Press the **Print Archive** button if you wish to print the data history archive.
   - Press the **Export Archive** button to export the data history archive to a file. You will be prompted to verify that the export device is ready to capture the data. The archive can be exported to either a USB device or the serial port.
2. After printing or exporting the archive, the data history will be overwritten with new measurements as additional data are collected.

Viewing Data History

You can view the data history stored in the Analyzer whether or not analysis is in progress. To display the **Data History** screen, follow these steps. On configurations without conductivity measurement, some options are not available.

1. Select the **Data** tab.
2. Press the **View** button to display the data history.

3. Press the **Setup** button to change the type of data displayed in the data history list.
4. Press the **Values** button and select one of these options:
    - **TOC/tCond/Mode** — Displays TOC and temperature-corrected conductivity data and the mode in which the data was measured.
    - **TOC/rCond/Temp** — Displays TOC, raw conductivity, and temperature data.
    - **TOC/Mode** — Displays TOC data and the mode only.
    - **TOC/IC/TC** — Displays TOC, IC, and TC data.

The data history list also displays the time of the analysis and the values for the items selected on the **Values** screen. The date in the header reflects the date of the highlighted measurement at the top of the list. For example, in Figure 13, the first line of data is highlighted, indicating the measurement was taken on October 26, 2005. Scroll up and down through the Data History list with the arrow keys, and move to the start or end of the list with the **Start** or **End** buttons.

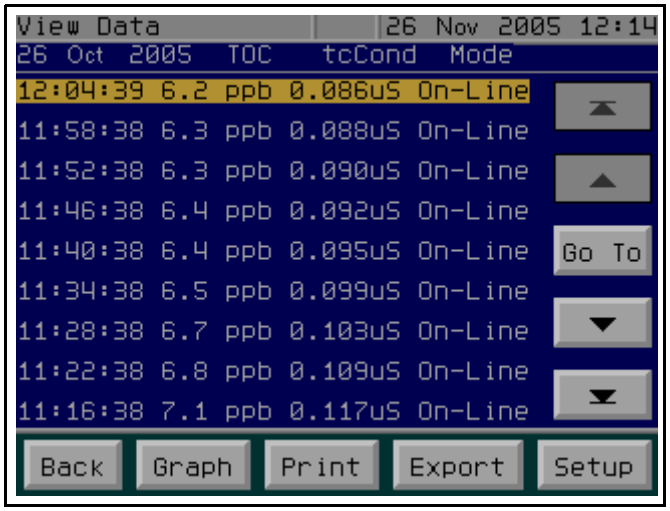

Figure 13: Specifying a Start Date on the View Data Screen

To display a specific portion of the data history, press the **Go To** button, use the number pad to enter the appropriate date and time settings, and then press the **Back** button. The first measurement for the date you entered is displayed at the top of the list. If you enter a date or time for which there is no data, the next closest date or time is displayed.

On the **Data History** screen, you also have the option to graph, export, and print data. See the following sections for details on using these screens.

Because the Analyzer uses acidified standards, conductivity data gathered during some system protocols may exceed the maximum range. In these cases, the Analyzer will show a conductivity reading of >60 µS/cm for raw conductivity (rCond) or >30 µS/cm for temperature-corrected conductivity (tCond).

Graphing Data History

You can set the time scale for the data that is displayed on the graph and specify which data are displayed. The settings you specify on the **Graph** screen also affect the graph that is displayed on the **Main** screen. On configurations without conductivity measurement, some options are not available.

To customize the graph, follow these steps:

1. Select the **Data** tab.
2. Press the **Graph** button to display the data graph (see Figure 14).
3. Press the **Setup** button to specify the scale for the graph.
4. Press the **Type** button to specify which data are displayed on the graph: **TOC only, TOC/IC/TC, Sample Cond.,** or **Sample Temp.**
5. Press the **X Scale** button and select a time range for the X axis of the graph: **1 Hour**, **2 Hour**, **4 Hour**, **8 Hour**, **1 Day**, **2 Days**, **1 Week**.
6. Press the **Y Scale** button to select a range for the Y axis.
   - Select **Auto** to have the Analyzer automatically calculate the appropriate range.
   - Select **Manual** to enter specific TOC values in ppb or conductivity values in µS. Press the **Min** button to enter the minimum value and press the **Max** button to enter the maximum value.
7. Press the **Back** button to save your changes and return to the graph display. A color-coded key displays to help identify the graph lines for each type of data.
8. To begin the graph from a specific measurement, press the **Go To** button, enter the appropriate date or time values, press **Enter**, and press the **Back** button.

Note: *Settings specified in the* **Setup** *screen affect the display of the graph on the* **Main** *screen, in addition to the graph displayed under the* **Data** *tab.*

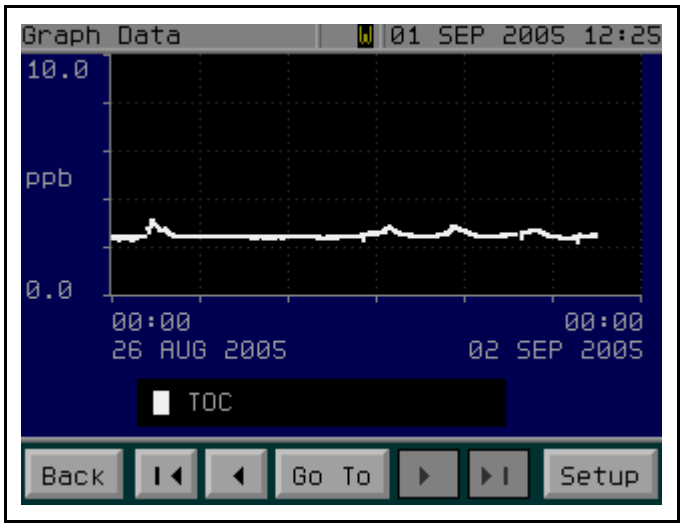

Figure 14: Graphing the Data History

Printing Data History

The Analyzer can print the data history for any valid time range that you specify. To print data, follow these steps. On configurations without conductivity measurement, some options are not available.

1. Select the **Data** tab.
2. Press the **Print** button.
3. Press the **Range** button to specify a preset time range: **1 Day**, **1 Week**, **All**, or **Custom**.
   - If you select a **Custom** range, press the **To Date** and **From Date** buttons and enter the desired time range values.
4. Press the **Values** button to specify which data will print:
   - **TOC/tCond/Mode** — Prints TOC and temperature-corrected conductivity data and and the mode in which the data was measured.
   - **TOC/rCond/Temp** — Prints TOC, raw conductivity, and temperature data
   - **TOC/Mode** — Displays TOC data and the mode in which the data was measured.
   - **TOC/IC/TC** — Prints TOC, IC, and TC data.

5. Press the **Print** button to print the data.

Note: *Prior to printing, you may want to confirm your printer settings. See "Configuring Printer Settings" on page 94 for more information.*

Exporting Data History

The Analyzer can export the data history for any valid time range that you specify, either to the serial (RS-232) port or the USB port.

To export data, follow these steps:

1. Select the **Data** tab.
2. Press the **Export** button.
3. Press the **Range** button to specify a preset time range: **1 Day**, **1 Week**, **All**, or **Custom**.
   - If you select a **Custom** range, press the **To Date** and **From Date** buttons and enter the desired time range values.
4. Press the **Export** button. Make sure a USB device or serial cable is attached to the Analyzer prior to pressing the **Export** button.
5. Indicate the destination port by pressing the **USB** or **Serial** button to start the data export.

The data is exported in two formats: comma-separated format (`.csv`) and an encrypted format for use with Sievers DataShare 500 software. In addition, the Audit Trail is exported. The files contain the following fields: Analysis mode, Date, Time, TOC, IC, TC, raw conductivity, and sample temperature. Most spreadsheet programs, such as Microsoft Excel, can open the `.csv` file without having to go through an import process.

Setting Up Analyzer Input and Output

Menu selections under the **I/O** tab allow you to configure data for alarms, analog output, binary input, serial output and printing.

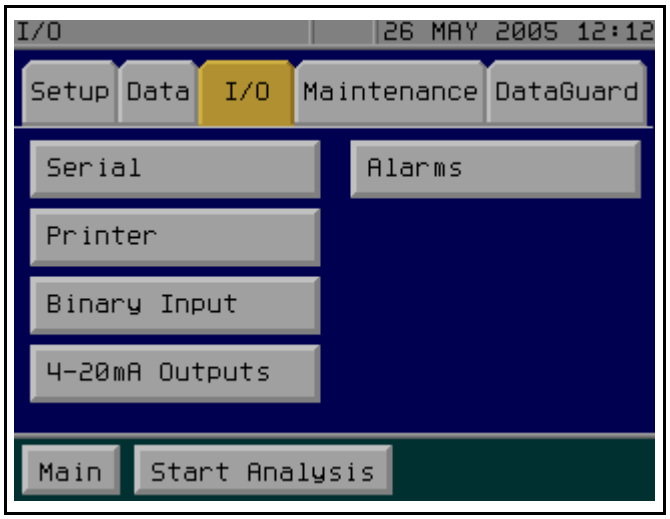

Figure 15: The I/O Tab

Setting Up Analog Output

The Sievers 500 RL On-Line TOC Analyzer has three 4-20 mA outputs. Select the output range for the 4-20 mA analog outputs by following the steps below. Instructions for wiring the 4-20mA output can be found in the "Installation" chapter on page 62. On configurations without conductivity measurement, some options are not available.

1. Select the **I/O** tab.
2. Press the **4-20mA Outputs** button.
3. Press the **Error/Standby Configuration** button. The settings here are applied to all the analog outputs when each condition exists.
    - Press the **Error** button and then press a button on the right to indicate the value for an error condition, either **1 mA**, **2.5 mA**, **4 mA**, **20 mA**, **22 mA**, or **LAST**. (**LAST** = Hold the last measurement until the next measurement.) The initial default value is **2.5 mA**.
    - Press the **Standby** button and then press a button on the right to indicate the value when the Analyzer switches out of Analysis mode and into Standby mode, either **1 mA**, **2.5 mA**, **4 mA**, **20 mA**, or **LAST.** The initial default value is **1 mA**.
    - Press the **Warning** button and then press a button on the right to indicate the value for a warning condition, either **1 mA**, **2.5 mA**, **4 mA**, **20 mA**, **22 mA**, or **LAST**. The initial default value is **LAST**.

Note: *The values for* **Error**, **Standby**, *and* **Warning** *should be different*.

4. Press the **Back** button.
5. Press one of the Analog Out buttons, either **Analog Out 1**, **Analog Out 2**, or **Analog Out 3**. Set the values for the following:
   - Press the **Value** button to set the output value that will be sent to the analog output. Press the **TOC**, **TC**, **IC**, **rCond**, **tCond**, or **Temp** button and then press **Enter** to change the value, or press **Cancel** to retain the current setting without making any changes.
   - Press the **Min** button to set the minimum value (in ppb or µS), corresponding to the minimum analog current. Enter a number and press the **Enter** button to save the value, or press **Cancel** to retain the current setting without making any changes.
   - Press the **Max** button to set the maximum value (in ppb or µS), corresponding to the maximum analog current. Enter a number and press the **Enter** button to save the value, or press **Cancel** to retain the current setting without making any changes.
6. To adjust the values output via the 4-20 mA outputs, see "Adjusting Analog Output Values" below.

Adjusting Analog Output Values

Adjust the 4-20 mA output values by following these steps:

1. Open the Analyzer door and connect wiring from one of the 4-20 mA outputs on TB 3 to a digital multimeter.
2. Select the **I/O** tab.
3. Press the **4-20mA Outputs** button.
4. Press the button that corresponds to the output to which you connected in Step 1 (either **Analog Out 1**, **Analog Out 2**, or **Analog Out 3**).
5. Press the **Adj. AnalogOut** button.
6. Press the **4 mA** button.
7. Specify a value between 0 and 65535 using the keypad and press the **Enter** button.
8. Check the value that is output to the multimeter. If the reading is not 4 mA ± 0.01 mA, go back to Step 6 and adjust the value. Repeat until the multimeter measures 4 mA ± 0.01 mA.
9. Press the **20 mA** button.
10. Specify a value between 0 and 65535 using the keypad and press the **Enter** button.

11. Check the value that is output to the multimeter. If the reading is not 20 mA ± 0.01 mA, go back to Step 9 and adjust the value. Repeat until the multimeter measures 20 mA ± 0.01 mA.
12. Disconnect the multimeter wires from TB3 and close the Analyzer door.

Setting Up Serial Output

To download data from the Analyzer directly to a computer, you must set the **Baud Rate** for the serial (RS-232) port. The default is **9600**.

1. Select the **I/O** tab.
2. Press the **Serial** button.
3. Press the **Baud Rate** button. Select **9600**, **19200**, or **38400** and press the **Enter** button to save the value, or press **Cancel** to retain the current setting without making any changes. Consult your computer manual to determine the maximum baud rate for your computer's serial port. The default value is **9600**.
4. Press the **Output Format** button. If your data acquisition system is set up to work with Sievers 400 ES TOC Analyzers and you want to use a serial output format compatible with the older format, press the **400 ES** button. Otherwise, **500 RL** should be selected as the output format. The default format is **500 RL**.

To capture the data via the serial (RS-232) port, you will need a computer that is running a serial port communications program, such as Hyperterminal. For information on setting up Hyperterminal to communicate with the Analyzer, see "Using HyperTerminal" on page 197 in the Appendix.

Note: *For long distance connections (up to 1,000 feet or 305 meters), GE Analytical Instruments recommends use of either a RS-232 current loop converter or a RS-422 converter. Companies such as B&B Electronics manufacture both kinds of converter.*

The computer's serial port should be set to the following:

Bits Per Second: 9600 (or a rate matching that set for the Analyzer)

Data Bits: 8

Parity: None

Stop Bits: 1

Flow Control: Hardware

Interpreting Serial Output

If configured to output 500 RL format, the Analyzer outputs the data shown in Table 4 to the Serial (RS-232) Port for every measurement,. On configurations without conductivity measurement, Field 7 is not available.

Table 4: Data Fields Output to the Serial (RS-232) Port

Field	Value
1	Mode
2	Date
3	Time
4	TOC (ppb)
5	IC (ppb)
6	TC (ppb)
7	Raw conductivity (rCond, µS/cm)
8	Temperature (°C)
9	Temperature-corrected conductivity (tCond, µS/cm)

For example, a successful measurement would output as follows:

```
On-Line,21 SEP 2005,10:23:47,550,48.9,599, 4.51,22.5, 4.77
   1         2          3      4    5    6     7     8     9
```

Mode values (Field 1) can be On-Line, Timed (On-Line Timed), Averaged (On-Line Averaged), or Grab. For information on Analyzer modes, see "Setting the Analyzer Mode" on page 82. In a warning or error condition, some values may not be output.

After field 9, the Analyzer outputs a carriage return, followed by a line feed.

If configured to a 400 ES format, refer to the *"Series 400ES, 400DI, 2244OL TOC Analyzer Operations and Maintenance Manual.*

Issuing Serial Commands to the Analyzer

You can use a PC running a communications program, such as HyperTerminal, to issue commands to the Analyzer via a serial (RS-232) connection. For information on establishing a connection, consult "Using HyperTerminal" on page 197 in the Appendix. The Analyzer accepts the following serial commands:

RUN	Start analysis
STP	Stop analysis

When the Analyzer receives one of these commands successfully, it returns **ACK** to the communications program on the PC. If the command fails or if a bad command is sent, the Analyzer returns **NAK**.

Configuring Printer Settings

You can change the way the Analyzer formats output sent to the printer.

1. Select the **I/O** tab.
2. Press the **Printer** button.
3. Press the **Printer** button and choose **Epson**, **Seiko**, or **Citizen**, depending on the type of printer you have. If no printer is attached to the Analyzer, choose **No Printer**. If you want to try using a printer made by a different manufacturer, select **Citizen**, as it offers the most generic compatibility.
4. Set **Header Frequency** to **First Page** or **All Pages** to specify when a header will print. The header includes basic information about the Analyzer, including the firmware version, Analyzer serial number, and the current date.
5. Press the **Interval** button to print the average TOC value for the period of time specified. The options are as follows: **Every Sample**, **Every Hour**, **Every 2 Hrs.**, **Every 4 Hrs.**, or **Every 8 Hrs.**

Activating Binary Input

You can start and stop analysis with binary input to the Analyzer.

1. Select the **I/O** tab.
2. Press the **Binary Input** button.

3. Press the **Binary Input** button, and select **On** (or **Off** if you wish to disable binary input).
4. Press the **Start Level** button and select **High** or **Low**. This value corresponds to the signal that will cause the Analyzer to start analysis. Confirm the correct value with your remote operations center.

Note that the Analyzer's flow switch status overrides **Binary Input** settings; when the flow switch detects loss of sample flow to the Analyzer, analysis will not begin until sample flow resumes.

Turn off the **Binary Input** function when performing system protocols, such as calibration.

Setting Alarm Values

The Analyzer has four customizable alarm outputs that can be triggered if the measured data exceeds a set value or if a warning or error occurs. By default, the alarms are disabled. When external alarms are connected to the Analyzer, you can set the alarm levels by following the steps below. Instructions for wiring the alarms can be found in the "Installation" chapter on page 60. On configurations without conductivity measurement, some options are not available.

1. Select the **I/O** tab.
2. Press one of the alarm buttons, either **Alarm 1**, **Alarm 2**, **Alarm 3**, or **Alarm 4**.
3. Press the **State** button to toggle the alarm output from **Off** to **On**.
4. Press the **Value** button to set the value that triggers the alarm. The options are:

- **TOC**, **TC**, **IC**, or **rCond.** — The alarm is triggered when a specified value is exceeded. Also press the **Level** button to set the alarm threshold.

- **Warn/Error** — The alarm is triggered when the Analyzer issues a warning or error.
- **Standby** — The alarm is triggered when the Analyzer goes out of on-line analysis.
- **Power Fail** — The alarm is triggered when the Analyzer loses power.
- **Error** — The alarm is triggered when the Analyzer issues an error.
- **Warning** — The alarm is triggered when the Analyzer issues a warning.
- **TOC Limit** — The alarm is triggered when the TOC level exceeds the TOC value (in PPB) as determined by the last system suitability verification.
- **Cond Limit** — The alarm is triggered when the conductivity level exceeds the limit specified for the sample's temperature in the currently selected pharmacopeia (USP, EP, UFI, EPPU).
- **Meas. Done** — The alarm is triggered for 2 seconds when the Analyzer finishes a measurement cycle and returns a reading.
- **Limits** — The alarm is triggered when measurements exceed the TOC limit or the conductivity limit.
- **Break In** — The alarm is triggered after five unsuccessful log in attempts by a single User ID. See "Reactivating Inactivated User Accounts" on page 123 for more information.

5. Press the **Menu** button when you are done.

   While the Analyzer is running system protocols, such as calibration, only the alarms for **Error/Warning**, **Power Fail**, and **Break In** are in an active monitoring state.

Managing Maintenance Information

Options on the **Maintenance** tab contain important operational information, including the Warnings/Errors list and consumables status. The **Maintenance** tab also provides access to calibration and verification functions and other advanced features; consult Chapter 6, "Calibration and System Protocols" for details on these functions.

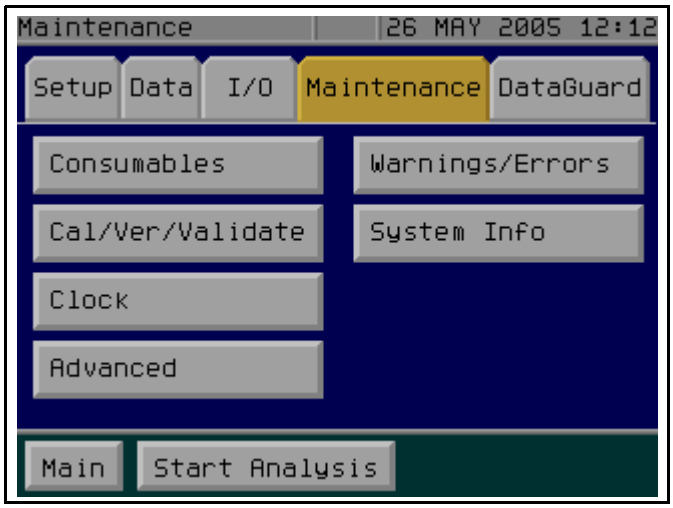

Figure 16: The Maintenance Tab

Displaying Consumables Status

The **Main** screen displays an overview graphic that indicates the relative life status of the Analyzer's consumables: UV lamp, pump heads, and resin bed. Status indicators on the **Main** screen change color as the need for replacement nears.

To display more detailed information about consumables status, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Consumables** button.

The status of each of the consumables is displayed, with an estimate of remaining life.

If you need to install new consumables, follow the instructions in Chapter 7, "Maintenance" for each consumable you install; also be sure to follow the instructions in the section called "Setting the Installation or Date for New Consumables" on page 165.

Setting the Analyzer Clock and Time Zone

You can set the Analyzer clock by following these steps:

1. Select the **Maintenance** tab.

2. Press the **Clock** button.
3. Press each date component button, enter the appropriate value, and press the **Enter** button.
4. Press each time component button, enter the appropriate value, and press the **Enter** button.
5. If you want to set the time zone as well, press the **Back** button, press the **Advanced** button, and then press the **Advanced Setup** button.
6. Press the **Time Zone** button, and specify the time zone via the two buttons on this screen. Note that the time zone information you enter here does not modify the time to which you set the clock in Step 3.
    - **Time Zone** — Allows you to set a text descriptor for the time zone. Usually this is a three-letter code, such as "EST" for Eastern Standard Time or "GMT" for Greenwich Mean Time.
    - **GMT Difference** — Allows you to enter the offset from Greenwich Mean Time. Use the number pad and the **+/-** button to specify the offset. For example, for Eastern Standard Time you should enter `-5.00`.

Note: *The Analyzer clock does* **not** *automatically update for time changes, such as the change to Daylight Savings Time in the USA.*

Reviewing Warnings and Errors

The Analyzer issues two levels of messages:

1. **Warnings** — Warnings do not stop TOC measurements, but may indicate that corrective action is required to prevent eventual Analyzer shutdown or loss of data.
2. **Errors** — Errors are serious alerts and all errors stop TOC measurements to prevent the collection of erroneous data or to protect the Analyzer from damage. Corrective action should be taken before the Analyzer can resume normal operation.

Warnings and errors issued by the Analyzer collect in the Warnings/Errors list after their initial display. The **W** icon displays in the **Menu** screen header when a warning has been issued and the **E** icon displays when an error has been issued; if both a warning and an error have been issued, then the **E** icon will display, as errors are more serious alerts than warnings. (See Chapter 8, "Troubleshooting" for additional information on warnings and errors.)

To display the Warnings/Errors list, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Warnings/Errors** button.
3. Use the scroll buttons to browse through the warnings and errors. For each warning/error, you have three options:
   - **Remove** — Remove the warning/error from the list. There is also an option to remove all errors/warnings.
   - **Export** — Send all the warning/error to the serial (RS-232) or USB port.
   - **Print** — Send all the warning/error to the printer.

The Analyzer displays the date, error number, error description, a brief suggestion for corrective action, time of last occurrence, and the number of times this warning or error has occurred. A complete listing of warnings and errors, along with corrective actions, is given in "Warnings and Error Messages" on page 170.

Note:	*The action of entering and exiting the Maintenance tab after a warning or error occurrence automatically resets the alarm(s).*

Displaying System Information

If you need to contact GE Analytical Instruments about your Analyzer, you can find most essential information on a single screen.

1. Select the **Maintenance** tab.
2. Press the **System Info** button. The following unit information is displayed:
   - Location name
   - Firmware version number
   - Analyzer serial number
   - GE Analytical Instruments phone numbers and Web site information

Advanced Analyzer Settings

Analyzer settings are considered to be advanced if they will not be regularly changed in the course of normal Analyzer operations. If Password Protection or DataGuard is enabled, logging in with a User ID that has a User Level of Quality or Administrator is required in order to change these settings.

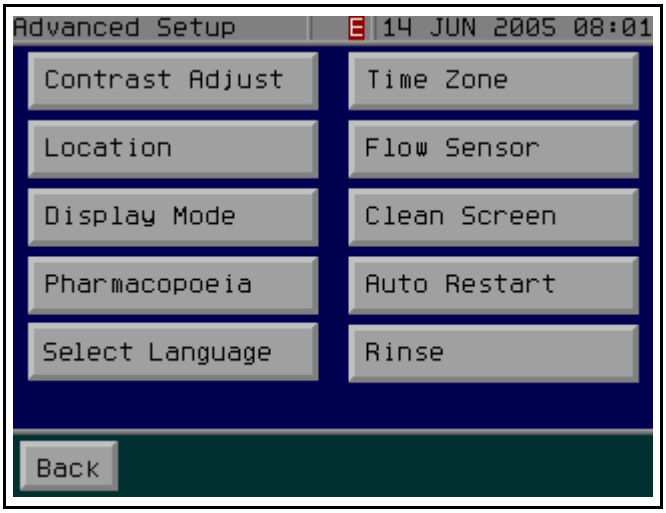

Figure 17: The Advanced Menu with One Program Language Loaded

Exporting or Printing the Warning and Error History

To export or print the Warning/Error History, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Warn/Error Out** button
   - Press **Print History** to output the history to the printer.
   - Press **Export History** to output the history to the USB flash memory drive.

Saving System Settings

You can archive settings to the USB port and restore them at a later time. This feature provides a backup mechanism in the event that you need to return to previous settings, including calibration and user-configurable settings. Save your Analyzer's system settings as follows:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **USB I/O** button. Make sure that the USB flash memory drive is attached to the USB port.
4. Press the **Save System** button.

To use the restore feature, be sure that the USB flash memory drive containing the previously exported data is attached to the Analyzer's USB port, repeat Steps 1 through 3 above, and select **Restore System**.

Printing the Constants Values

Calibration constants and other key parameters are stored in non-volatile memory. If you have a printer attached to the Analyzer, you can print these settings for future reference by following these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Print Constants** button, and then select one of the following to print:
   - **System Configuration** — Prints basic user-configurable settings.
   - **System Constants** — Prints the factory-set constants for each conductivity cell.
   - **Calibration Constants** — Prints constants set by the most recent calibration.
   - **Consumables Settings** — Prints usage and expected life information about consumables.
   - **USP 645 Stage 1 Table** — Prints the USP 645 Stage 1 Table for temperature and conductivity requirements.

Adjusting Display Contrast Settings

The Analyzer's color LCD can be adjusted for proper viewing in your environment as follows:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Contrast Adjust** button and use the keypad to change the contrast level of the display. Press **Enter** to change the contrast to the new value, and then push **Menu** to exit. Use a smaller number to increase screen brightness.

Naming the Analyzer Location

You can assign a name to the Analyzer that displays on printed and exported data. This feature is particularly useful if you have multiple Analyzers at your facility and want to easily distinguish data collected from each instrument. To assign a name, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Location** button.
5. Use the keypad to specify a name for the Analyzer and press **Enter**.

Changing the Display Mode

By default, the Analyzer displays the TOC and conductivity values on the **Main** screen. You can change the display for other values as follows:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Display Mode** button.
5. Select the values you want displayed on the Main screen: **TOC/tCond**, **TOC/rCond/Temp**, **TOC**, or **TOC/IC/TC**, **TOC/IC/rCond**, **TOC/IC/tCond**.

Specifying the Pharmacopeia

Because Pharmacopeia standards diverge, the Analyzer allows you to specify which Pharmacopeia is applicable to your environment. To specify the Pharmacopeia, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Pharmacopeia** button.
5. Select from the following options:
   - **USP WFI/PW**: U.S. Pharmacopeia for Water for Injection/Purified Water
   - **EP WFI**: European Pharmacopeia for Water for Injection
   - **USP and EP**: U.S. Pharmacopeia and European Pharmacopeia (encompasses the values in the previous two menu items).
   - **EP PW**: European Pharmacopeia for Purified Water
   - **None**

Selecting the Program Language

If you have loaded a second program language into the Analyzer, you can switch between the two languages by following these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Select Language** button. Two buttons will display; the choices depend on which languages you have loaded into the Analyzer. Select the desired language to continue.

   Note that if only one program language is loaded, the **Select Language** button does not display.

   Note *If you change the program language by mistake and need help navigating the menus to switch back to your native language, see "Problems Changing the Program Language" on page 184.*

Configuring the Flow Sensor

In configurations with an **iOS** or Super **iOS**, the Analyzer automatically detects the presence of the sample stream when it is working in On-Line mode. When the water flow is interrupted, the Analyzer issues an error and stops analysis. To change the **Flow Sensor** setting, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Flow Sensor** button.
5. By default, the Flow Sensor is set to **On**. To change the Flow Sensor Status, press the **Flow Sensor** button and then select **On** or **Off**.

Note: *Every time the Analyzer is stopped and re-started in On-Line mode, the Flow Sensor automatically resets to On, to protect the Analyzer.*

Press the **Flow Restart** button and set it to **On** or **Off**. Setting the **Flow Restart** to **On** means the Analyzer will automatically begin analysis again after a temporary stoppage of sample flow, if it was taking measurements at the time sample flow stopped. When flow is interrupted, a warning will be recorded in the warnings/errors list.

Warning
Operating the Analyzer in On-Line mode with the Flow Sensor off can result in erroneous measurements if there is no sample flow.

Specifying Auto Restart Settings

If your Analyzer has a Super **iOS**, you can specify whether the Analyzer should automatically restart after various system functions. If your Analyzer has a standard **iOS** or a Sample Inlet Block, Auto Restart is available only after Rinse Down mode. Auto Restart does not occur if the Analyzer is configured for Grab mode prior to running a system function By default, Auto Restart is Off.

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Auto Restart** button.

5. Select a function and then set it to **On** or **Off**. Available system functions will depend on what kind of **iOS** System you have. Super **iOS** options include **Rinse Down**, **Verification**, **System Suitability**, and **Linearity**.

For verification, system suitability, and linearity functions, analysis only restarts only when the protocol is completed successfully. If any of these protocols fail, analysis does not restart.

Programming the TOC Autozero

If your application requires you to perform on-line TOC measurements, you may want to set the Analyzer to automatically perform a TOC Autozero at a specific interval. The TOC Autozero is recommended only if the TOC concentration in the sample stream is 50 ppb or less. The TOC Autozero function is described in more detail on page 182.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button, select the **Maintenance** tab, and press the **Cal/ver/Validate** button.
3. Press the **Program Autozero** button.
4. Press the **State** button and select **On**.
5. Press the **Frequency** button and use the number keypad to enter how often you want to program the TOC Autozero function to work. The **Frequency** is measured in days; if you enter 7 the TOC Autozero will run every week starting one week from the date you specify. For example, if you enter 14, it will run every two weeks.
6. Use the date and time buttons to specify the start date and time for the first TOC Autozero.

   When two consecutive negative measurements occur, the Analyzer will automatically perform a TOC Autozero and then returns to analysis. If two consecutive negative measurements occur a second time, the Analyzer will again automatically perform a TOC Autozero. If two consecutive measurements occur a third time, the Analyzer issues Warning 12, TOC Autozero Failed.
7. Press **Back** when you are done.

Note: *If the Analyzer is not powered on when a TOC Autozero is programmed to occur, the scheduled TOC Autozero is skipped. If the composition of the water is changing too rapidly at the time the TOC Autozero is scheduled, the TOC Autozero will be stopped. In both cases, the next TOC Autozero will occur at its regularly programmed time.*

Draining the iOS System

At times you may need to drain the **iOS** System or the Super **iOS** System (depending on the configuration of your Analyzer).

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Drain iOS** button.
4. Follow the prompts on-screen.

   You will need to stop sample flow to the Analyzer before the **iOS** System can drain properly.

Activating Additional Features

If you purchased a 500 RL TOC Analyzer with a Sample Inlet Block, it is possible to activate additional features available by default on other 500 RL configurations. If you purchased a feature upgrade, follow these steps to activate the feature:

1. Insert the USB flash drive containing the feature activation into the Analyzer's USB port.
1. Press the **Menu** button, select the **Maintenance** tab, press the **Advanced** button, and then press the **Advanced Setup** button.
2. Press the **Activate Options** button.
3. Press the **OK** button and wait for the Analyzer to detect the USB flash drive.
4. Press the **Activate** button to activate the new feature.

If you activate the conductivity feature, note that the **Main** screen will not automatically display conductivity values. See "Changing the Display Mode" on page 102 for instructions on changing the data that display on the **Main** screen.

Basic Hardware Operation Issues

Opening the Analyzer Case

The Analyzer case is easy to open to facilitate routine maintenance tasks.

Open the Analyzer front panel by turning the two latches and swinging the panel door to the left; you will need to unlock the bottom latch with the key provided in the Analyzer's accessories kit. When closing the front panel, be sure to firmly close both of the latches. In addition, some subsystems inside the Analyzer, such as the electrical enclosure at the top, are protected by covers. Remove the covers by loosening the captive screws with a Phillips screwdriver, and always make sure the Analyzer is powered off and the power is disconnected before removing the covers. When replacing the covers, be sure to seat the cover securely and evenly.

The Touch Screen

The Analyzer's touch screen is a quarter-VGA color LCD. The operator's finger is optimal for interacting with the display. To avoid scratching the display, do not use pens or pencils to press buttons.

Recommended Operational State

To assure optimal performance across the operating range, the Analyzer should remain powered On in the idle state when not in use. This will allow the measurement components and other subsystems to maintain their equilibrium with the ambient environment. If the Analyzer cannot be left on between uses, allow the it to re-equilibrate for 90 minutes prior to beginning analysis. Failure to do so may compromise the Analyzer's initial results. This could mean a decrease in the instrument's accuracy, an increased likelihood of obtaining negative TOC values, or an increase in the standard deviation values.

The iOS System

GE Analytical Instrument offers three inlet systems for use with the Sievers 500 RL On-Line TOC Analyzer: a sample inlet block for dedicated on-line analysis, a standard Integrated On-Line Sampling (**iOS**) System, with one vial port, and a Super **iOS**, with four vial ports. Both **iOS** systems provide a convenient sample inlet for on-line sample sources and standards in vials. You do not need to change the inlet configuration when switching analysis from on-line mode to sample from vials. If you have a standard **iOS** System, slide the **iOS** System door open, wait 30 seconds for sample to drain from the **iOS** System, and then insert the vial containing the standard or sample.

The Super **iOS** System is designed to take advantage of Sievers Standards in cartridges for automated system protocols (see below). If you have a Super **iOS** System and want to run in grab mode, the Analyzer draws sample from vials placed in Vial Port 1.

Figure 18: The Standard iOS System

Always stop analysis before opening the standard **iOS** System door to avoid generating erroneous measurement data. If the flow sensor is **On**, opening the **iOS** System door while analysis is taking place causes the flow sensor to activate and halt analysis. If the flow sensor is **Off**, opening the **iOS** System door while analysis is taking place results in air being drawn into the Analyzer.

Warning
 The **iOS** System contains two sharp needles designed to pierce the septa of sample vials. Do not put fingers or inappropriate materials into the **iOS** System.

Warning
 Water in the standard **iOS** System may be hot. Before inserting a vial into the standard **iOS** System, slide the door open and wait 30 seconds to allow sample to completely drain. Inserting a vial before draining can result in potentially hot water spray projecting upward out of the standard **iOS** System.

Figure 19: The Super iOS System

The Sample Inlet Block

The Sample Inlet Block (see Figure 20) is designed to for on-line sampling only. Sampling from a vial is not possible with this configuration.

Figure 20: The Sample Inlet Block

Warning
 The Sample Inlet Block may be hot. If the sample water is hot, be careful to avoiding touching the Sample Inlet Block.

Vial Set Cartridges

The Super **iOS** is designed to take advantage of Sievers Standards in cartridges. The Analyzer automatically reads certain data from the cartridge, including the following:

- Vial set part number
- Vial set expiration date
- Vial set name
- Vial name
- Vial part number
- Vial lot number
- Vial expiration date

Steam Exposure

The **iOS** and Super **iOS** are rated at IP 45 and can withstand short-term steam exposure of up to 40 psi steam for 30 minutes. When exposed to steam, the Analyzer should be powered off or in standby mode, and not in analysis mode. After exposure to steam, allow the Analyzer to cool before returning to Analysis mode. Observe the following cool-down intervals before starting analysis after steam exposure:

Table 5: Required Time interval After iOS Steam Exposure

Ambient Temperature	Time Interval
Below 20 °C	15 minutes
20 - 30 °C	30 minutes
30 - 40 °C	90 minutes

Chapter 5. Password Protection and DataGuard

Overview

The Sievers 500 RL On-Line TOC Analyzer includes **Password Protection** using one user name and password for all users. You can activate or deactivate this feature, as needed. Using Password security, there are two options for **Menu Lockout** (*On* and *Off)* that define when a user must enter the user name and password.

Turn the **Menu Lockout** option to *On* to restrict access to the Main Menu, and therefore all menus, without first entering the user name and password. The user can then access all menus, run and stop analysis, and change parameters on all screens—without having to re-enter the user name and password.

Turn the **Menu Lockout** option to *Off*, to automatically allow users access to screens that run and stop analysis, or display sampling data, without the need to enter the user name and password. Users are ONLY required to enter a user name and password in order to change parameters that affect calibration and analysis. To view which menus and sub-menus require a password, see Figure 21: Menu Map — Menu Lockout Off (Requires Calibration Passwords) on page 115.

The **DataGuard** security feature is also available as an optional upgrade from GE Analytical Instruments. DataGuard allows the use of up to 100 unique user IDs, which you can configure for different levels of user access to various menu items and settings. The feature supports 21 CFR Part 11 by maintaining an audit trail of all user operations. The minimum User Level

required to access each of the menu screens is listed in Figure 21: Menu Map — Menu Lockout Off (Requires Calibration Passwords) on page 115.

Note: Regardless of which type of security you use with your Analyzer, all security-related settings are configured on the **DataGuard** tab.

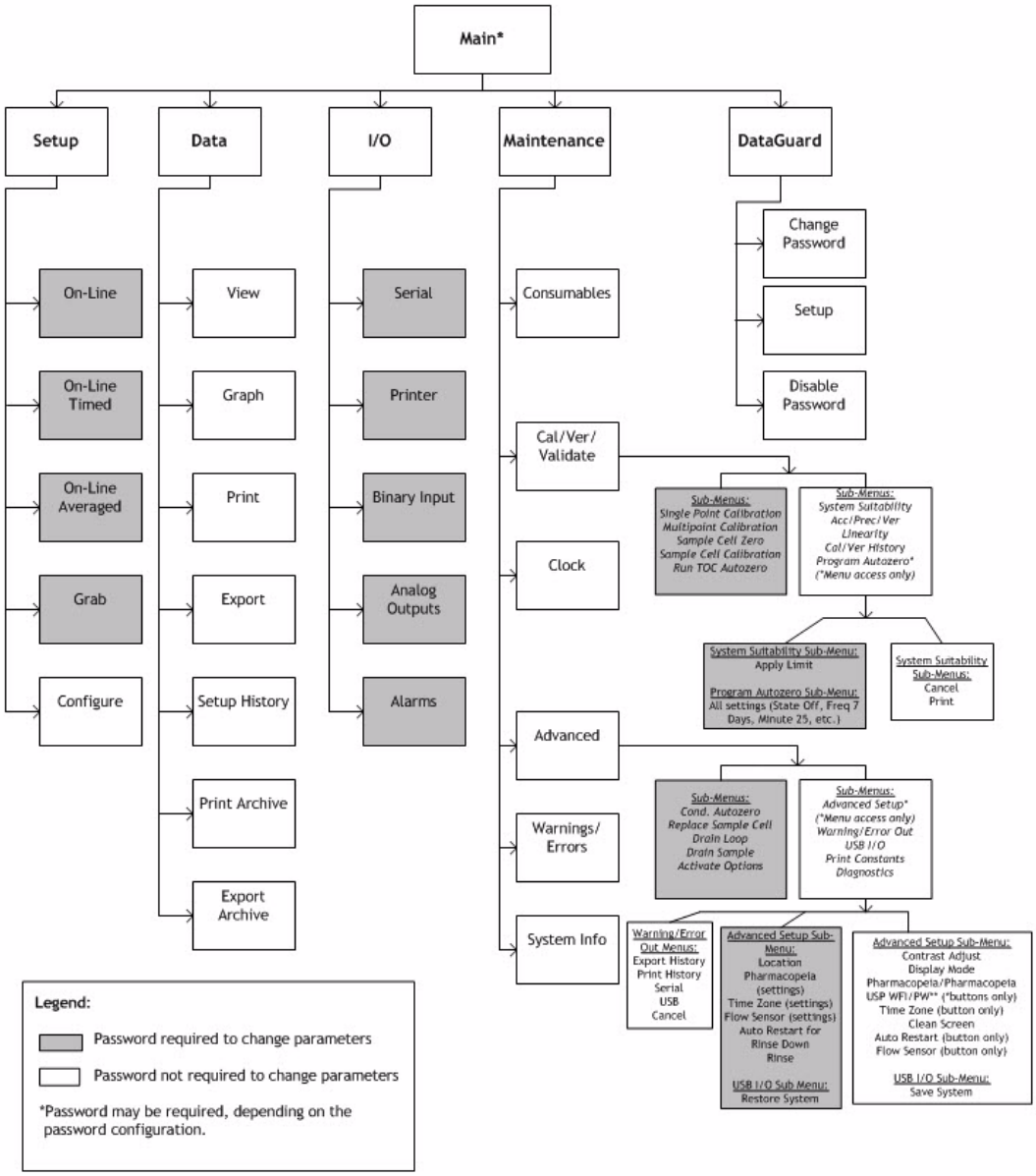

Figure 21: Menu Map — Menu Lockout *Off* (Requires Calibration Passwords)

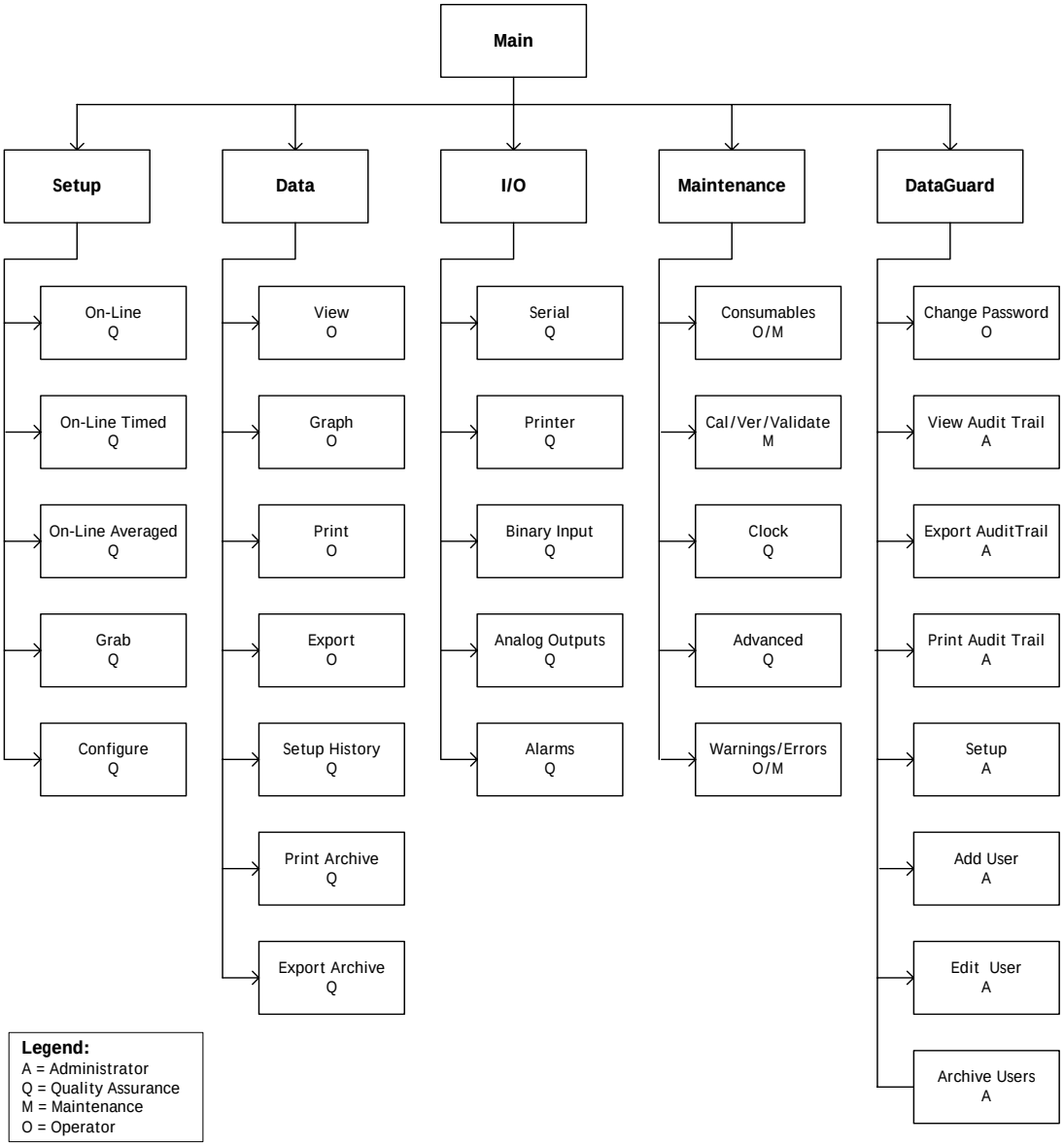

Figure 22: Menu Map — DataGuard (Optional Upgrade)

Enabling Password Protection

Enabling Password Protection ensures that only authorized personnel change parameters that control the measurement functions of the Analyzer. Once Password Protection is enabled, all users must enter the default User ID and Password, i.e., there is ONLY one User ID and one password

To enable Password Protection

1. Press the **Menu** button and select the **DataGuard** tab.
2. Press the **Enable Password** button.

   Password Protection security is immediately activated, and you will need to enter your Administrator ID and Password the next time you access a Password-required screen. If the Lockout *On* option was previously selected, the Main screen automatically displays after you press the **Enable Password** button. In this case, press **Menu** and enter your Administrator User ID and password.

To change the password

After Password protection has been enabled, you can change the default Password by following these steps:

1. Press the **Menu** button and select the **DataGuard** tab.
2. Press the **Change Password** button.
3. Enter the old password and press the **Enter** button.
4. Enter the new Password using the on-screen keyboard and press the **Enter** button.
5. Re-enter the same new Password for verification and press the **Enter** button.

   The new Password is immediately activated.

To configure password settings

After enabling Password Protection, you can specify the password preferences as follows:

1. Press the **Menu** button and select the **DataGuard** tab.
2. Press the **Setup** button.

- **Password Expires** — Specifies how long the Password is valid before it must be changed. The default is 90 days. You can enter a value in the range of 30 to 365 days.
- **Login Timeout** — Specifies the period of inactivity that passes before the use is automatically logged out. The default is 5 minutes. You can enter a value in the range of 1 to 30 minutes.
- **Password Min Len** (minimum length)— Specifies the minimum number of characters required for a valid Password. The default is 3 characters. You can enter a value in the range of 3 to 8 characters.
- **Menu Lockout** - When the *On* option is enabled, the user login and password are ONLY required to access the Main menu. When the *Off* option is enabled, the user login and password are required to change parameters that affect calibration or analysis measurements. The default setting is Menu Lockout *Off*. For more information, see Figure 21: Menu Map — Menu Lockout Off (Requires Calibration Passwords) on page 115.

Disabling Password Protection

To disable Password protection follow these steps:

1. Log in to the Analyzer with the User ID and Password.
2. Press the **Menu** button and select the **DataGuard** tab.
3. Press the **Disable Password** button. When the confirmation window displays, press **OK**.

Password protection is immediately disabled.

The minimum User Level required to access each of the menu screens is listed in Figure 21: Menu Map — Menu Lockout Off (Requires Calibration Passwords) on page 115.

Using DataGuard

DataGuard offers support for regulation 21 CFR Part 11, providing multiple levels of user access to the Analyzer via up to 100 unique User IDs and maintaining an audit trail of all user operations. DataGuard must be purchased as an upgrade from GE Analytical Instruments; once it is enabled, it cannot be disabled.

Enabling DataGuard

DataGuard is locked until it is activated by following the steps below. When activating DataGuard, to ensure system security we strongly recommend that you create a new administrator-level account and inactivate the default administrator account (Steps 7 through 21 below).

1. Insert the USB flash drive containing the DataGuard activation into the Analyzer's USB port.

1. Press the **Menu** button, select the **Maintenance** tab, and press the **Advanced** button.
2. Press the **Activate Options** button.
3. Press the **OK** button and wait for the Analyzer to detect the USB flash drive.
4. Press the **Activate** button to enable DataGuard.

   When the DataGuard **Activation Code** is accepted, the Analyzer security settings are immediately put into effect and you will be required to log in to the Analyzer with the default administrator User ID and Password.

   User ID: ADMIN

   Password: GEAI
5. Press the **Login** button and enter the default administrator Login ID. Press **Enter**.
6. Enter the Password and press **Enter**.

   After you log in for the first time, create a new administrator-level account and inactivate the default administrator account as follows:
7. Press the **Menu** button and select the **DataGuard** tab.
8. Press the **Add User** button.
9. Specify a new User ID for the administrator and press the **Enter** button.
10. Specify the Password for the administrator User ID and press **Enter**.
11. Verify the Password and press **Enter**.
12. Press the **User Level** button and select **Administrator**.
13. Press the **Password Expired** button and select **False**.
14. Press the **Back** button.
15. Press the **Logout** button. You will now use the new administrator account and delete the default account.
16. Press the **Login** button and enter the new User ID and Password you just created.

17. Select the **DataGuard** tab.
18. Press the **Edit User** button.
19. Use the arrow buttons to highlight the default administrator account and press **OK**.
20. Press the **User Status** button and select **Inactive**.
21. Press the **Menu** button to return to the **Menu** screen.

Note: Once you inactivate the default administrator account, it cannot be used to access the Analyzer. If you forget the login information for the new administrator account that you have created, contact GE Analytical Instruments for assistance.

Adding User IDs

After DataGuard has been enabled, you can add a User ID by following these steps:

1. Select the **DataGuard** tab.
2. Press the **Add User** button.
3. Specify a new User ID and press the **Enter** button. (If you enter an existing User ID, an error message will display.)
4. Specify the temporary Password for the new User ID and press **Enter**. Unless you change the expiration status (see "Editing User Information" below), the user will be required to change the Password when logging in for the first time.
5. Verify the Password and press the **Enter** button.
6. The **Edit User** screen displays automatically. Press the **Menu** button to accept the default user settings, or edit any of the user settings. For additional information, see Step 4 in "Editing User Information" below.

Editing User Information

Once you have created a User ID, you can edit its account settings as follows. Note that when you are adding a new User ID, you do not need to follow Steps 1 through 3, as the **Edit User** screen automatically displays whenever a new User ID is created.

1. Select the **DataGuard** tab.
2. Press the **Edit User** button.

3. Select a User ID from the list using the scroll buttons and then press **OK**.
4. You can modify the following User ID settings:
    - **User Level** — Indicates the level of access the user has to various Analyzer menus. The options in order of ascending access are **Operator** (default for all new User IDs), **Maintenance**, **Quality**, and **Administrator**. See Figure 21: Menu Map — Menu Lockout Off (Requires Calibration Passwords) on page 115 for a menu map that indicates the minimum **User Level** required to access each menu.
    - **User Status** — Indicates whether the User ID is **Active** (default for all new User IDs) or **Inactive**. When you set a User ID to **Inactive**, the user will not be able to log in to the Analyzer, and the User ID will be deleted from memory the next time you archive (see "Archiving User Accounts" on page 123 for more information). Note that if the user unsuccessfully attempts to log in to the Analyzer five times, the account is automatically set to **Inactive**; see "Reactivating Inactivated User Accounts" on page 123 for more information.
    - **Password Expired** — Indicates whether the user will be required to establish a new Password at the next successful log in. The default for a new user is **True**. Change this setting to **False** if you do not want to require the user to change the Password at the next log in. This value defaults to the setting chosen for the last User ID that was created.

Note: To help a new user remember the password, and to ensure security, require a new user to change the Password upon login.

    - **Password** — Press the **Password** button to change the Password for the selected User ID.
5. Press the **Menu** button to save changes and return to the **DataGuard** screen.

Configuring Login Settings

To further ensure Analyzer security, DataGuard allows you to configure login settings as follows:

1. Select the **DataGuard** tab.
2. Press the **Setup** button.
    - Press the **Password Expires** button to set the number of days for which a Password is valid. The default value is **90** days.

- Press the **Min Length** button to set the minimum character length for a Password. The default value is **3** characters.
- Press the **Login Timeout** button to set the number of minutes of allowable keypad inactivity before users are required to re-enter their login information. The default value is **5** minutes.

Changing User Passwords

All users can change their own Passwords by following these steps:

1. Log in with a valid User ID and Password.
2. Select the **DataGuard** tab.
3. Press the **Change Password** button.
4. Enter the old Password and press **Enter**.
5. Specify a new Password and press **Enter**.
6. Verify the new Password and press **Enter**.

Administrators can change the Password associated with any User ID by pressing the **Password** button on the **Edit User** screen ("Editing User Information" on page 120).

Dealing with Forgotten Passwords

If users forget their Passwords, the administrator must assign new Passwords by following these steps:

1. Log in to the Analyzer with an administrator-level User ID and Password.
2. Select the **DataGuard** tab.
3. Press the **Edit User** button.
4. Select the appropriate User ID from the list using the scroll buttons and press **OK**.
5. Press the **Password** button.
6. Specify a new Password and press **Enter**.
7. Verify the new Password and press **Enter**.
8. Press the **Menu** button to return to the **DataGuard** screen.

Reactivating Inactivated User Accounts

After five unsuccessful login attempts, a User ID is suspended and set to **Inactive**. An administrator must reactivate the User ID before the user can log in to the system. To reactivate a User ID, follow these steps:

1. Log in to the Analyzer with the administrator-level User ID and Password.
2. Select the **DataGuard** tab.
3. Press the **Edit User** button.
4. Select the User ID from the list using the scroll buttons and then press **OK**.
5. Press the **User Status** button and select **Active**.
6. If the user has forgotten the Password, you can assign a new Password now. Press the **Password** button, specify and confirm the new Password, and press **Enter**.
7. Press the **Menu** button to save and return to the **DataGuard** screen.

Archiving User Accounts

If you want to remove User IDs from the user list, you must first set the unwanted User IDs to **Inactive** and then archive your unused user settings as follows:

1. Log in to the Analyzer with an administrator-level User ID and Password.
2. Select the **DataGuard** tab.
3. Press the **Edit User** button.
4. Select a User ID from the list using the scroll buttons and then press **OK**.
5. Press the **User Status** button and select **Inactive**.
6. Press the **Menu** button to save the change and return to the **DataGuard** screen.
7. Repeat steps 3 through 6 for each User ID you want to remove.
8. Press the **Archive Users** button. You will be warned that user accounts set to **Inactive** will be removed. Make sure you have a USB storage device attached to the Analyzer.
9. Press the **OK** button.

All **Inactive** user accounts will be permanently removed from the list of users. Although it is possible to reuse User IDs that have been removed, keep in mind that regulation 21 CFR Part 11 specifies

that unique User IDs should be maintained. You may want to keep a list of User IDs to avoid duplication; Table 7 on page 126 provides a format for recording current and archived User IDs.

Viewing, Exporting, and Printing Audit Trails

The DataGuard feature maintains an audit trail showing the history of activities performed on the Analyzer by each User ID. Each audit trail entry details what operation was performed, when the operation was performed, and the ID of the user who performed the operation. When appropriate, the old and new values of the action also are stored. The audit trail can accomodate approximately 1,200 entries.

To manage the audit trail, follow these steps:

1. Log in to the Analyzer with an administrator-level User ID and Password.
2. Select the **DataGuard** tab.
    - Press the **View Audit Trail** button to display the audit trail entries on-screen.
    - Press the **Export Audit** button to export the current audit trail to the serial (RS-232) port or the USB port as a comma-separated text file (`.csv`). Make sure a USB device or serial cable is attached to the Analyzer.
    - Press the **Print Audit** button to print the current audit trail. Note that printing the audit trail can be time consuming; to save time, first export the audit trail and then print it from your PC.

The Analyzer can store approximately 1,000 entries. When the audit trail is almost full, a message will be displayed requesting that the audit trail be archived (either by printing or exporting). When the audit trail is full, you must archive it by printing or exporting. After printing or exporting, you will be prompted to erase the printed or exported audit trail information. Press **OK** to erase the data or **Cancel** to keep it.

The audit trail output format is shown in Table 6.

Table 6: Audit Trail Output Format

Field #	Field Contents	Format/Notes	Example
1	User ID	11 alpha-numeric characters (columns 1-11)	ADMIN

Table 6: Audit Trail Output Format

Field #	Field Contents	Format/Notes	Example
2	Entry ID Number	9 numeric characters (columns 13-21)	693090237
3	Date and Time	dd MMM yyyy hh:mm:ss (columns 23-33)	17 OCT 2004 10:22:47
4	Action	20 alpha-numeric characters (columns 44-63)	PASSWORD SET
5	Old Value	Alpha-numeric characters (columns 65-end of line)	QUALITY 01
6	New Value	Alpha-numeric characters (columns 65-end of line)	QUALITY 02

Logging Out

When users have finished their activities on the Analyzer, logging out prevents a second user from accessing the system under the first user's account. This practice helps preserve the integrity of the audit trail. Logging out also minimizes the risk of unauthorized access by other personnel.

To log out, press the **Logout** button on any display screen. If the **Logout** button is not displayed on the current screen, press the **Back** or **Menu** button until any of the main tabs (**Setup**, **Data**, **I/O**, **Maintenance**, or **DataGuard**) display, and then press the **Logout** button.

Table 7: Record of User IDs

User ID	User's Name	Date Created	Date Archived

Chapter 6. Calibration and System Protocols

Overview

The Analyzer is calibrated at the factory and should require recalibration only once per year. When replacing items that affect analysis, such as the UV lamp or pump heads, perform a verification of the calibration; only re-calibrate if verification indicates that a new calibration is necessary.

The Sievers 500 RL On-Line TOC Analyzer can be calibrated using one of two methods: single-point calibration at 1.5 ppm; or multi-point calibration at 500 ppb, 1.0 ppm, and 1.5 ppm. GE Analytical Instruments recommends single-point calibration for most applications. Multi-point calibration is available as an alternative procedure for customers.

The Sievers 500 RL On-Line TOC Analyzer facilitates the calibration and verification process by handling the necessary calculations internally; you will have the opportunity to accept or reject the calibration during the procedure. Calibration and verification are accomplished using Sievers Standards in 40-mL and 30-mL vials, sampled via the Analyzer's **iOS** System.

If your Analyzer has a standard **iOS** System (one vial port), you will need to insert the appropriate standard into the **iOS** when prompted by the Analyzer. If your Analyzer has a Super **iOS** System (four vial ports), you can insert all standards required for most system protocols into the **iOS** at one time; when running multi-point calibration, you will need to switch vials once during the procedure.

Note: *Only a single-point calibration **or** a multi-point calibration needs to be performed. Do not perform both types of calibration.*

If your Analyzer is equipped with a sample inlet block, you must install an IOS to calibrate and verify the Analyzer.

Required Calibration Supplies

The number of standards required for the calibration procedure depends on whether you choose a single-point or multi-point calibration. Standards vials are inserted into the **iOS** System as prompted by the Analyzer's on-screen instructions.

A single-point calibration should require approximately 2.75 hours to complete, and multi-point calibration should require approximately 4.5 hours to complete.

Sievers Standards for all calibration and verification procedures should be purchased from GE Analytical Instruments. Standards sets for calibration and verification can be purchased individually, or as vial sets for use with a Super **iOS** System. All standards are provided in 40-mL and 30-mL vials.

To purchase standards in North America or Canada, contact GE Analytical Instruments by phone at 800.255.6964 or 303.444.2009 or by e-mail at InsideSales@geinstruments.com.

To purchase standards in the United Kingdom, contact GE Analytical Instruments at 44(0) 161866 9337.

To purchase standards in Europe, Asia, and other parts of the world, contact your local Sievers distributor.

Standards used in each of the system protocols are shown in Table 8 through Table 12. Standards concentrations are shown in ppm and ppb. Note that 1ppm = 1 mg C/L, and 1ppb = 1 µg C/L. For configurations without conductivity measurement, standards sets without conductivity standards are available.

Table 8: Standards Required for Single-Point Calibration

Calibration Blank (2 vials)
1.5 ppm TOC (as KHP)
25 µS/cm Conductivity (as HCl)

Table 9: Standards Required for Multi-Point Calibration

Calibration Blank (3 vials)
1.5 ppm TOC (as KHP)
25 µS/cm Conductivity (as HCl)
1.0 ppm TOC (as KHP)
500 ppb TOC (as KHP)

Table 10: Standards Required for Accuracy, Precision, and Verification

Verification Blank
500 ppb TOC (as NIST sucrose)
25 µS/cm Conductivity (as HCl)

Table 11: Standards Required for System Suitability Verification

Reagent Water Blank - Rw
500 ppb TOC (as sucrose) - Rs
500 ppb TOC (as benzoquinone) - Rss
Rinse Water

Table 12: Standards Required for Linearity Verification

750 ppb TOC (as KHP)
500 ppb TOC (as KHP)
250 ppb TOC (as KHP)
Reagent Water Blank - Rw

Warning
Consult the MSDS that accompanies each standards set to identify proper disposal techniques.

Warning
Standards for the Sievers 500 RL On-Line TOC Analyzer are acidified. If you prepare your own standards and use glass vials, ensure that you acidify the standards to a pH of 3, or the system protocols will yield poor results.

Preparing for Calibration

Save System Settings

Prior to performing any calibration procedure or system protocol, save the current system settings, in the event they need to be re-loaded. (You also may want to print the settings in case you must refer to them in the future.) To save the system settings, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **USB I/O** button. Make sure that the USB flash memory drive is attached to the USB port, and then press the **Save System** button.

Perform Annual Maintenance Tasks

Before calibrating the Analyzer, perform annual maintenance tasks as appropriate, such as replacing the sample pump heads, UV lamp, and DI water cartridge. In particular, if the calibration coincides with the Analyzer's annual maintenance, first replace the DI water cartridge before proceeding; for more information, see "Replacing the DI Water Cartridge" on page 160.

Handling Standards

Because of the prevalence of both conductivity contaminants and organic carbon contaminants, sample preparation and control is extremely delicate. Special handling of the standard solutions is required.

Store standards at approximately 5 °C (±4 °), away from light, in a box or solid-door refrigerator. Warm standards to ambient temperature prior to starting analysis. Avoid touching the top of the vials to protect against introducing foreign particles, TOC, and conductivity.

After following these steps, proceed either to "Performing a Single-Point Calibration" below or to "Performing a Multi-Point Calibration" on page 134.

Disable Daily Download and Binary Input

If you will be performing calibration or other system protocols at a time when a daily download of history data may occur, temporarily disable the download to ensure the system protocol activities are not interrupted.

1. Select the **Data** tab.
2. Press the **Setup History** button.
3. Press the **Daily Download** button and select **Off**.
4. When you are finished performing calibration or other system protocols, reset the **Daily Download** value to **On**.

If you use the **Binary Input** function, disable **Binary Input**.

1. Select the **I/O** tab.
2. Press the **Binary Input** button.
3. Press the **Binary Input Off** button.
4. When you are finished performing calibration or other system protocols, press **On** to reset the **Binary Input** function.

Performing a Single-Point Calibration

Before performing a single-point calibration, save the current Analyzer system settings, as described under the section called "Preparing for Calibration" on page 130. If your configuration does not measure conductivity, you will not be using the conductivity standard for this protocol.

When you are ready to calibrate the Analyzer, follow these steps:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.

2. Press the **Menu** button, select the **Maintenance** tab, and press the **Cal/Ver/Validate** button.
3. Press the **Single Pt Cal** button.
4. If you have a Super iOS System and purchased a vial set:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).
   - When prompted, insert the cartridge into the Super **iOS** System with the label facing away from the Analyzer and press **Next**. Proceed to Step 7.
5. If you have a Super iOS System and purchased individual vials rather than a vial set in a cartridge:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).
   - Confirm the value shown on the label of the Conductivity Standard.
   - When prompted to insert the vial set, insert the vials into the **iOS** System vial ports in the following order:

     Port 1 = TOC Calibration Blank
     Port 2 = TOC Calibration Blank
     Port 3 = TOC Calibration Standard (1.50 ppm KHP)
     Port 4 = Conductivity Standard
   - Press the **Next** button.
   - Press the **No Set** button.
   - If the label of the Conductivity Standard shows a value of 25 µS/cm HCl, press **Next** to continue. If the label shows a different value, press **Edit**, enter the value, press **Enter**, and then press **Next**. If your configuration does not measure conductivity, you will not be prompted to enter a conductivity value and you can skip this step.
   - Proceed to Step 7.
6. If you have a standard **iOS** System:
   - Open the door to the **iOS** System and wait 30 seconds for water to drain.
   - Insert the first TOC Calibration Blank into the **iOS** System and press **Next**.
   - When prompted, remove the TOC Calibration Blank from the **iOS** System, insert the second TOC Calibration Blank, and press **Next**.

- When prompted, remove the TOC Calibration Blank from the **iOS** System, insert the TOC Calibration Standard (1.50 ppm KHP), and press **Next**.
- When prompted, remove the TOC Calibration Standard (1.50 ppm KHP) from the **iOS** System. Confirm the value of the Conductivity Standard and insert the vial into the **iOS** System. If the label shows a value of 25 µS/cm HCl, press **Next** to continue. If the label shows a different value, press **Edit**, enter the value, press **Enter**, and then press **Next**. If your configuration does not measure conductivity, you will not be prompted to enter a conductivity value and you can skip this step.

7. After the last standard has been analyzed, the Calibration Summary screen is displayed. Part 1 of the summary screen displays the data for the TOC standard (see Figure 23). Press the **Next** button.
8. Part 2 of the summary displays the data for the conductivity standard (see Figure 24).
9. Press the **Print** button if you want to print the Calibration results.
10. The Analyzer indicates if the calibration passed.
    - If the calibration passed, press the **Apply** button to accept the calibration and continue.
    - If the calibration failed, press the **Cancel** button to reject the calibration. You may need to perform the calibration procedure again. However, first consult the chapter called "Troubleshooting" on page 169 to determine if there is a problem with the Analyzer.

    The summary screens show data collected for each of the vials, as well as several calculated values.

    Exp is expected value. For **RW IC** (TOC Calibration Blank), this is the measured value for the TC channel, with the UV lamp off. For **1.50ppm TOC** (TOC Calibration Standard), this is the expected value for **RW2 TOC** plus 1.5 ppm. For **25.00 µS/cm tCond** (Conductivity Standard), this is the certified value of the standard, as shown on the vial label.

    Diff is percent difference between the average and expected value.

    Adj is the adjusted value, with the new calibration applied.
11. Remove the vial(s) from the **iOS** System and slide the **iOS** door closed.
12. You should now verify the calibration. Proceed to "Accuracy, Precision, and Calibration Verification" on page 138 for instructions.

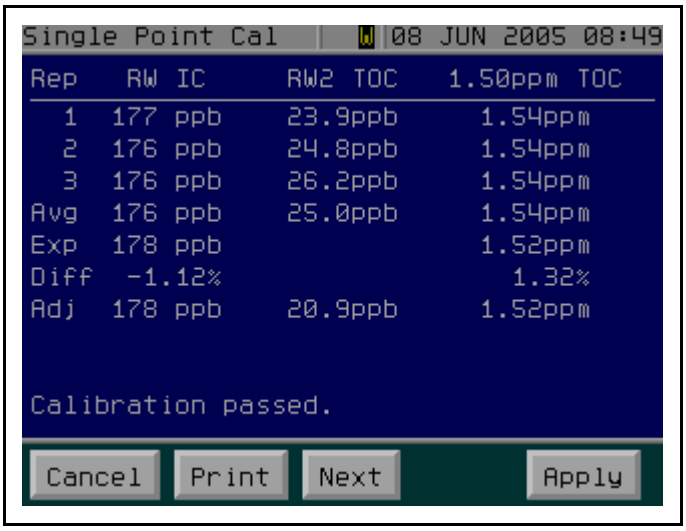

Figure 23: Reviewing TC and IC Values from a Single-Point Calibration

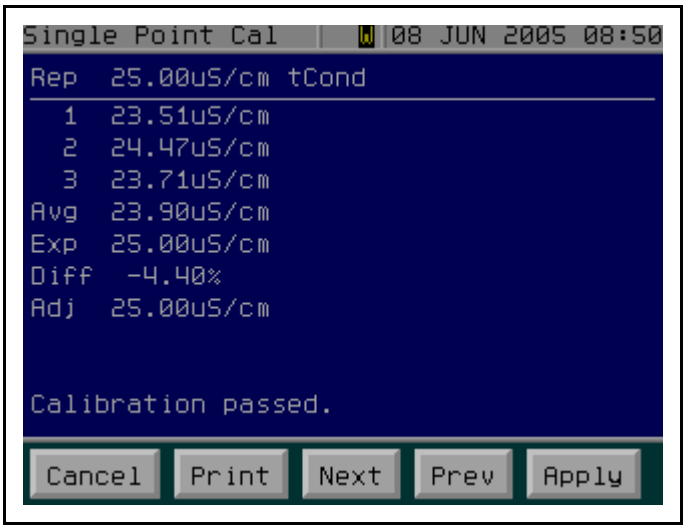

Figure 24: Reviewing Conductivity Values from a Single-Point Calibration

Performing a Multi-Point Calibration

Before performing a multi-point calibration, save the current Analyzer system settings, as described under the section called “Preparing for Calibration” on page 130. If your configuration does not measure conductivity, you will not be using the conductivity standard for this protocol.

When you are ready to calibrate the Analyzer, follow these steps:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button, select the **Maintenance** tab, and press the **Cal/Ver/Validate** button.
3. Press the **Multi Pt Cal** button.
4. If you have a Super iOS System and purchased vial sets:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - When prompted, insert the cartridge containing Calibration Set A into the Super **iOS** System with the label facing away from the Analyzer and press **Next**.
   - When prompted by the Analyzer, remove the first cartridge, insert the cartridge containing Calibration Set B into the Super **iOS** System with the label facing away from the Analyzer, and press **Next**.
   - Proceed to Step 7.
5. If you have a Super iOS System and purchased individual vials rather than a vial set in a cartridge:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).
   - Confirm the value shown on the label of the Conductivity Standard.
   - When prompted, insert the Calibration set into the Super **iOS** System vial ports in the following order:

     Port 1 = TOC Calibration Blank
     Port 2 = TOC Calibration Blank
     Port 3 = TOC Calibration Standard (1.50 ppm KHP)
     Port 4 = Conductivity Standard
   - Press the **Next** button.
   - Press the **No Set** button.
   - If the label of the Conductivity Standard shows a value of 25 µS/cm HCl, press **Next** to continue. If the label shows a different value, press **Edit**, enter the value, press **Enter**, and then press **Next**. If your configuration does not measure conductivity, you will not be prompted to enter a conductivity value and you can skip this step
   - When prompted by the Analyzer, remove the first four vials and insert the next four vials into the Super **iOS** System vial ports in the following order:

Port 1 = empty
Port 2 = TOC Calibration Blank
Port 3 = TOC Calibration Standard (1.0 ppm KHP)
Port 4 = TOC Calibration Standard (500 ppb KHP)

- Press the **Next** button.
- Proceed to Step 7.

6. If you have a standard **iOS** System:
   - Open the door to the **iOS** System and wait 30 seconds for water to drain.
   - Insert the first TOC Calibration Blank into the **iOS** System and press **Next**.
   - When prompted, remove the TOC Calibration Blank from the **iOS** System, insert the second TOC Calibration Blank, and press **Next**.
   - When prompted, remove the TOC Calibration Blank from the **iOS** System, insert the TOC Calibration Standard (1.50 ppm KHP), and press **Next**.
   - When prompted, remove the TOC Calibration Standard (1.50 ppm KHP) from the **iOS** System. Confirm the value of the Conductivity Standard and insert the vial into the **iOS** System. If the label shows a value of 25 µS/cm HCl, press **Next** to continue. If the label shows a different value, press **Edit**, enter the value, press **Enter**, and then press **Next**. If your configuration does not measure conductivity, you will not be prompted to enter a conductivity value and you can skip this step.
   - When prompted, remove the Conductivity Standard from the **iOS** System, insert the third TOC Calibration Blank, and press **Next**.
   - When prompted, remove the TOC Calibration Blank from the **iOS** System, insert the TOC Calibration Standard (1.0 ppm KHP), and press **Next**.
   - When prompted, remove the TOC Calibration Standard (1.0 ppm KHP) from the **iOS** System, insert the TOC Calibration Standard (500 ppb KHP), and press **Next**.
7. After the last standard has been analyzed, the Calibration Summary screen is displayed. Part 1 of the summary screen displays the data for the first two blanks and the 1.50 ppm standard (see Figure 25). Press the **Next** button.
8. Part 2 of the summary displays the data for the conductivity standard (see Figure 26). Press the **Next** button.
9. Part 3 of the summary displays data for the blank, 1.0 ppm standard, and 500 ppb standard (see Figure 26).
10. Press the **Print** button if you want to print the Calibration results.

11. The Analyzer indicates if the calibration passed.
    - If the calibration passed, press the **Apply** button to accept the calibration and continue.
    - If the calibration failed, press the **Cancel** button to reject the calibration. You may need to perform the calibration procedure again. However, first consult the chapter called "Troubleshooting" on page 169 to determine if there is a problem with the Analyzer.

    The summary screens show data collected for each of the vials, as well as several calculated values.

    Exp is expected value. For **RW IC** (TOC Calibration Blank), this is the measured value for the TC channel, with the UV lamp off. For **1.50ppm TOC** (TOC Calibration Standard), this is the expected value for **RW2 TOC** plus 1.5 ppm. For **1.00ppm TOC** and **500 ppb TOC** (TOC Calibration Standards), this is the expected value for RW3 plus 1.00 ppm or 500 ppb, respectively. For **25.00 S/cm tCond** (Conductivity Standard), this is the certified value of the standard, as shown on the vial label.

    Diff is percent difference between the average and expected value.

    Adj is the adjusted value, with the new calibration applied.

12. Remove the vials from the **iOS** System and slide the **iOS** door closed.
13. You should now verify the calibration. Proceed to "Accuracy, Precision, and Calibration Verification" on page 138 for instructions.

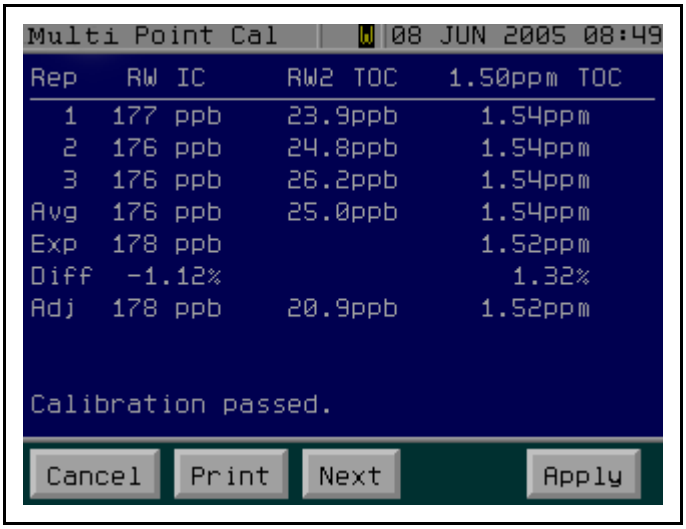

Figure 25: The First Summary Screen in a Multi-Point Calibration

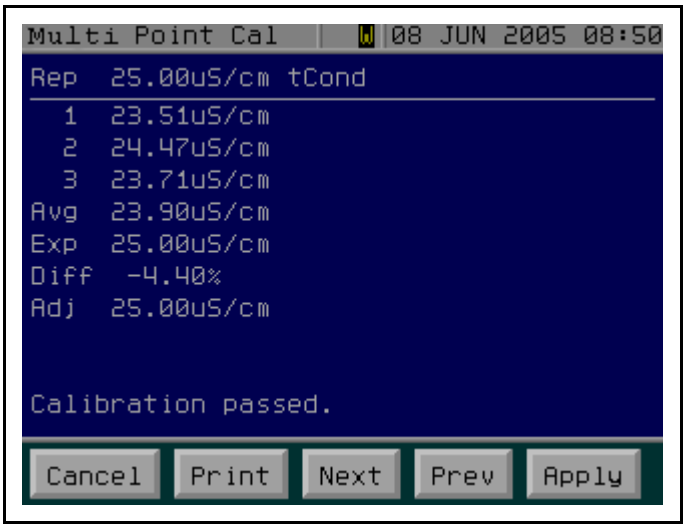

Figure 26: The Second Summary Screen in a Multi-Point Calibration

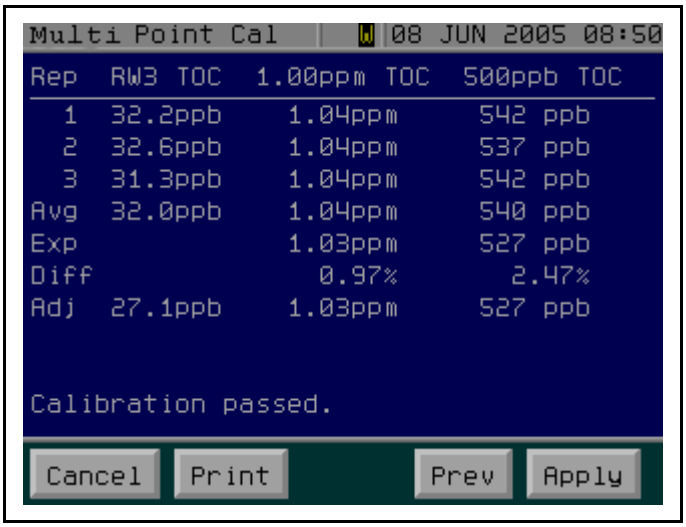

Figure 27: The Third Summary Screen in a Multi-Point Calibration

Accuracy, Precision, and Calibration Verification

The Sievers 500 RL On-Line TOC Analyzer automatically calculates accuracy, precision, and calibration verification values. Use this procedure to confirm that the Analyzer's current calibration is accurate. GE Analytical Instruments recommends performing a verification after replacement of

consumables, such as the pump heads (with pump tubing), DI water cartridge, or UV lamp, and after calibration. If your configuration does not measure conductivity, you will not be using the conductivity standard for this protocol.

To perform accuracy, precision, and calibration verification, follow this procedure:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button, select the **Maintenance** tab, press the **Cal/Ver/Validate** button, and press the **Acc/Prec/Ver** button.
3. If you have a Super iOS System and purchased a vial set:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).
   - When prompted, insert the Accuracy, Precision, and Calibration Verification cartridge into the Super **iOS** System with the label facing away from the Analyzer and press **Next**. Proceed to Step 6.
4. If you have a Super iOS System and purchased individual vials rather than a vial set in a cartridge:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).
   - Confirm the value shown on the label of the Conductivity Standard.
   - When prompted, insert the vials into the Super **iOS** System vial ports in the following order:

     Port 1 = empty
     Port 2 = Verification Blank
     Port 3 = Accuracy/Precision and Verification Standard
     Port 4 = Conductivity Standard

   - Press the **Next** button.
   - Press the **No Set** button.
   - If the label of the Conductivity Standard shows a value of 25 µS/cm HCl, press **Next** to continue. If the label shows a different value, press **Edit**, enter the value, press **Enter**, and then press **Next**. If your configuration does not measure conductivity, you will not be prompted to enter a conductivity value and you can skip this step.
   - Proceed to Step 6.
5. If you have a standard **iOS** System:

- Open the door to the **iOS** System and wait 30 seconds for water to drain.
- Insert the Verification Blank into the **iOS** System and press **Next**.
- When prompted, remove the Verification Blank from the **iOS** System, insert the Accuracy/Precision and Verification Standard, and press **Next**.
- When prompted, remove the Accuracy/Precision and Verification Standard from the **iOS** System, insert the Conductivity Standard, and press **Next**.
- When prompted, remove the Accuracy/Precision and Verification Standard (500 ppb sucrose) from the **iOS** System. Confirm the value of the Conductivity Standard and insert the vial into the **iOS** System. If the label shows a value of 25 µS/cm HCl, press **Next** to continue. If the label shows a different value, press **Edit**, enter the value, press **Enter**, and then press **Next**.

6. After the last standard has been analyzed, the summary screen is displayed. Part 1 of the summary screen displays the data for the standards (see Figure 28). Press the **Next** button.
7. Press the **Print** button if you want to print the Calibration results.
8. Part 2 of the summary screen calculations summary for the standards (see Figure 29). Acceptance criteria are as follows:
   - TOC Precision: RSD (Relative Standard Deviation) of last three measurements of 500 ppb standard ≤ 3%
   - Conductivity Precision: RSD of last three compensated conductivity measurements on 25 µS/cm standard ≤ 2%
   - TOC Accuracy: % Difference ≤ ±7%
   - Conductivity Accuracy: % Difference ≤ ±2%

The standard deviation and relative standard deviation are calculated as follows:

Standard Deviation = $\sqrt{\frac{n\sum x^2 - (\sum x)^2}{n(n-1)}}$

$\sum$ = Sum of
x = Each Result
n = Number of Measurements in a set
(# of repetitions - # of rejections)

9. Press the **Exit** button to continue.

$$\text{Relative Standard Deviation (RSD)} = \frac{\text{Standard Deviation}}{\text{Measured TOC Concentration}} \times 100$$

10. Remove the vial(s) from the **iOS** System and slide the **iOS** door closed.

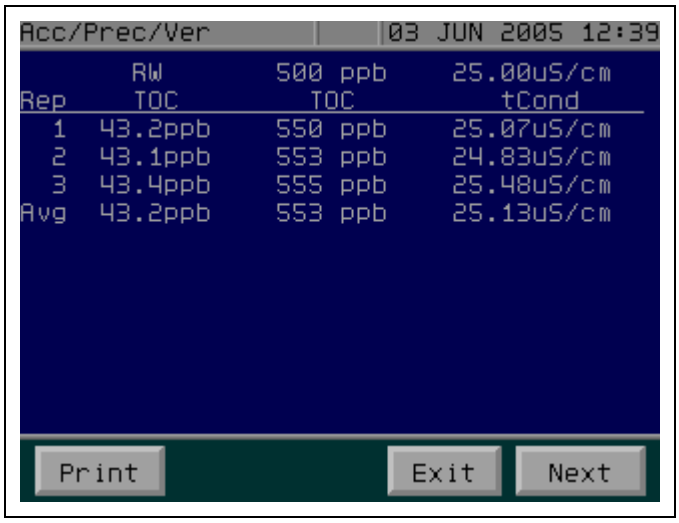

Figure 28: The Accuracy, Precision, and Verification Summary Screen, Part 1

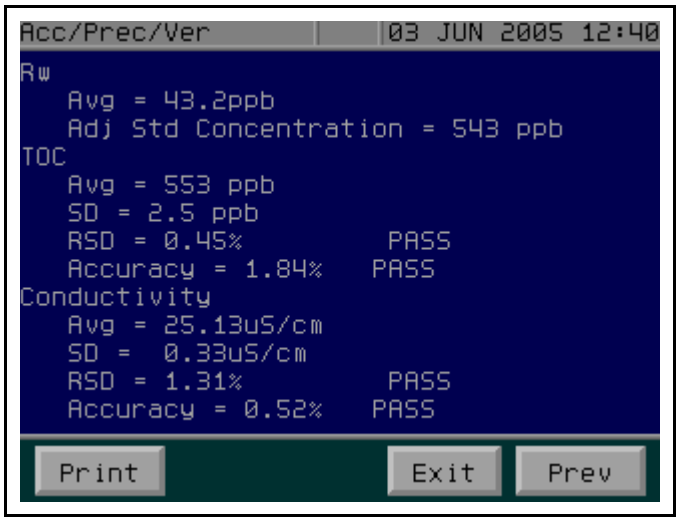

Figure 29: The Accuracy, Precision, and Verification Summary Screen, Part 2

System Suitability Verification

The Sievers 500 RL On-Line TOC Analyzer is designed to make system suitability verification easy. The Analyzer firmware performs all functions necessary to meet USP Chapter <643> or EP Chapter 2.2.44 specifications. The response efficiency and response limit are automatically calculated.

To perform the system suitability verification, follow this procedure:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button, select the **Maintenance** tab, press the **Cal/Ver/Validate** button, and press the **Suitability** button.
3. If you have a Super iOS System and purchased a vial set:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).
   - When prompted, insert the cartridge into the Super **iOS** System with the label facing away from the Analyzer and press **Next**. Proceed to Step 6.
4. If you have a Super iOS System and purchased individual vials rather than a vial set in a cartridge:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).
   - When prompted, insert the System Suitability vial set into the Super **iOS** System vial ports in the following order:

     Port 1 = RW Reagent Water Control
     Port 2 = Rs Standard Solution
     Port 3 = Rss System Suitability Solution
     Port 4 = Rinse Water
   - Press the **Next** button.
   - Press the **No Set** button.
   - Proceed to Step 6.
5. If you have a standard **iOS** System:
   - Open the door to the **iOS** System and wait 30 seconds for water to drain.
   - Insert the Reagent Water (Rw) into the **iOS** System and press **Next**.

- When prompted, remove the Reagent Water (Rw) from the **iOS** System, insert the 500 ppb Sucrose Standard (Rs), and press **Next**.
- When prompted, remove the 500 ppb Sucrose Standard (Rs) from the **iOS** System, insert the 500 ppb Benzoquinone Standard (Rss), and press **Next**.
- When prompted, remove the 500 ppb Benzoquinone Standard (Rss) from the **iOS** System, insert the Rinse Water standard, and press **Next**.
- Press the **Print** button if you want to print the Calibration results.

6. After the last standard has been analyzed, the System Suitability summary screen is displayed (see Figure 30). The Analyzer indicates if the system suitability passed or failed based on the following criteria:

   Acceptance criteria for USP System Suitability is response efficiency between 85% and 115%.

   Response efficiency is calculated as follows:

$$RE = \frac{(Rss - Rw)}{(Rs-Rw)} \times 100$$

   Response Limit is calculated as follows:

$$\text{Response Limit} = Rs - Rw$$

7. Click the **Apply** button if you want the new data to be saved as the Analyzer's response limit.

   If you accept the Response Limit, this new value determines when to trigger the Analyzer's Response Limit alarm, when activated (see "Setting Alarm Values" on page 95). Press the **Yes** button to confirm that you want to accept the new value.

8. Press the **Exit** button to continue.
9. Remove the vial(s) from the **iOS** System and slide the **iOS** door closed.

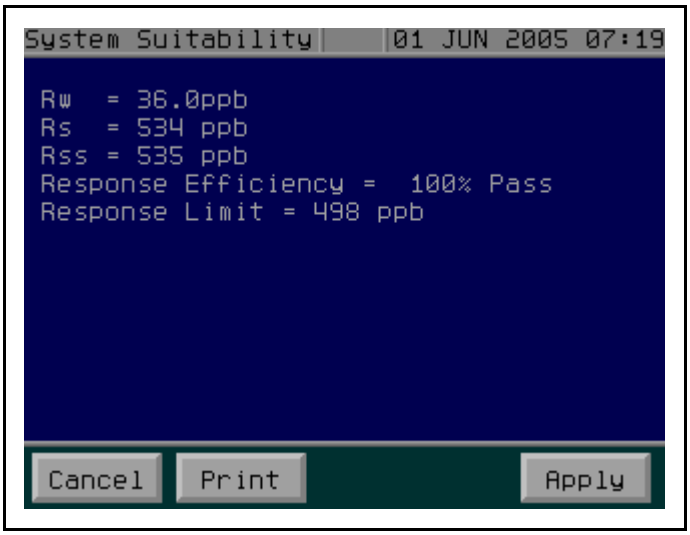

Figure 30: System Suitability Summary Screen

Linearity

The Sievers 500 RL On-Line TOC Analyzer is designed to make linearity verification easy. The Analyzer's linearity, limit of detection, and limit of quantitation are automatically calculated.

To perform the linearity verification, follow this procedure:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button, select the **Maintenance** tab, press the **Cal/Ver/Validate** button, and press the **Linearity** button.
3. If you have a Super iOS System and purchased a vial set:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).
   - When prompted, insert the cartridge into the Super **iOS** System with the label facing away from the Analyzer and press **Next**. Proceed to Step 6.
4. If you have a Super iOS System and purchased individual vials rather than a vial set in a cartridge:
   - If there are vials in the Super **iOS**, remove them now. Press **Next** to continue.
   - Wait for the Analyzer to drain each of the Super **iOS** vial chambers (about 2 minutes).

- When prompted, insert the Linearity vial set into the Super **iOS** System vial ports in the following order:

  Port 1 = High Level Linearity Standard (750 ppb KHP)
  Port 2 = Mid Level Linearity Standard (500 ppb KHP)
  Port 3 = Low Level Linearity Standard (250 ppb KHP)
  Port 4 = Linearity Blank

- Press the **Next** button.
- Press the **No Set** button.
- Proceed to Step 6.

5. If you have a standard **iOS** System:
   - Open the door to the **iOS** System and wait 30 seconds for water to drain.
   - Insert the High Level Linearity Standard (750 ppb KHP) into the **iOS** System and press **Next**.
   - When prompted, remove the High Level Linearity Standard from the **iOS** System, insert the Mid Level Linearity Standard (500 ppb KHP), and press **Next**.
   - When prompted, remove the Mid Level Linearity Standard from the **iOS** System, insert the Low Level Linearity Standard (250 ppb KHP), and press **Next**.
   - When prompted, remove the Low Level Linearity Standard from the **iOS** System, insert the Linearity Blank, and press **Next**.
   - Press the **Print** button if you want to print the Calibration results.
6. After the last standard has been analyzed, the first linearity summary screen is displayed (see Figure 31). The Analyzer indicates if the linearity passed based on the following criterion:

$$R^2 \geq 0.96$$

where

$$R^2 = \left(\frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{\left[n\sum(x^2) - (\sum x)^2\right]\left[n\sum(y^2) - (\sum y)^2\right]}} \right)^2$$

X = Certified values of TOC standards)
Y = Measured values of TOC standards (blank-corrected)

7. Press the **Next** button to display the second page of the linearity summary, which includes LOD and LOQ data.
8. Press the **Exit** button to continue.
9. Remove the vial(s) from the **iOS** System and slide the **iOS** door closed.

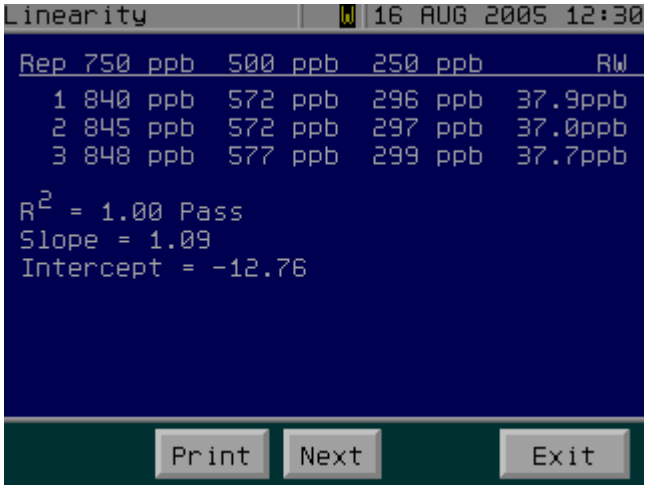

Figure 31: The Linearity Summary Screen, Part 1

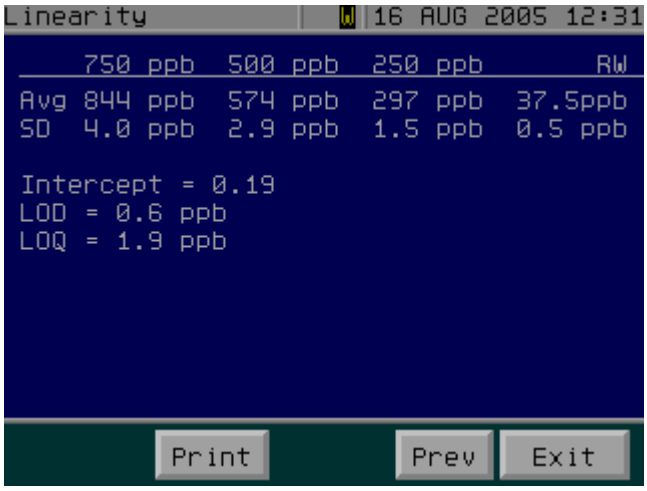

Figure 32: The Linearity Summary Screen, Part 2

Reviewing Calibration and Verification History

If you need to review the results summary of past calibrations, follow these steps:

1. Press the **Menu** button and select the **Maintenance** tab.
2. Press the **Calibrate** button.
3. Press the **Cal/Ver History** button.
    - Press the **Print History** button to output the calibration history to the printer.
    - Press the **Export History** button to output the calibration history to the USB port or the serial port in text (`.csv`) format.

If you want to review specific measurements from calibration or verification, you can display the data history as you normally would. The **Mode** column lists **TC Cal** and **IC Cal** for calibration results, **TC Ver** and **IC Ver** for verification results, **Sys Suit** for system suitability results, and **Linearity** for Linearity results. These results also are included when you export the data history.

The Analyzer's **Cal/Ver History** is divided by protocol type, and a finite number of result summaries for each type will be stored (see Table 13). Once the maximum number of stored result summaries is reached for a particular protocol, the oldest result summary is overwritten by the newest result summary of the protocol type. For calibrations, result summaries are stored in **Cal/Ver History** memory only if the calibration was applied.

Table 13: Maximum Stored Results by Protocol Type

System Protocol Type	Maximum Number of Stored Results
System Suitability	14
Accuracy/Precision/Verification	3
Single Point Calibration	3
Multipoint Calibration	3
Sample Cell Calibration	3
Linearity	3

Single-Point Calibration Worksheet

Company Name _____ Date_____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____ Standards Expiration Date_____

Standards Set Lot No. (optional) _____ Standards Vials Lot Nos. _____

Enter data for the Calibration:

Rep	RW IC	RW2 TOC	1.50 ppm TOC	25.00 µS/cm tCond
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____
Avg	_____	_____	_____	_____
Exp	_____		_____	_____
Diff	_____		_____	_____
Adj	_____	_____	_____	_____

Calibration Results: ☐ Passed ☐ Failed

Calibration Action: ☐ Applied ☐ Canceled

Multi-Point Calibration Worksheet

Company Name _____ Date_____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____ Standards Expiration Date_____

Standards Set Lot No. (optional) _____ Standards Vials Lot Nos. _____

Rep	RW IC	RW2 TOC	1.50 ppm TOC	25.00 µS/cm tCond
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____
Avg	_____	_____	_____	_____
Exp	_____		_____	_____
Diff	_____		_____	_____
Adj	_____	_____	_____	_____

Rep	RW3 TOC	1.00 ppm TOC	500 ppb TOC
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
Avg	_____	_____	_____
Exp		_____	_____
Diff		_____	_____
Adj	_____	_____	_____

Calibration Results: ☐ Passed ☐ Failed

Calibration Action: ☐ Applied ☐ Canceled

Accuracy, Precision, and Verification Worksheet

Company Name _____ Date_____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____ Standards Expiration Date_____

Standards Set Lot No. (optional) _____ Standards Vials Lot Nos. _____

Rep	RW TOC	500 ppb TOC	25.00 µS/cm tCond
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
Avg	_____	_____	_____

	RW	TOC	Conductivity	
Avg	_____	_____	_____	
Adj Standard Concentration	_____	N/A	N/A	
SD	N/A	_____	_____	
RSD (verification)	N/A	_____	_____	☐ Pass ☐ Fail
Accuracy	N/A	_____	_____	☐ Pass ☐ Fail

Pass criteria:

- TOC Precision: RSD of last three measurements of 500 ppb standard ≤ 3%
- Conductivity Precision: RSD of last three compensated conductivity measurements on 25 µS/cm standard ≤ 2%
- TOC Accuracy: % Difference ≤ ±7%
- Conductivity Accuracy: % Difference ≤ ±2%

System Suitability Worksheet

Company Name _____ Date_____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____ Standards Expiration Date_____

Standards Set Lot No. (optional) _____ Standards Vials Lot Nos. _____

Average TOC of Reagent Water (Rw) _____ (Line 1)

Average TOC of 500 ppb Sucrose Standard (Rs) _____ (Line 2)

Average TOC of 500 ppb Benzoquinone Standard (Rss) _____ (Line 3)

Response Efficiency _____ (Line 4)

Response Limit _____ (Line 5)

$$\text{Response Efficiency} = \frac{(\text{Rss - Rw})}{(\text{Rs-Rw})} \times 100$$

$$\text{Response Limit} = \text{Rs - Rw}$$

Acceptance criteria for USP System Suitability is response efficiency between 85% and 115%

☐ Pass ☐ Fail

Linearity Worksheet

Company Name _____ Date_____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____ Standards Expiration Date_____

Standards Set Lot No. (optional) _____ Standards Vials Lot Nos. _____

Rep	750 ppb	500 ppb	250 ppb	RW
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____

R^2 (Square of the Correlation Coefficient) _____

Slope _____

Intercept (Expected vs Measured Values) _____

Rep	750 ppb	500 ppb	250 ppb	RW
Avg	_____	_____	_____	_____
SD	_____	_____	_____	_____

Intercept (Expected Value vs Standard Deviation) _____

LOD _____

LOQ _____

$\mathbf{R^2 \geq 0.96}$ ☐ Pass ☐ Fail

Chapter 7. Maintenance

Replacing Consumables and Maintenance Items

To ensure optimum performance of the Analyzer, routinely replace Analyzer consumables and maintenance items. Refer to Table 14 below for the recommended maintenance schedule. The in-line filter, UV lamp, DI water cartridge, and sample pump tubing (including pump heads) must be purchased from GE Analytical Instruments.

If you need additional assistance, contact GE Analytical Instruments Technical Support at 800.255.6964. Training is also available from GE Analytical Instruments.

Note that this chapter covers replacement instructions for all routine maintenance items that are replaced on a regular schedule; instructions for non-routine maintenance items are provided in those items' packaging.

A one-year maintenance record log is provided for convenience to ensure that all required maintenance is performed when necessary (see Table 16 on page 167).

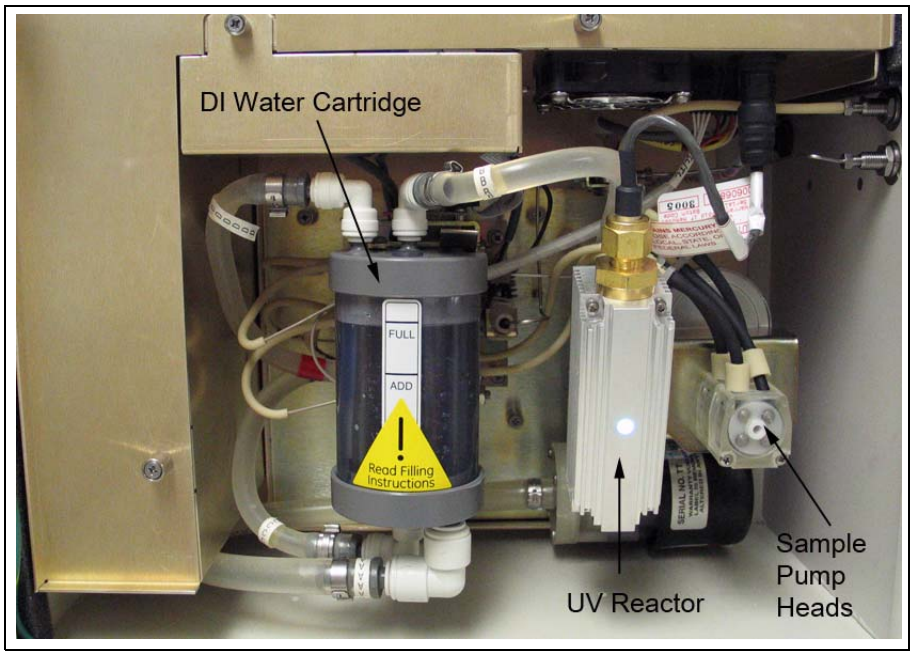

Figure 33: Interior Overview of the Analyzer

Table 14: Replacement Schedule for Consumables

Description	Typical Operating Life
DI Water Level	Refill as needed (check when replacing other items)
UV lamp	6 months
Pump tubing (with pump heads)	12 months
DI Water Cartridge	Typically 24 Months (depends on water quality)
Inline filter	Replace as needed (depends on water quality)

Checking and Refilling the DI Water Level

The water level in the DI water cartridge should be checked periodically and refilled as necessary. For this procedure, you will need the water bottle (from the accessories kit) filled with DI water.

To check the level of water in the DI water cartridge:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Turn off power to the Analyzer with the main power switch.

3. Open the Analyzer front panel.
4. Locate the DI water cartridge at the center of the Analyzer (see Figure 33 on page 154).
5. If the water level is below the **Full** line, you need to add DI water to the cartridge.
6. Remove the rubber inlet cover, located on the top of the DI water cartridge (see Figure 34).
7. Fill the water bottle from the Analyzer accessory kit with DI water and use the nozzle on the water bottle to fill the DI water cartridge. Fill the cartridge until the water level reaches the **Full** line.
8. Replace the inlet cover by gently pushing it back into place on the cartridge.
9. If you need to replace other consumables, follow the procedures listed in the appropriate sections of this chapter. Otherwise, close and latch the Analyzer door.
10. Restore power to the Analyzer.
11. Press the Start Analysis button. After five minutes, open the Analyzer front panel and check the water level in the DI water cartridge to make sure it is still at the **Full** line. If necessary, repeat these steps to add more water.

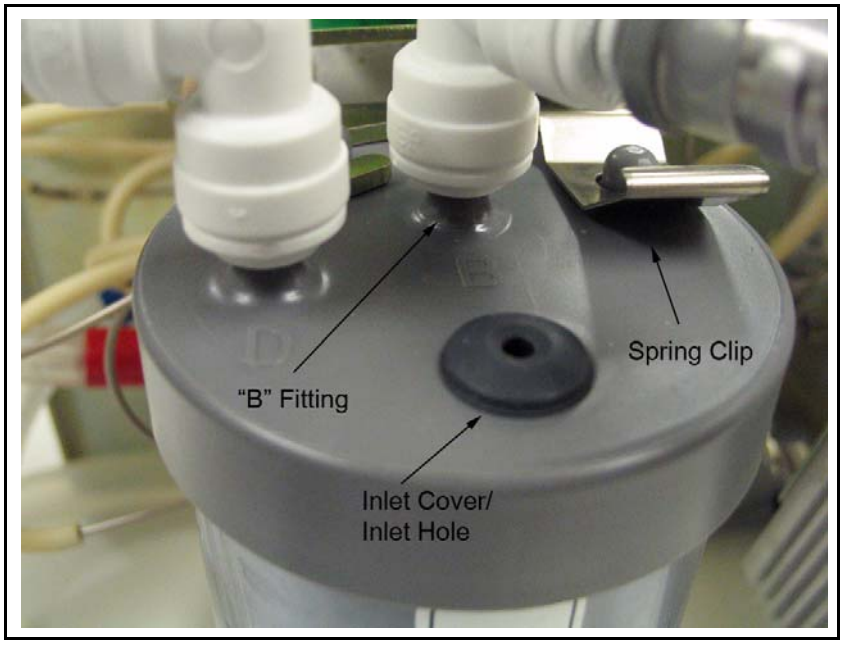

Figure 34: Filling the DI Water Cartridge

Replacing the UV Lamp

The intensity of the UV lamp, particularly the emission of short-wavelength radiation, decreases over time. Replace the lamp after every six months of operation.

Warning

The UV lamp contains mercury and may be considered hazardous material in your local area. Dispose of the UV lamp in accordance with federal, state, or local government regulations.

Warning

Installation of the UV lamp requires access to the inside of the Analyzer. To avoid potentially dangerous shock, disconnect the power cord before opening the Analyzer's front panel.

Warning

Should the UV lamp become broken or damaged, it should be handled in accordance with your organization's toxic waste handling procedure and disposed of in accordance with federal, state, or local government regulations.

Note: *A cotton glove to be worn during the installation is included with the replacement UV lamp to avoid leaving fingerprints on the quartz window of the lamp. Fingerprints absorb UV radiation and decrease the performance of the oxidation reactor. If necessary, use methanol to remove any fingerprints before installing the new lamp.*

To replace the UV lamp:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Turn off the Analyzer by using the main power switch.
3. Open the Analyzer front panel.

4. Locate the UV lamp enclosure at the right of the Analyzer (see Figure 33 on page 154). The UV enclosure has a brass nut and a gray wire with a black connector extending from the nut.
5. Disconnect the black power connector from the power supply by turning the connector and then carefully pulling the two halves of the plug apart.
6. Loosen the brass nut on the UV enclosure. The nut should only be finger-tight; do not use a wrench.
7. Slowly slide the UV lamp out of the enclosure.
8. Put on the glove provided with the new UV lamp, to avoid leaving fingerprints on the quartz window of the lamp. Remove the new lamp from the packet and the nut and ferrules from the zip-top bag.
9. Slide the nut up the lamp housing (toward the connector cord), and then slide the ferrules up the lamp housing, until they are level with the black heat shrink tubing. Be careful when inserting the lamp into the Analyzer as the nut and ferrules may slide off. Refer to Figure 35 and Figure 36 for proper orientation of the ferrules.

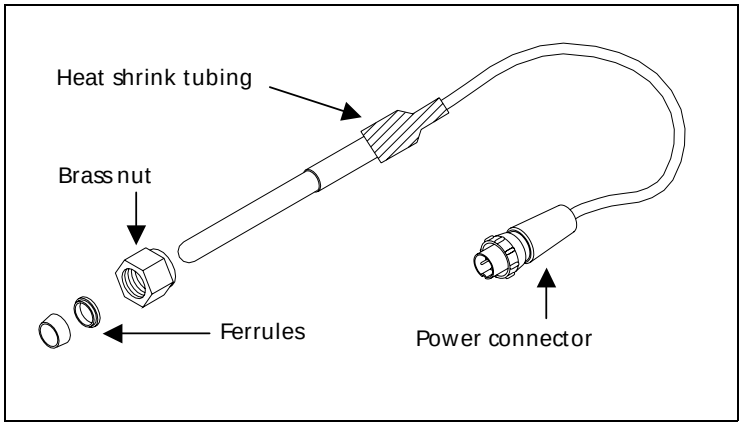

Figure 35: Relative Positioning of Components in the UV Lamp Assembly

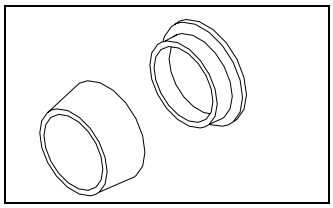

Figure 36: UV Lamp Ferrule Orientation Detail

10. Carefully slide the lamp assembly into the enclosure. Stop if you feel any resistance, and realign the lamp in the reactor. Make sure the black heat tubing is flush against the brass-colored nut.
11. Tighten the brass-colored nut finger-tight. While tightening the nut, make sure the heat shrink tubing remains flush against the nut (Figure 35). Do **not** use a wrench.
12. Connect the power connector to the power supply by aligning the slot on the connector with the slot on the power supply. Tighten the connector screw. Gently pull on the power connector to make sure it is securely attached to the power supply.
13. Record the installation date for the lamp in the service log (see Table 16 on page 167).
14. If you need to replace other consumables, follow the procedures listed in the appropriate sections of this chapter. Otherwise, close and latch the Analyzer door.
15. Plug in the main power cord and turn the Analyzer on with the main power switch.
16. Enter the installation date for the UV lamp by following the procedures in "Setting the Installation or Date for New Consumables" on page 165.
17. After changing the UV lamp, perform a calibration verification (see "Accuracy, Precision, and Calibration Verification" on page 138).

Replacing the Sample Pump Tubing and Pump Heads

The tubing for the sample pump loses elasticity over time and must be replaced annually to ensure proper flow rates; the tubing cannot be replaced independently of the sample pump heads, and is provided as a kit with new pump heads. The sample pump tubing and pump heads must be purchased from GE Analytical Instruments; use of tubing from other sources or failure to replace the tubing on the prescribed replacement schedule will affect Analyzer functionality.

Warning
⚠ Installation of the sample pump tubing and pump heads requires access to the inside of the Analyzer. To avoid potentially dangerous shock, disconnect the power cord before opening the Analyzer's front panel.

Have paper towels available during the procedure in case water leaks from the old pump heads during the removal process. Reference Figure 37 on page 160, as needed.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Turn off the Analyzer by using the main power switch.
3. Stop the flow of sample water to the Analyzer.
4. Open the Analyzer front panel.
5. Locate the sample pump heads (see Figure 33 on page 154).
6. Remove the masterflex tubing from the four barbs.
7. Use a small Phillips screwdriver (from the accessories kit) to loosen the two screws that secure the pump heads. Remove the screws and retain them.
8. Pull both pump heads straight out and off the shaft. Dispose of the old pump heads. Use a paper towel to clean any dripping that occurs.
9. Remove the new pump heads from the packaging. Slide one pump head onto the shaft and push it all the way back, making sure the set pins are seated properly. You may need to "walk" the pump head onto the shaft. The shaft is a "D" and must align properly with the pump heads.
10. Repeat Step 9 for the second pump head.
11. Replace and secure the two Phillips screws.
12. Reattach the sample pump tubing. Tubing on the left side of the pump head should run to either length of the Masterflex tubing on the left; tubing on the right side of the pump head should run to either fork of the "Y" tubing.
13. Record the installation date for the pump heads in the service log (see Table 16 on page 167).
14. If you need to replace other consumables, follow the procedures listed in the appropriate sections of this chapter. Otherwise, close and latch the Analyzer door.
15. Restore power to the Analyzer.
16. Enter the installation date for the pump heads by following the procedures in "Setting the Installation or Date for New Consumables" on page 165.

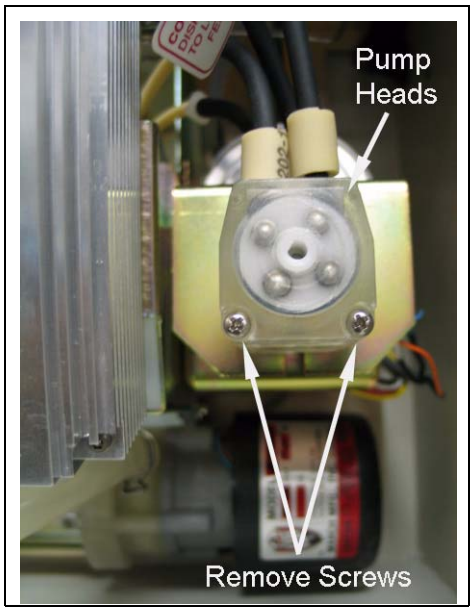

Figure 37: Replacing the Sample Pump Heads

Replacing the DI Water Cartridge

The ion exchange resin (resin bed) within the DI water cartridge depletes over time. With typical Analyzer use, the DI water cartridge should be replaced after every 24 months of operation.

To replace the DI water cartridge, you will need the new cartridge; paper towels; and the water bottle, John Guest fitting tool, and tray from the accessories kit. While replacing the DI water cartridge, you will need to remove the four connections to the cartridge. All connections are labeled, but if necessary refer to Table 15 on page 163 when reattaching the tubing.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Turn off the Analyzer by using the main power switch; also switch off the external circuit breaker for the Analyzer.
3. Stop the flow of sample water to the Analyzer.
4. Open the Analyzer front panel.
5. Locate the DI water cartridge (see Figure 33 on page 154).
6. Slide the tray under the DI water cartridge.

7. Lift the spring clip at the top of the DI water cartridge, and rotate the cartridge to the right so it slides out of the retaining hook.
8. Remove the John Guest fitting labeled “B” from the barb on the top of the DI water cartridge. To loosen the fitting, use the John Guest fitting removal tool from the accessories kit to push in on the bottom ring on the fitting, so that the ring moves toward the fitting Place the fitting into the tray to collect water (see Figure 38).
9. Remove the rubber inlet cover from the top of the cartridge.
10. Loosen the fitting labeled D from the barb on the top of the DI water cartridge, and place it in the tray to collect water. When water is no longer dripping from either of the connectors, carefully remove the tray from the Analyzer, empty the water, and return the tray to the Analyzer.
11. Remove the two John Guest fittings from the barbs on the bottom of the DI water cartridge, labeled “A” and “C.” Drain the water from the tubing into the tray.
12. Dispose of the old DI water cartridge in compliance with local, state, and federal regulations.
13. Carefully remove the tray and discard the collected water.
14. Remove the new DI water cartridge from the packaging, and remove the caps from each of the barbs.
15. Remove the rubber inlet cover from the new cartridge and set it aside.
16. Attach the John Guest fittings to the barbs on the bottom of the new DI water cartridge, labeled “A” and “C.”
17. Slide the water bottle nozzle into the inlet hole. Make sure the tubing that connects to Port “B” is positioned higher than the DI water cartridge, and then gently squeeze the water bottle. Be sure to fill the reservoir until the water reaches the **Full** line.
18. Connect the fitting labeled “B” to the barb labeled “D” on top of the DI water cartridge.
19. Slide the DI water cartridge into the bracket and rotate it into the retaining clip until it snaps into place. The cartridge must be level as you rotate it inward, and the bottom of the cartridge must be perpendicular to the bracket.
20. Visually check for leaks from the reservoir after the DI water cartridge has been filled.
21. Turn on the Analyzer using the main power switch. This will start the DI pump. Check for large air bubbles in all the tubing that connects to the DI water cartridge. If large air bubbles are present, tap or manipulate the tubing to work the air bubbles out.
22. Keep the Analyzer powered on for 2 minutes.

23. After 2 minutes, turn the Analyzer off.
24. Lift the spring clip at the top of the DI water cartridge, and rotate the cartridge clockwise (as viewed from the top) so it slides out of the retaining hooks.
25. Remove the John Guest fitting labeled “B” from the barb on the top of the DI water cartridge.
26. Connect the fitting labeled “B” to the barb labeled “B” on the top of the cartridge.
27. Connect the fitting labeled “D” to the barb labeled “D” on the top of the cartridge.
28. Slide the DI water cartridge into the bracket and rotate it into the retaining clip until it snaps into place.
29. Replace the rubber inlet cover.
30. Close and latch the Analyzer door.
31. Restore power to the Analyzer.
32. Check the level of the DI water cartridge. If the water level has dropped below the **Full** line, remove the rubber inlet cover from the top of the cartridge, add more water, and replace the inlet cover.
33. Let the Analyzer run for two hours.
34. After two hours, open the Analyzer front panel and check for leaks. Also check the water level in the DI water cartridge.
35. Record the installation date for the DI water cartridge in the service log (see Table 16 on page 167).
36. Enter the installation date for the pump heads by following the procedures in “Setting the Installation or Date for New Consumables” on page 165.

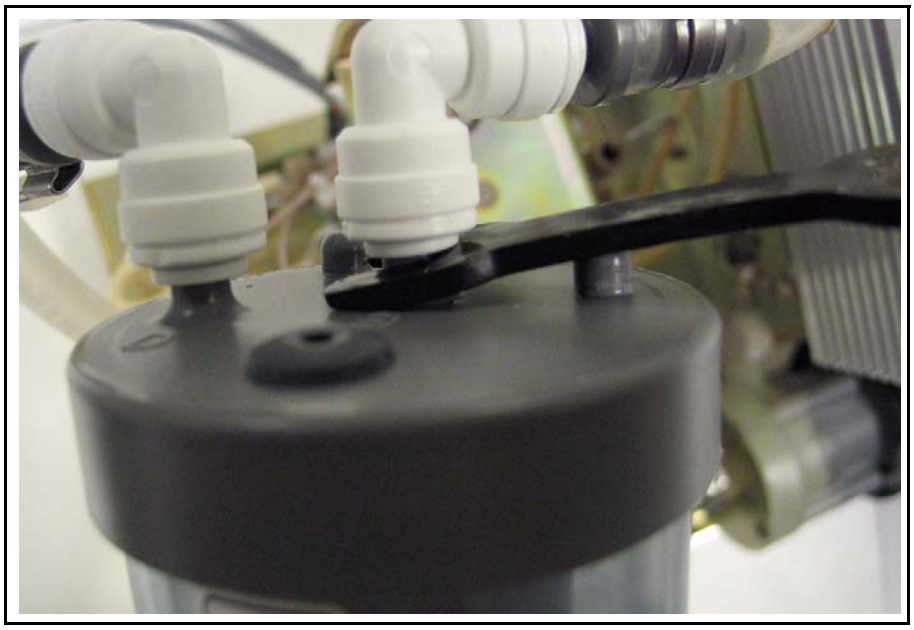

Figure 38: John Guest fittings on the DI Water Cartridge (Detail)

Table 15: Connections to the DI Water Cartridge

Barb Label	Connection
A	Outlet to pump
B	Inlet from pump
C	Outlet to manifold
D	Inlet from manifold

Replacing the In-Line Filter Element

To prevent clogging in on-line configurations, a filter is installed on the sample inlet line. The lifetime of the filter element depends on the level of particles in the water samples. If monitoring the TOC of the feed water (prior to purification), the filter element will need to be replaced more often than if monitoring the water after purification.

If the filter element clogs too frequently, contact GE Analytical Instruments to receive help in the selection of larger-capacity filters. As the filter is used, the flow rate of water through the **iOS** System will decrease and can even stop. A simple way to determine if the filter element needs to be changed is to periodically measure the flow rate of water out the waste line from the **iOS** System and replace the filter element when the flow rate starts to decrease.

It is desirable to replace the filter element on a routine basis to prevent clogging. For this procedure, two 3/4" wrenches are needed. To replace the filter element, follow these steps:

1. Stop the Analyzer by pressing the **Stop Analysis** button.
2. Turn off the Analyzer using the main power switch.
3. Shut off the water to the sample inlet system.
4. Remove the filter by loosening the Swagelok nuts on the 1/4" Teflon tubing and disconnecting the tubing.
5. Position the 3/4" wrenches on the ends of the filter (see Figure 39). Loosen the adapter on the inlet side of the filter.
6. Unscrew the spring-loaded inlet adapter, taking care not to lose the spring.
7. Remove the old filter element from the body of the filter.
8. Insert a new filter element into the body of the filter, opened end first.
9. Replace the spring in the inlet adapter and screw the inlet adapter into the body of the filter.
10. Secure the inlet adapter by tightening approximately one-quarter turn past finger-tight.
11. Reconnect the 1/4" Teflon tubing from the sampling port adapter to the inlet of the in-line filter. The in-line filter has arrows on the body of the filter that indicate the direction of flow through the filter. Tighten the nut one-quarter turn past finger-tight.
12. Reconnect the 1/4" Teflon tubing to the outlet of the filter and tighten the nut one-quarter turn past finger-tight.
13. Turn on the water supply at the sampling port.
14. Turn on the Analyzer using the main power switch.

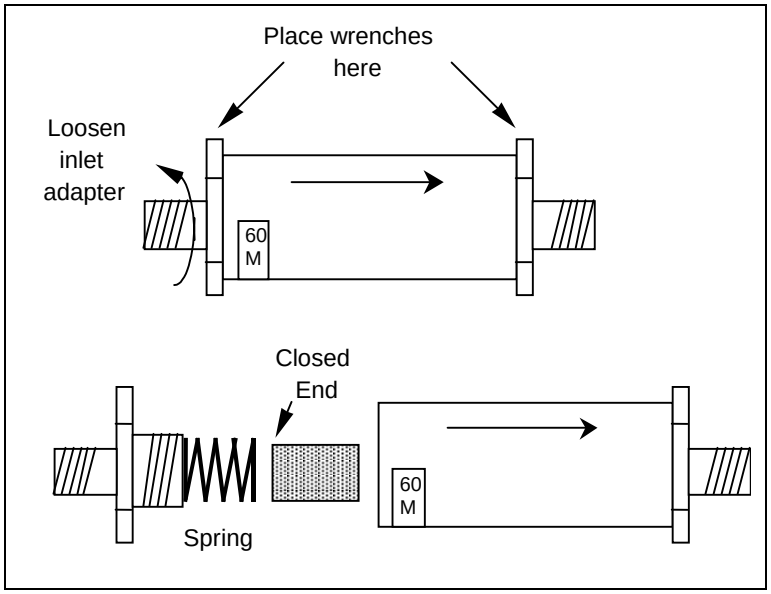

Figure 39: Replacing the In-Line Filter Element

Setting the Installation or Date for New Consumables

When you replace a consumable, you must enter the date of installation ensure that the Analyzer keeps an accurate record of usage and that the indicators on the Main screen remain accurate.

1. Press the **Menu** button and select the **Maintenance** tab.
2. Press the **Consumables** button.
3. Press the **New...** button that corresponds to the consumable you are installing. Choose **New Lamp**, **New Tube**, or **New RBed**, press the **Accept** button to enter today's date, or enter values for the appropriate Day, Month and Year and then press the **Accept** button.
4. Repeat Step 3 for each consumable that you installed.

Note: *When Password protection or DataGuard is activated, not all users are able to modify settings on this screen. See "Menu Map — DataGuard (Optional Upgrade)" on page 116 or "Using DataGuard" on page 118 for more information.*

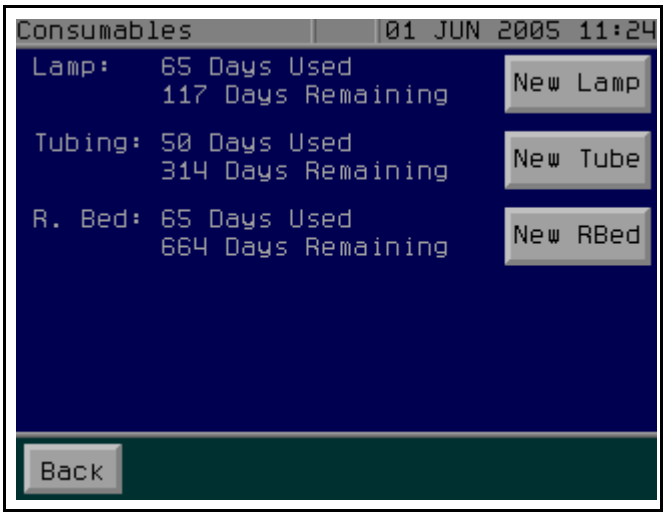

Figure 40: The Consumables Screen

Cleaning the Analyzer

You can clean the external housing of the Analyzer with a damp cloth using water or non-abrasive cleaners. Turn off power to the Analyzer and disconnect it from main power prior to cleaning. Do not spray liquids directly on the Analyzer. Wipe dry with a clean, soft cloth.

The touch screen may be cleaned with a soft cloth or cotton pad. Isopropyl Alcohol may be used, but insure that all solvent residue is removed. Water may cause damage or discoloration of the polarizer. Clean any condensation or moisture from any source immediately. Before cleaning the screen, you can temporarily deactivate touch screen sensitivity for 30 seconds by selecting the following option:

1. Press the **Menu** button and select the **Maintenance** tab.
2. Press the **Advanced** button, press the **Advanced Setup** button, and then press the **Clean Screen** button.

Table 16: Sievers 500 RL On-Line TOC Analyzer 3-Year Maintenance Worksheet

Item	Period	Installation Date	Notes
UV Lamp	6 months		
DI Water Filled	6 months		
Pump Heads	12 months		
UV Lamp	12 months		
DI Water Filled	12 months		
UV Lamp	18 months		
DI Water Filled	18 months		
Pump Heads	24 months		
UV Lamp	24 months		
DI Water Cartridge	24 months		
DI Water Filled	24 months		
UV Lamp	30 months		
DI Water Filled	30 months		
Pump Heads	36 months		
UV Lamp	36 months		
DI Water Filled	36 months		

Note: the DI water cartridge should be checked and filled as necessary as part of every maintenance.

Analyzer Serial number _____ Date placed into operation _____

Dates of operation encompassed by this worksheet: from _____to _____

Chapter 8. Troubleshooting

Overview

This chapter provides the starting point for troubleshooting basic issues with your Analyzer. If you need additional assistance, in the U.S. contact GE Analytical Instruments Technical Support at 800.255.6964. In other parts of the world, contact your local GE Analytical instruments representative.

Step 1: Review Warnings and Errors

The best first step in troubleshooting erratic readings, poor reproducibility (>3%), or other operational problems is to review and print the Warnings/Errors list.

Note: For Analyzer firmware with the DataGuard feature, a Maintenance-level (or higher) User Level is required for performing most diagnostic tests; a QA-level (or higher) password is required for performing the 4-20mA test. Check with your system administrator for an appropriate password. For more information, see "Using DataGuard" on page 118.

To display and print the Warnings/Errors list, follow these steps:

1. Select the **Maintenance** tab.

2. Press the **Warnings/Errors** button.
3. Use the scroll buttons to browse the warnings and errors.
4. Press the **Print** button to print the list.

You also can print or export a full list of warnings and errors that includes the time each event occurred, even after you have removed items from the Warnings/Errors list. To do so, follow these steps:

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Warn/Error Out** button.
4. Press either the **Print History** or **Export History** button.

   If you select **Export History**, you will be prompted to select the port for export. Press either **Serial** or **USB** to export the list of warnings and errors.

A complete list of warnings and errors is shown below.

Warnings and Error Messages

5 - UV Lamp Warning

Message: "The estimated lamp life is less than 15 days. Order a new UV lamp."
Explanation: Based on the history of usage, the Analyzer estimates that only 10% of the UV lamp life remains. Order a new UV lamp from GE Analytical Instruments now to avoid down time when the lamp expires.

6 - Tubing Warning

Message: "The estimated tubing life is less than 15 days. Order new tubing."
Explanation: Based on the history of usage, the Analyzer estimates that only 10% of the sample pump tubing life remains. Order new pump tubing from GE Analytical Instruments now to avoid down time when the tubing expires.

7 - Resin Bed Warning

Message: "The resin bed life is less than 15 days. Order a new resin bed."
Explanation: Based on the history of usage, the Analyzer estimates that only 10% of the resin bed life remains. Order a new resin bed from GE Analytical Instruments now to avoid down time when the resin bed expires.

8 - User List Warning

Message: "The user list is nearly full. Archive the user list before adding more users."

Explanation: DataGuard allows a maximum of 100 users. This warning displays when 90 user accounts have been created.

9 - History Data Warning

Message: "The history data is nearly full. Archive the history data before taking more measurements."
Explanation: The data history can accommodate approximately 33,000 entries (about 90 days of usage). This warning displays when the data history is 90% full (when approximately 31,941 entries have been saved).

10 - Audit Trail Warning

Message: "The audit trail is nearly full. Archive the audit trail before taking more measurements."
Explanation: The audit trail can accomodate approximately 1,200 entries. This warning displays when the audit trail is 90% full (when approximately 1,080 entries have been saved).

11 - Printer Timeout

Message: "Printer has timed out. Check that the printer is on and selected."
Explanation: The printer did not respond and is not ready to print. Confirm that the printer's selection light is green (you may have to press the **SEL** or **Online** button on the printer).

15 - ID Board Warning

Message: "A problem has been detected with the ID Board. Please contact GE."
Explanation: A communication error with the ID board has occurred. Turn the Analyzer off and on and restart analysis. If the warning persists, contact Technical Support.

16 - Flow Started

Message: "Sample stream flow restored."
Explanation: The flow of sample water to the Analyzer has been restored after a system-reported interruption. This message automatically clears the related 63 - Flow Stop error from the screen, and replaces the E (Error) icon at the top of the screen with a W (Warning) icon.

18 - UV Lamp Warning

Message: "The UV lamp needs to be replaced."
Explanation: Based on the history of usage, the Analyzer estimates that the UV lamp has expired. Order a UV lamp now. Continuing to use the expired UV lamp can result in incomplete oxidation and poor measurements.

21 - Tubing Warning

Message: "The tubing needs to be replaced."
Explanation: Based on the history of usage, the Analyzer estimates that the sample pump tubing has expired. Order new pump tubing from GE Analytical Instruments now.

22 - Resin Bed Warning

Message: "The resin bed needs to be replaced."

Explanation: Based on the history of usage, the Analyzer estimates that the resin bed has expired. Order a new resin bed from GE Analytical Instruments now.

23 - Autozero Warning

Message: "TOC Autozero cancelled -- sample too variable. Autozero will be retried at next scheduled time."
Explanation: The Analyzer was unable to perform the TOC Autozero due to fluctuations in the IC or TC levels of the sample stream. The Analyzer waits until the next scheduled time and attempts to perform the Autozero again. If this warning persists, there may be an issue with the water system.

25 - History Data Warning

Message: "A problem has been corrected in the history data. Contact GE if the warning persists."
Explanation: The Analyzer has detected a problem reading or writing to the data history memory; as much of the data history as possible is reconstructed. If the problem continues, contact GE Analytical Instruments technical support.

26 - System Restart Warning

Message: "The system has experienced an error and has automatically restarted. Contact GE if the warning persists."
Explanation: The Analyzer has restarted for a reason other than a power failure. If the problem continues, there may be a problem with the Analyzer and you should contact GE Analytical Instruments technical support.

29 - USB Warning

Message: "A problem has been detected with the USB device. Please refer to the Oper. and Maint. manual for info on supported devices."
Explanation: The Analyzer was unable to write to or read from the USB flash memory drive. Make sure the USB device is attached to the Analyzer properly and attempt the operation again. If you are not using the USB flash memory drive that was supplied in the Analyzer's accessories kit, it is possible your USB device is not compatible with the Analyzer. For a list of known compatible USB flash memory drives, follow the Sievers 500 RL Analyzer link on our Web page, www.geinstruments.com.

42 - ID Board Error

Message: "A problem has been detected with the ID Board. Please contact GE."
Explanation: A communication error with the ID board has occurred. Turn the Analyzer off and on and restart analysis. If the warning persists, contact Technical Support.

43 - Analog Error (IC or TC Cell Conductivity)

Message: "Measurement out of range. Please refer to the Oper. and Maint. Manual for recommendations."
Explanation: Ten (10) consecutive readings from the related channel are out of range. This warning generally displays when IC or TC cell conductivity is out of range. Confirm that there are no air bubbles in any tubing inside the Analyzer, and make sure the water level in the DI water cartridge is

sufficient. Also confirm that sample water is flowing to the Analyzer. If necessary, turn the Analyzer off and on, and restart analysis. If the warning persists, contact Technical Support.

44 - Analog Error (Sample Cell Conductivity)

Message: "Measurement is out of range. Please refer to the Oper. and Maint. Manual for recommendations."
Explanation: Ten (10) seconds from the related channel are out of range.This warning generally displays when sample cell conductivity is out of range. If starting the instrument after a prolonged amount of time, perform a rinse down. Confirm that there are no air bubbles in any tubing inside the Analyzer, and make sure the water level in the DI water cartridge is sufficient. Also confirm that sample water is flowing to the Analyzer. If necessary, turn the Analyzer off and on, and restart analysis. If the warning persists, contact Technical Support.

45 - Analog Error (Temperature)

Message: "Measurement is out of range. Please refer to the Oper. and Maint. Manual for recommendations."
Explanation: Ten (10) seconds of consecutive out-of-range readings have occurred on the sample cell conductivity channel. This warning generally displays when temperature is out of range. Confirm that there are no air bubbles in any tubing inside the Analyzer, and make sure the water level in the DI water cartridge is sufficient. Also confirm that sample water is flowing to the Analyzer. If necessary, turn the Analyzer off and on, and restart analysis. If the warning persists, contact Technical Support.

50 - Unstable Measurements Error

Message: "Unstable measurements detected during calibration/verification. Please refer to the Oper. and Maint. Manual for recommendations."
Explanation: This error displays when the results from calibration/verification are inappropriate and calibration/verification cannot continue. Follow the suggestions in the section called "Step 2: Visual Inspection" on page 176 before continuing with analysis. You may need to contact Technical Support to confirm that the Analyzer is functioning properly.

51 - History Flash Error

Message: "A problem has been detected in the history data flash. Please contact GE."
Explanation: The Analyzer experienced a problem when trying to store data in the flash memory. It is possible a section of the flash memory is damaged. To protect against losing data, the system will automatically abort analysis. Contact Technical Support.

52 - User List Error

Message: "The user list is full. Archive the user list before adding more users."
Explanation: DataGuard allows a maximum of 100 users. This error displays when 100 user accounts have been created. If you have inactive accounts in the user list, you can archive users (**DataGuard** tab → **Archive Users**) to remove them from the list; you will then be able to add additional users.

53 - History Data Error

Message: "The history data is full. Archive the history data before taking more measurements."
Explanation: This error displays when the data history is completely filled. Export (**Data** tab → **Export**) or Print (**Data** tab → **Print** the data) before proceeding.

54 - Audit Trail Error

Message: "The audit trail is full. Archive the audit trail before taking more measurements."
Explanation: This error displays when the audit trail is completely filled. To comply with 21 CFR Part 11, you must either Export (**DataGuard** tab → **Export AuditTrail**) or Print (**DataGuard** tab → **Print Audit Trail**) the audit trail before proceeding.

55 - Linearity Vial Error

Message: "The Linearity vials appear to be in the wrong order. Check the vials to assure they are in the correct order."
Explanation: This error generally displays when the vials in a Linearity protocol are not inserted into the Super iOS System in the correct order. Consult Chapter 6, "Calibration and System Protocols" for the correct vial order.

56 - Sample Pump Error

Message: "The sample pump is not pumping. Please refer to the Oper. and Maint. Manual. Contact GE is problem persists."
Explanation: The Analyzer has detected that the sample pump is not turning and thus not drawing sample water through the Analyzer. Try cycling power to the Analyzer. If you recently performed maintenance on the Analyzer, confirm that all connections were plugged in properly. Contact technical support for additional assistance.

58 - UV Lamp Error

Message: "A problem has been detected with the UV lamp. Inspect the cable. Refer to the Oper. and Maint. Manual for recommendations."
Explanation: The Analyzer has detected that the UV lamp is not functioning properly. Try cycling power to the Analyzer. If you recently performed maintenance on the Analyzer, confirm that the UV lamp power supply is properly connected and that the lamp is secured to the UV reactor housing. Also confirm that the glass window in the UV reactor shows the lamp is illuminated when the Analyzer is powered on. Contact technical support for additional assistance.

59 - Language Error

Message: "Incorrect language pack installed. Refer to the Oper. and Maint. Manual for recommendations."
Explanation: The Analyzer's firmware has been updated, but the language packs have not been updated. Locate the USB flash memory drive that contained the firmware update, turn off the Analyzer, and insert the USB drive into the Analyzer's USB port. When you turn on the Analyzer, it will offer you the opportunity to update the language pack. If this error persists after updating the language pack, contact technical support; you may need a newer version of the language pack.

60 - TOC Zero Error

Message: "Negative TOC readings occurred after two TOC Autozeros."
Explanation: When **Neg TOC** is set to **On** under **Program Autozero**, the Analyzer automatically initiates a TOC Autozero when two consecutive negative measurements occur. If negative readings occur after a second TOC Autozero, this warning is issued. Consult troubleshooting techniques under "Step 3: Review Solutions for Basic Problems" on page 177, and contact GE Analytical Instruments Technical Support if negative readings persist.

61 - iOS Comm Error

Message: "Unable to communicate with **iOS**. Please refer to the Oper. and Maint. manual for info."
Explanation: The Analyzer is not able to establish communication with the **iOS** System, due to a hardware issue. Contact GE Analytical Instruments Technical Support.

63 - Flow Stopped Error

Message: "An interruption in the sample stream flow has been detected."
Explanation: The flow of sample water to the Analyzer has been interrupted. Confirm that the valve controlling sample flow is open. Also make sure the control valve on the **iOS** System is open. The flow rate is controlled by a needle valve, which is adjusted by the screw on the **iOS**. Turn the screw counter-clockwise to increase flow.

65 - Main Board Error

Message: "An error has been detected on the Main Board. Please refer to the 500 Oper. and Maint. Manual. Contact GE if problem persists."
Explanation: A communication error with the main (System) board has occurred. Turn the Analyzer off and on and restart analysis. If the error persists, contact Technical Support.

66 - Analog Error

Message: "An error has been detected on the analog board. Please refer to the 500 Oper. and Maint. Manual. Contact GE if problem persists."
Explanation: A communication error with the analog board has occurred. Turn the Analyzer off and on and restart analysis. If the error persists, contact Technical Support.

67 - Internal Error

Message: "An internal error has been detected. Please contact GE."
Explanation: This error displays when a software error occurs in the Analyzer. Contact Technical Support.

69 - Analog Board Error

Message: "incorrect analog board detected. Please contact GE."
Explanation: This error displays after maintenance has been performed on the Analyzer's analog board, possibly during an upgrade procedure. Contact Technical Support.

70 - Super iOS Error

Message: "Incorrect firmware detected in Super iOS. Please contact GE."

Explanation: The firmware in the Super iOS is not the correct version for use with this Analyzer. Contact Technical Support.

Step 2: Visual Inspection

After confirming that there are no warning or error messages indicating a specific problem, proceed to a visual inspection of the Analyzer to identify any obvious physical problems or symptoms. Begin with an external visual inspection, and proceed to an internal visual inspection. If possible, perform the inspection with the Analyzer in analysis mode so you can verify that relevant modules are performing as usual (described below).

External Inspection

- Confirm that there are no leaks present at the sample inlet or the waste connections.
- Confirm that all cables are securely attached to the Analyzer.
- If you are sampling from vials, confirm that the needle in the **iOS** System is not obstructed.

Internal Inspection

Open the Analyzer front panel and do the following:

- Check for leaks throughout the Analyzer; there should not be moisture on the inside floor of the Analyzer case.
- Confirm that the sample pump is turning.
- Check to make sure there are no leaks from tubing in the DI water system.
- Confirm that the DI water cartridge is full. If necessary, add water up to the **Full** line.
- If maintenance work has recently been performed on the Analyzer, confirm that electronics cables, such as the connector between the analog and ID boards, are securely attached.
- Make sure there are no air bubbles present in any of the DI loop tubing.
- Make sure tubing is not bent or obstructed.
- Make sure the UV lamp is working. During analysis, the window on the UV reactor will illuminate when the lamp is functioning properly.

Note that if tubing has become bent, kinked, or otherwise damaged, a tubing replacement kit is available from GE Analytical Instruments Technical Support.

Step 3: Review Solutions for Basic Problems

If a visual inspection of the Analyzer does not help you identify the source of the problem you are experiencing, consult the specific problems discussed in this section.

The Analyzer Will Not Power On

The Analyzer does not contain a user-replaceable fuse. If the Analyzer will not power on, confirm that the external circuit breaker has not been switched off. Also confirm that the electrical power lines that lead in to the Analyzer are attached securely to the terminal block, and that the grounding wire is connected.

No Flow Through the Analyzer

To troubleshoot a lack of flow through the Analyzer, follow the steps in the following two sections: "Checking the Sample Pump" and "Backflushing the Analyzer." Note that sample will not flow through the Analyzer if the sample pump is not operating or if the 60-µm stainless steel in-line filter is clogged.

Checking the Sample Pump

While the Analyzer is operating, open the Analyzer front panel and make sure the sample pump is turning. If the pump is not turning and the Analyzer is operating (the display screen indicates that analysis is taking place), contact GE Analytical Instruments Technical Support for instructions.

Warning
 To avoid potentially dangerous shock, do not touch anything inside the Analyzer while observing the sample pump.

Confirm Flow of Water to the Analyzer

Make sure the flow of sample water to the Analyzer is enabled from your water system.

Also, confirm that the **iOS** System or Super **iOS** System inlet valve is open. Inlet to the **iOS** System is controlled by a needle valve, which is adjusted by the screw on the **iOS**. Turn the screw clockwise to decrease flow, and turn the screw counter-clockwise to increase flow. The flow rate should be adjusted so that flow out of the waste line is between 30-300 mL/min.

Make sure the Analyzer is powered on at all times, except when maintenance is being performed, to ensure that water flows through the Analyzer's fluidics module.

Backflushing the Analyzer

When there is a lack of flow through the Analyzer, a flush of the DI and sample fluidics may clear clogs in the tubing. Follow these steps to confirm that a backflush is needed and to perform the backflush:

1. Open the Analyzer door.
2. Begin by testing the flow of water on the DI water side of the fluidics module. Remove the Masterflex tubing from the stainless steel tubing connected to the cell. If water is flowing from the stainless steel tubing, proceed to Step 5. If there is no water flowing from the tubing, proceed to the next step.
3. On the Analyzer's touch screen, press the **Menu** button, then select **Maintenance → Advanced → Diagnostics**.
4. Press the **Test Pumps** button, and then press the **DI Pump** button. Cycle the pump on and off a few times, by pressing the **On** and **Off** buttons, finally leaving it set to **On**. If there is no flow, contact GE Analytical instruments for further assistance. You may need to replace the measurement module.
5. Replace the Masterflex tubing, so it connects to the stainless steel tubing.
6. Remove the Masterflex tubing from the front solenoid valve and check to see if water is flowing through the restrictor tubing (see Figure 41).
    - If there is water flowing from the restrictor tubing, reconnect the tubing to the solenoid valve. If there is no water flowing through the restrictor tubing, you may need to replace the restrictor tubing (available in the 500 RL Tubing Set from GE Analytical Instruments).

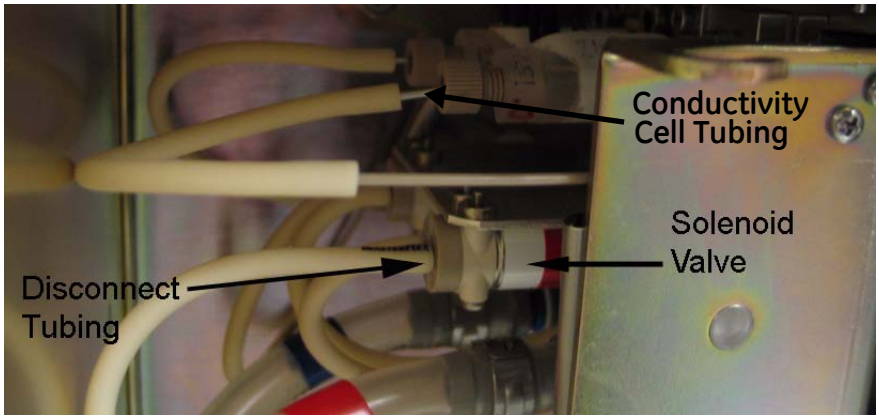

Figure 41: Disconnecting the Tubing from the Front Solenoid Valve

7. On the **Test Pumps** screen, press the **Off** button.
8. Continue by testing the flow of water on the sample water side of the fluidics module. Inside the Analyzer, swap the inlet and outlet tubing connections (see Figure 42). Connect the inlet fitting to the waste port and the waste fitting to the inlet port. Loosen each of the Valco fittings and connect them to the opposite port by tightening 1/4 turn past finger-tight.

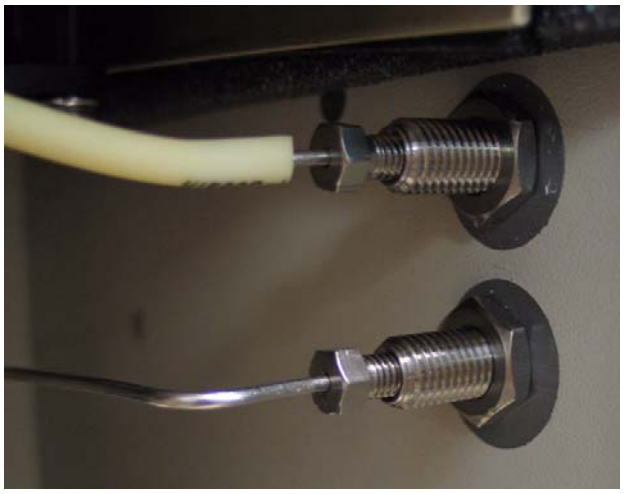

Figure 42: The Inlet and Outlet Connections Inside the Analyzer

9. Swap the two pairs of connections leading to the sample pump tubing at the plastic barbs (see Figure 43). The first pair of tubes (on the left) should be connected to the barbs that normally connect to the second pair of tubes (on the right). The second pair of tubes (on the right) should be connected to the barbs that normally connect to the first pair of tubes (on the left).

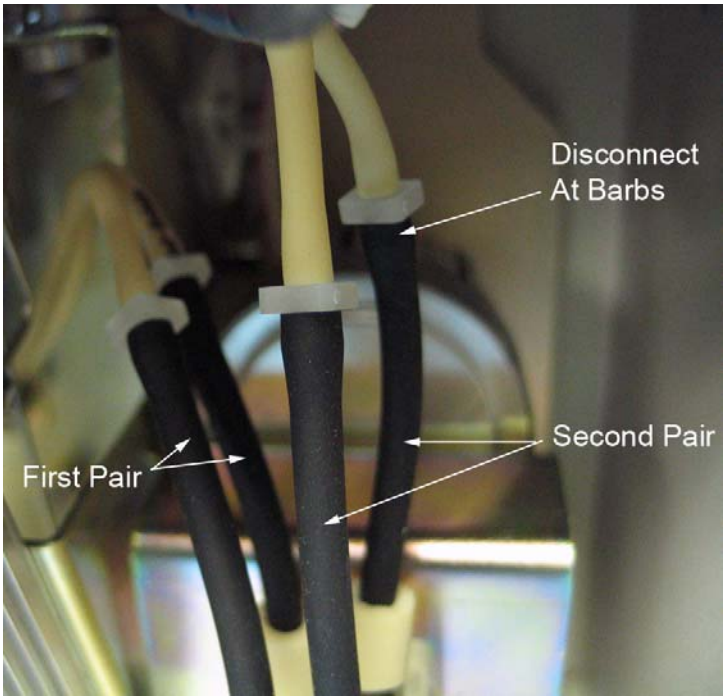

Figure 43: The Sample Pump Tubing Connections

10. On the Analyzer's touch screen, press the **Menu** button, then select **Maintenance → Advanced → Diagnostics → Test Pumps**.
11. Press the **Sample Pump** button and then select **On**.
12. Let the Analyzer run this way for approximately 5 minutes. Then, press the **Sample Pump** button and select **Off**.
13. Restore the sample pump tubing connections to their normal configuration.
14. Restore the inlet and waste fittings to their normal configuration.

Negative, High, or Erratic Measurements

Many of the previous steps in this chapter will help troubleshoot negative or erratic measurements. If the previous steps did not remedy the situation, you may need to perform one of the following procedures.

Conductivity Autozero

If the Analyzer is returning unusually high IC or conductivity values, a sample conductivity cell autozero may be necessary. If you have recently run a system protocol, let the Analyzer run for at least five hours before performing a conductivity autozero.

1. Make sure the Analyzer is not taking measurements.
2. Press the **Menu** button and select the **Maintenance** tab.
3. Press the **Advanced** button.
4. Press the **Cond. Autozero** button.

Sample Conductivity Cell Calibration

If for any reason the sample conductivity cell has been replaced, or you suspect poor performance of the cell, then you may need to perform a sample conductivity cell calibration. For this protocol you will need a Sievers 25 µS/cm Conductivity Standard (as HCl). If you have a Super **iOS**, place this standard in vial port 1.

1. Make sure the Analyzer is not taking measurements.
2. Press the **Menu** button and select the **Maintenance** tab.
3. Press the **Cal/Ver/Validate** button.
4. Press the **Sample Cell Cal** button.

5. When the calibration is complete, a summary screen will display:

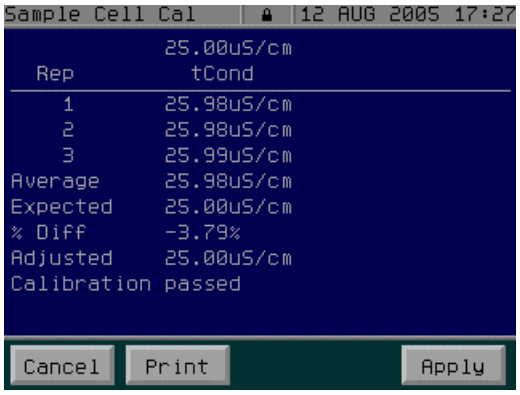

Figure 44: The Sample Cell Calibration Results Screen

6. Press the **Print** button to print the results. Press the **Apply** button to applies the calibration results or press the **Cancel** button to exit without changing the sample conductivity cell values.

Sample Cell Zero

If for any reason the sample conductivity cell has been replaced, or you suspect poor performance of the cell, you may need to perform a sample conductivity cell conductivity autozero. If you have also performed a sample conductivity cell calibration, be sure to wait 5 hours after the calibration before performing the sample cell zero.

1. Make sure the Analyzer is not taking measurements.
2. Press the **Menu** button and select the **Maintenance** tab.
3. Press the **Cal/Ver/Validate** button.
4. Press the **Sample Cell Zero** button.
5. Follow the prompts on the screen.

TOC Autozero

The TOC Autozero corrects for minor differences in the response of the two CO_2 sensors. This adjustment may help when the Analyzer is reading very high or negative values. If you have

recently run a system protocol, let the Analyzer run in On-Line mode for 30 minutes before performing a TOC Autozero.

The TOC Autozero requires that the on-line water supply be available to the Analyzer. Make sure the sample inlet is configured properly before continuing.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button, select the **Maintenance** tab and press the **Cal/Ver/Validate** button.
3. Press **Run TOC Autozero**.
4. Wait for the TOC Autozero to complete before proceeding.

TOC Offset

At extremely low TOC concentrations, very small changes in water system conditions may make it difficult to utilize the TOC autozero procedure for the purposes of achieving instrument-to-instrument agreement consistent with the stated analyzer specifications. If the TOC autozero procedure does not yield acceptable agreement between multiple instruments, you may utilize the manual TOC zero offset adjustment to adjust the TOC reading to match a known accurate reference value.

NOTE: adjusting the TOC offset value manually will affect *all TOC readings by an amount equal to the amount of adjustment*. *This procedure should only be used when all other recommended methods of calibration and autozero have failed to allow multiple instruments to match within the stated accuracy specifications of the analyzer.*

To set the TOC Offset, follow these steps:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button, select the **Maintenance** tab and press the **Cal/Ver/Validate** button.
3. Press the **Program Autozero** button.
4. Press the **Offset** button.
5. Use the number keypad to enter a positive or negative number for the offset. The maximum allowable offset is ±5.00 ppb.

6. Press the **Enter** button.

Problems Changing the Program Language

When you have multiple languages loaded on your Analyzer, if you change the program language out of your native language, it is possible that you will not be able to switch back easily since you cannot read the program menus. If this happens, follow these steps to navigate to the correct menu to change the program language back to your language:

1. Make sure the **Menu** screen is displayed. If the **Main** screen is displayed (it shows the chart of measurements), press the button at the bottom left corner of the screen.
2. Select the fourth tab from the left (this is the **Maintenance** tab).
3. Counting from the top, press the fourth button in the left column (**Advanced**).
4. Press the fourth button in the left column (**Advanced Setup**).
5. Press the fifth button in the left column (**Select Language**).
6. Select your language by pressing the appropriate button. The program language changes immediately.

Problems with Vial Set Cartridges

If you have a Super **iOS** and are having problems using vial sets in cartridges, do the following.

- Make sure the cartridge is properly seated in the Super **iOS** System. Remove the cartridge and re-insert it into the Super **iOS** System firmly.
- Make sure the cartridge is oriented properly. The label should face to the right, away from the Analyzer, so the contacts on the cartridge are close to Vial Port 1.
- Confirm that you are trying to use the appropriate cartridge for the system protocol you have chosen. For example, the Analyzer automatically checks to make sure a system suitability cartridge is not used to run calibration.

Problems with The DI Water Pump

If there are air bubbles blocking the flow of water through the DI water pump, the pump may "squeal" or emit a continuous noise. This problem is more likely to happen when the DI water cartridge has not been filled properly, especially if the Analyzer had been drained and the "B" connection on the DI water cartridge was not removed prior to adding DI water. If the pump begins emitting a noise, try the following:

1. Turn off power to the Analyzer and wait 15 seconds.
2. Restore power to the Analyzer. Cycling power causes the DI pump to stop and start, potentially freeing a trapped air bubble. If the noise persists, turn off power to the Analyzer again.
3. Open the Analyzer front panel.
4. Check for large air bubbles in all the tubing that connects to the DI water cartridge. If large air bubbles are present, tap or manipulate the tubing to work the air bubbles out.
5. If simple manipulation of the tubing does not free the air bubbles, disconnect the John Guest fitting that connects to barb B on the DI water cartridge. Raise the tubing so that it is higher than the cartridge and remove the rubber vent cover. Move the tubing lower than the DI water cartridge, to force any air bubbles out of the tubing. Be prepared to raise the tubing quickly; as soon as all air is forced out of the tubing, water will begin to flow out of the tubing.
6. Check the level of the DI water cartridge. If the water level has dropped below the **Full** line, remove the rubber inlet cover from the top of the cartridge, add more water, and replace the inlet cover.
7. Restore power to the Analyzer. If the problem persists, repeat steps 1 through 3.

Step 4: Contact Technical Support

After pursuing Steps 1 through 3, in the USA contact GE Analytical Instruments Technical Support at 800.255.6964. In other parts of the world, contact your local GE Analytical instruments representative. When you call technical support, please have basic Analyzer information from the System Information screen (**Maintenance** tab → **System Info**) available.

Step 5: Return the Analyzer to GE Analytical Instruments

In some instances, after consulting with GE Analytical Instruments Technical Support, it will be necessary to return the Analyzer to the factory for repairs. **Only return the Analyzer to GE Analytical Instruments if Technical Support has issued you a Return Authorization (RA) number.**

Several precautions must be followed to ensure that the Analyzer is not damaged during shipment. If the original shipping container has not been retained, contact GE Analytical Instruments at 1-800-255-6964 or 303-444-2009 to order shipping supplies. **Under no circumstances should you try to pack the Analyzer in anything other than the original shipping container.**

Warning
If the Analyzer is returned in anything other than an GE Analytical Instruments shipping container, you will be charged for any damage that occurs during shipping.

Before repackaging, water must be drained from the Analyzer.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button and select the **Maintenance** tab.
3. Disable the flow of water to the Analyzer.
4. Press the **Advanced** button and then press the **Drain Sample** button. Follow the prompts on screen. It will take 8 to 10 minutes for the **iOS** to drain. If you do not have an **iOS** or Super **iOS**, proceed to Step 6.
5. After 10 minutes, press the **Exit** button.
6. Turn off power to the Analyzer.
7. Open the Analyzer front panel.
8. Slide the tray from the accessories kit under the DI water cartridge.
9. Lift the spring clip at the top of the DI water cartridge, and rotate the cartridge clockwise (as viewed from the top) so it slides out of the retaining hooks.
10. Remove the John Guest fitting labeled “B” from the barb on the top of the DI water cartridge. To loosen the fitting, use the John Guest fitting removal tool from the

accessories kit to push in on the bottom ring on the fitting, so that the ring moves toward the fitting (see Figure 45). Place the fitting into the tray or other receptacle, to collect water.

Warning

To avoid scratches, do not use a metal tool to remove the John Guest fittings on the DI water cartridge. Always use the John guest tool provided in the Analyzer's accessories kit.

11. Remove the rubber inlet cover from the top of the cartridge. Water will drain from the DI water cartridge.
12. Loosen the fitting labeled D from the barb on the top of the DI water cartridge, and place it in the tray to collect water. When water is no longer dripping from either of the connectors, carefully remove the tray from the Analyzer, empty the water, and return the tray to the Analyzer.
13. Use the John Guest tool to remove the two John Guest fittings from the barbs on the bottom of the DI water cartridge, labeled A and C. Drain the water from the tubing into the tray.
14. Carefully remove the tray and discard the collected water.
15. Slide the DI water cartridge into the bracket and rotate it into the retaining clip until it snaps into place. The cartridge must be level as you rotate it inward, and the bottom of the cartridge must be perpendicular to the bracket.
16. Replace the John Guest connections to the DI water cartridge.
17. Replace the rubber inlet cover on the DI water cartridge.
18. Disconnect the waste tubing and sample inlet tubing from the Analyzer.
19. Remove any printer, alarm, analog output, or computer cables.
20. Disconnect the power connection to the Analyzer. You will need to detach the wiring from the terminal block inside the Analyzer. Refer to Figure on page 59 for a detailed view of the terminal block. You may need an electrician to help you disconnect the Analyzer from the power supply.
21. If there are alarm or 4-20mA connections to the Analyzer, disconnect them from the terminal block. You may need an electrician to help you disconnect the output connections.
22. Close and latch the Analyzer front panel.

You can now repackage the Analyzer and ship it to GE Analytical Instruments.

For international shipments, coordinate with an GE Analytical Instruments representative to ensure quick passage through customs.

Figure 45: Removing the John Guest Fittings

Appendix A: Analyzer Dimension Diagrams

Diagrams show Analyzer dimensions and required clearances as follows: inches [millimeters].

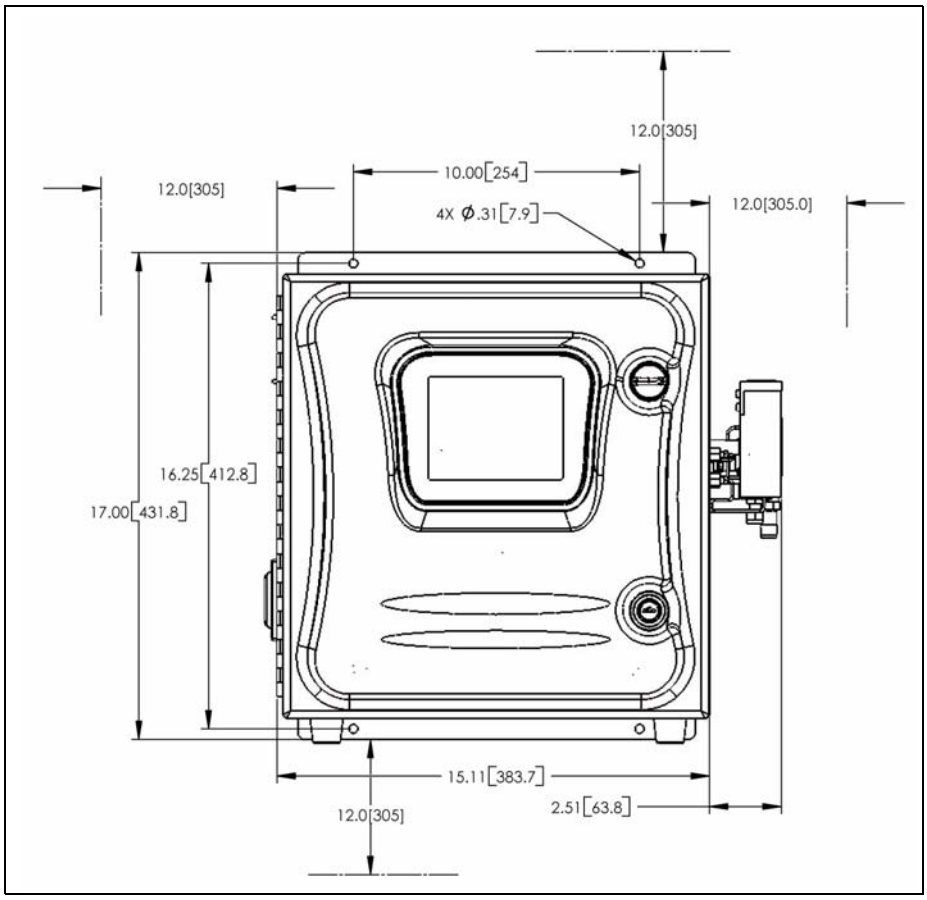

Figure 46: Analyzer Dimensions, with Standard iOS System

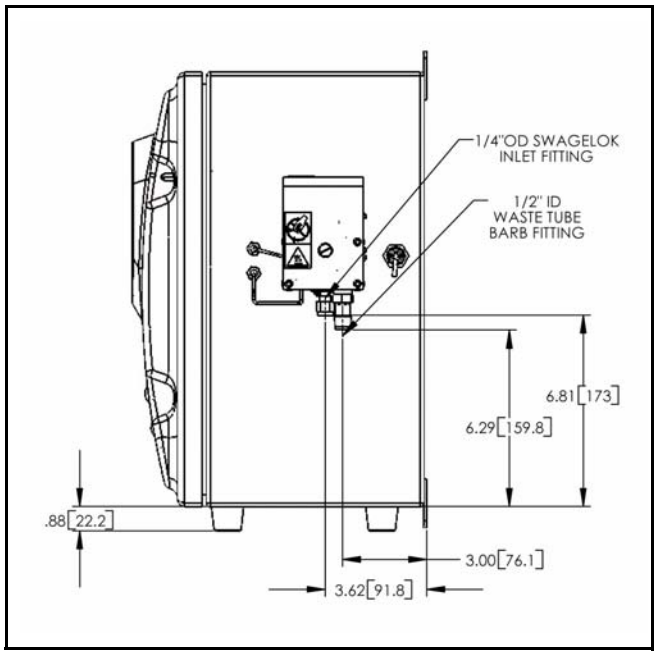

Figure 47: Right-Side Analyzer Dimensions, with Standard iOS System

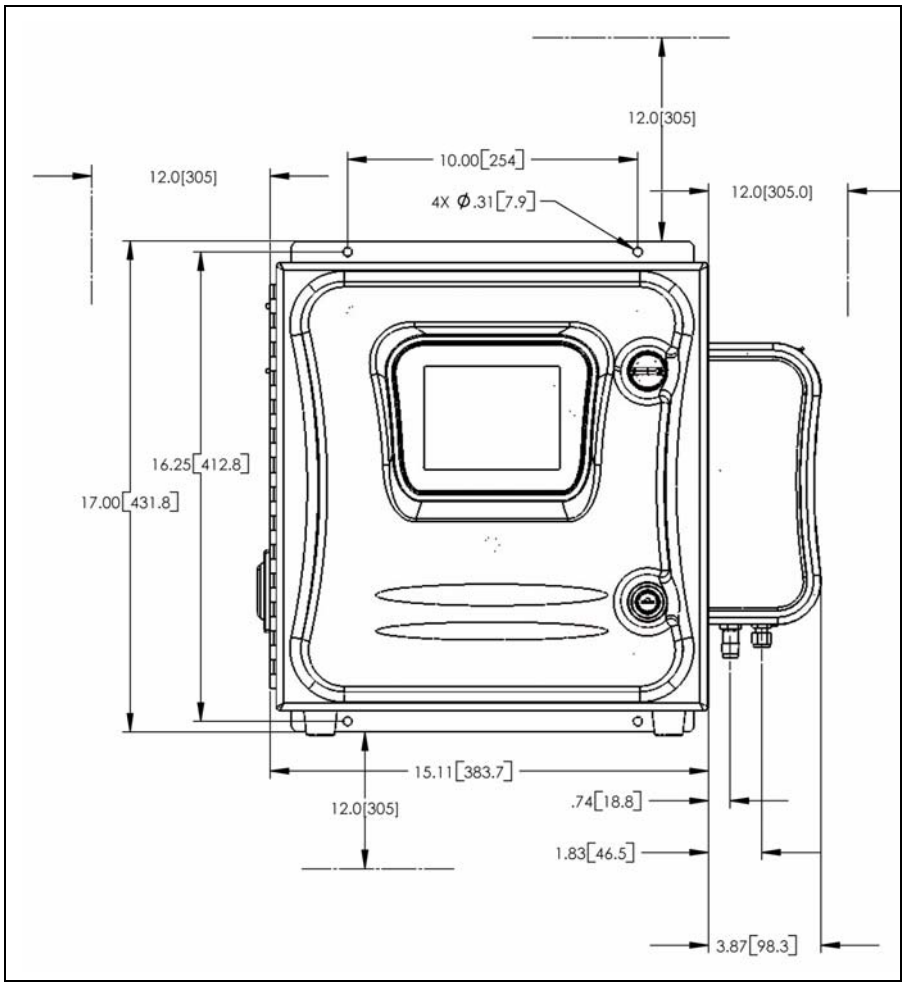

Figure 48: Analyzer Dimensions, with Super iOS System

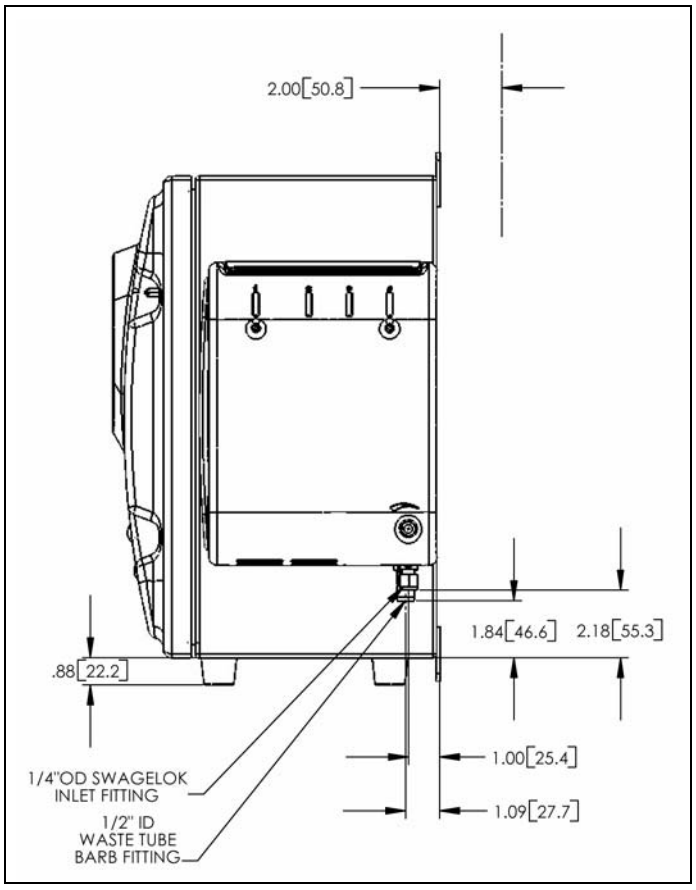

Figure 49: Right-Side Analyzer Dimensions, with Super iOS System

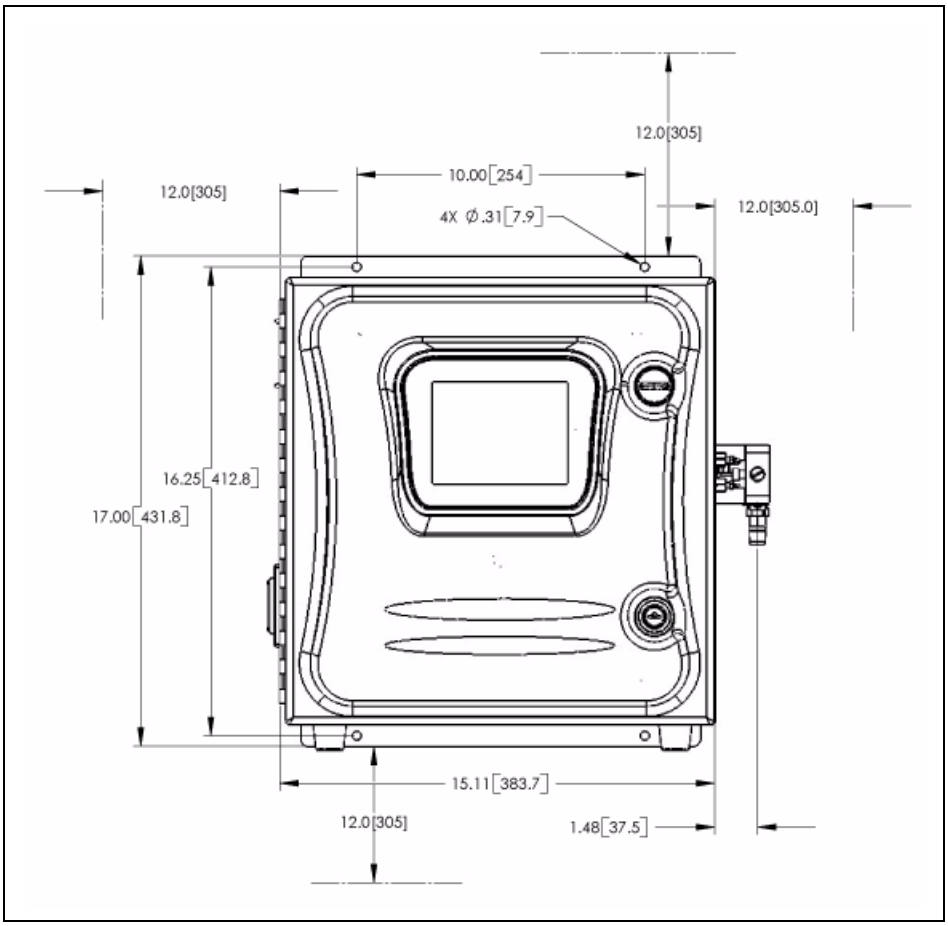

Figure 50: Analyzer Dimensions, with Sample Inlet Block

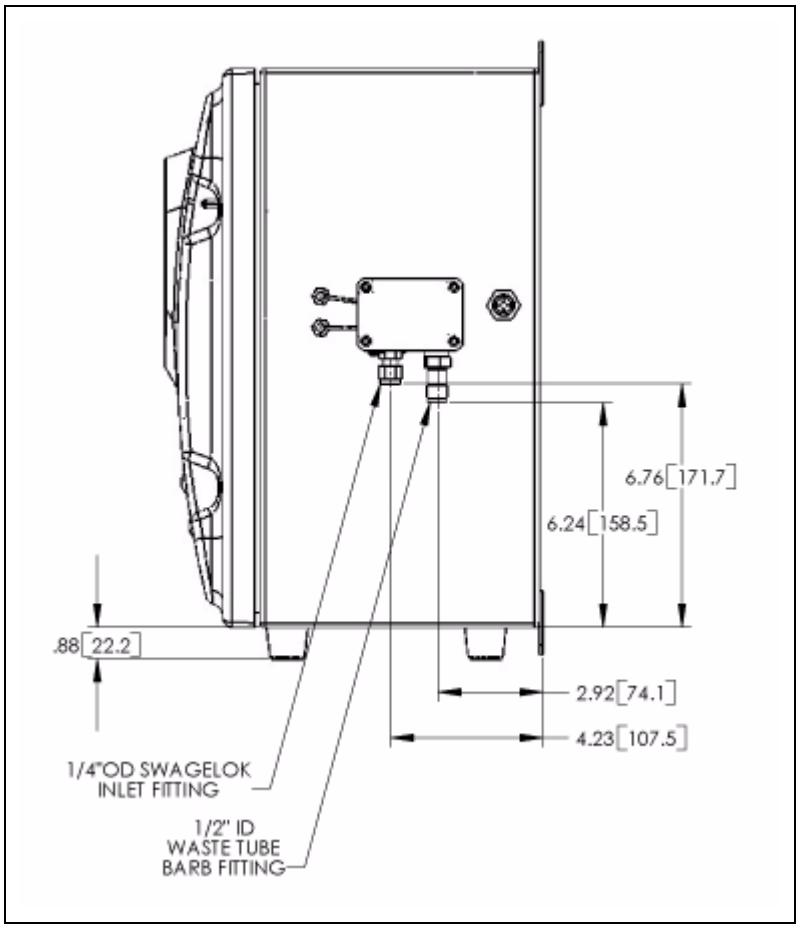

Figure 51: Right-Side Analyzer Dimensions, with Sample Inlet Block

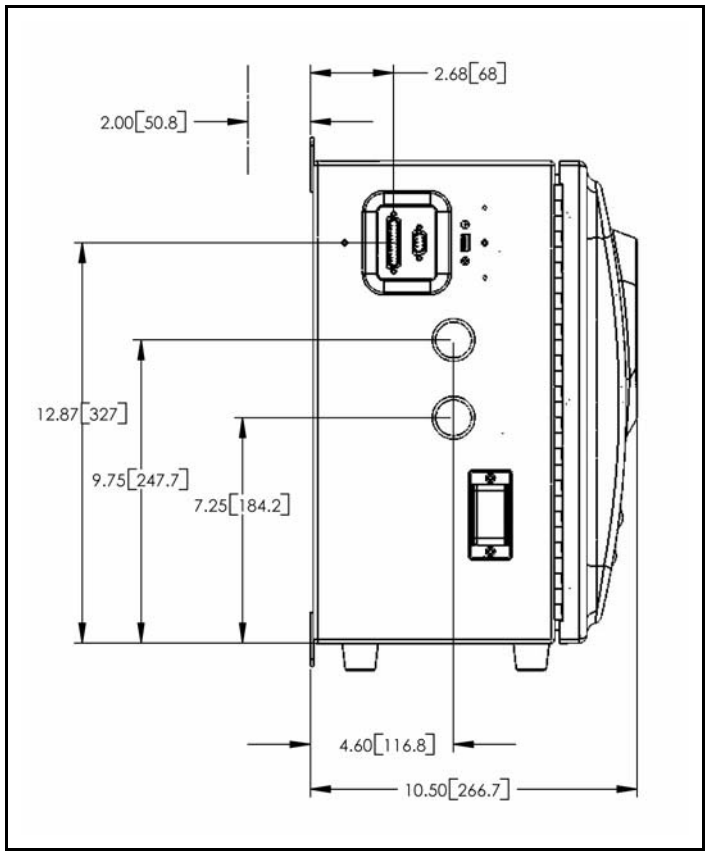

Figure 52: Left-Side Analyzer Dimensions

Appendix B: Connecting to a PC

Using HyperTerminal

Hyperterminal is a Microsoft communications program that can be used to communicate with serial devices, such as the Analyzer. To use Hyperterminal, you must first connect your Analyzer to the computer with a serial (RS-232) cable.

To use Hyperterminal with the Analyzer:

1. Make sure the serial cable is connected to the Analyzer and the computer, and make sure the Analyzer is powered on.
2. Launch HyperTerminal using one of these methods:
   - The location of HyperTerminal varies from computer to computer. Often it can be launched by exploring the Start menu path as follows:
     Start ¶ Programs ¶ Accessories ¶ Communications ¶ HyperTerminal.
   - Select **Start** → Run, type `Hypertrm` in the **Open** field, and click **OK**.
3. When HyperTerminal launches, the **Connection Description** window displays. Enter a name in the Name field, such as `Sievers 500 TOC Analyzer`, and click **OK**.
4. When the **Connect To** window displays, select **Communications Port** from the **Connect Using** drop-down menu. Click **OK**. If more than one communications port is in the list and you're not sure which one to select, see "Determining Your Communications Port Number" on page 198.
5. In the **Com Settings** window, specify the following settings:

   Bits Per Second:9600 (or rate that matches Analyzer setting)

   Data Bits:8

   ParityNone

   Stop Bits:1

   Flow Control:Hardware

   After selecting these values, click **OK**.

6. The main HyperTerminal window displays. Select **Transfer → Capture Text**. Specify a location and name for the file and click **OK**. Include a file extension of either `.txt` or `.csv`. For example, `JulyData.csv`.
7. On the Analyzer, export the data you want to capture. Be sure to select **Serial** as your export destination.
8. When the export begins, you will see the data streaming in the HyperTerminal window. When the export is complete (activity stops in the HyperTerminal window), select **Transfer → Capture Text → Stop**.
9. The data is now saved in the file location you specified in Step 6. When you open the file in a spreadsheet or database program, you will need to browse to this folder in the program's **Open** dialog box.
10. Exit out of HyperTerminal. You will be prompted to save the connection information. Saving the information makes it easier to connect to the Analyzer the next time you want to capture data.

Determining Your Communications Port Number

If your computer has more than one serial port, it is possible that more than one communication port is in use. To try to determine which communication port is being used to connect to the Analyzer, you can follow these steps:

1. Display the **System Properties** window (select **System** in the **Control Panel** window).
2. Select the **Hardware** tab.
3. Click the **Device Manager** button.
4. Scroll down to **Ports (Com and LPT)** and expand the menu by clicking the plus sign (+).
5. The communication ports in use should be listed, along with device names.

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