GE Power & Water
Water & Process Technologies

Sievers 900 Series
Total Organic Carbon Analyzers

Operation and Maintenance Manual

Firmware Version 2.13 or later

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DLM 90688-03 Rev. A

Identification Records

Default Administrator User ID: ADMIN

Default Administrator Password: GEAI

Analyzer Serial Number: _____
(This number appears on label located on the left side of the Analyzer.)

Date of Receipt and Installation of Analyzer: _____
(This is the warranty start date.)

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Revision History

New editions are complete revisions of the manual and incorporate the content of previous editions and updates.

Document Version	Firmware Version	Date
DLM 90688-01 Rev. A	Firmware v. 2.10	January 2010[1]
DLM 90688-02 Rev. A	Firmware v. 2.11	March 2010
DLM 90688-03 Rev. A	Firmware v. 2.13	January 2011

1. Prior to this date, separate operation and maintenance manuals were published for each instrument model (Online, Lab, and Portable). This revision includes the operation and maintenance information common to all 900 Series TOC Analyzers, and addresses the installation and operation information specific to the model, where applicable.

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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
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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 IOS System and vial ports contain sharp needles designed to pierce the septa of sample vials. Do not put fingers or inappropriate materials into the IOS System or vial port.

Warning
 In 900 Laboratory and Portable Analyzers, for continued protection against fire hazard, replace fuse with same type and rating.

Warning
 In 900 On-Line and Portable Analyzers, water in the IOS System may be hot. Before inserting a vial into the IOS System or vial port, 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 or vial port.

Warning
 In 900 On-Line Analyzers, 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

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, if possible, 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.

Warning

When servicing parts inside the Analyzer, keep hands clear of the reagent syringe assembly if the Analyzer is powered on. The syringes are controlled by moving parts that can pinch skin.

Warning

This is a Safety Class I product. It must be must be attached to a grounded power source.

Warning

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

Warning

Hazardous reagents (ammonium persulfate and phosphoric acid) are used in the Analyzer. The waste stream from the instrument is acidic and must be disposed of properly. Consult your federal, state, and local government regulations.

Warning

Always stop analysis before turning off or unplugging the Analyzer.

Warning
Make sure the DI water Reservoir 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
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
For performance within specifications on ozonated water systems, an Ozone Destruct Kit must be purchased from GE Analytical Instruments and installed according to instructions.

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

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	
	En los analizadores portátiles y de laboratorio 900, para disponer en todo momento de protección frente al peligro de incendio, sustituya los fusibles por otros del mismo tipo y

Advertencia

En los analizadores portátiles y en línea 900, 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

En los analizadores en línea 900, este símbolo indica el terminal de protección a tierra (masa) del analizador.

Advertencia

Este símbolo indica que para cumplir la Directiva 2002/96/CE de la Unión Europea sobre residuos de aparatos eléctricos y electrónicos (RAEE), el analizador debe desecharse por separado de los residuos normales.

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

Cuando esté realizando el mantenimiento de piezas situadas en el interior del analizador, no coloque nunca las manos en el ensamblado de jeringas de reactivos si el analizador está encendido. Las jeringas están controladas por piezas móviles que pueden atravesar la piel.

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

El analizador utiliza reactivos peligrosos (persulfato de amonio y ácido fosfórico). El flujo de residuos del instrumento es ácido y deberá desecharse adecuadamente. Consulte la normativa federal, del estado o del gobierno local.

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 trabajar dentro de las especificaciones en sistemas de agua ozonizada, se deberá adquirir un kit de destrucción de ozono a GE Analytical Instruments e instalarlo de acuerdo con las instrucciones.

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
 Pour une protection continue contre les risques d'incendie, remplacez les fusibles dans les analyseurs portables et de laboratoire 900 par des pièces de même type et de même voltage.

Avertissement
 Dans les analyseurs portables et en ligne 900, 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
 Sur les analyseurs en ligne 900, ce symbole spécifie la borne de protection (mise à la terre) de l'analyseur.

Avertissement
 Ce symbole indique que, pour être en conformité avec la directive européenne 2002/96/CE relative à l'élimination des appareils électriques et électroniques (Waste Electrical and Electronic Equipment, WEEE), l'analyseur doit être mis au rebut séparément des déchets courants.

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

Lors d'une intervention de maintenance à l'intérieur de l'analyseur, tenez vos mains hors du bloc de seringues de réactif chimique si l'analyseur est sous tension. Les seringues sont contrôlées par des éléments en mouvement qui peuvent pincer la peau.

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

Des réactifs chimiques dangereux (persulfate d'ammonium et acide phosphorique) sont utilisés dans l'analyseur. Le flux résiduel de l'instrument est un acide qui doit être éliminé de manière appropriée. Pour ce faire, reportez-vous aux réglementations locales en vigueur.

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
Pour des performances optimales avec les spécifications des systèmes d'eau ozonée, un kit de destruction d'ozone (Ozone Destruct Kit) doit être obtenu auprès d'GE Analytical Instruments et installé conformément aux instructions données.

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
 Ersetzen Sie zum Schutz gegen Brandgefahr in den Analysegeräten 900 Laboratory Analyzer und 900 Portable Analyzer die Sicherung durch eine Sicherung der gleichen Art und Stärke.

Warnung
 In den Geräten 900 On-Line Analyzer und 900 Portable 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 900 On-Line Analyzers gibt dieses Symbol schützenden Erdungskontakt (Boden) für das Analysegerät an.

Warnung

Dieses Symbol weist darauf hin, dass der Analysator in Übereinstimmung mit der Richtlinie 2002/96/EG der Europäischen Union über Elektro- und Elektronik-Altgeräte getrennt vom Normalmüll entsorgt werden sollte.

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

Achten Sie beim Warten von Teilen im Analysegerät darauf, dass Ihre Hände nicht mit der Reagenzienspritze in Berührung kommen, wenn der Analyser eingeschaltet ist. Die Spritzen werden von beweglichen Teilen gesteuert, die die Haut verletzen können.

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

Im Analysegerät werden gefährliche Reagenzien (Ammoniumsulfat und Phosphorsäure) verwendet. Der Abfallstrahl des Instruments ist säurehaltig und muss entsprechend entsorgt werden. Beachten Sie die staatlichen oder regionalen Vorschriften.

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

Für die Funktion gemäß Spezifikationen für sauerstoffangereicherte Wassersysteme muss ein Ozone Destruct Kit für GE Analytical Instruments erworben werden und gemäß den Anweisungen installiert werden.

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
 Per essere sempre protetti dal pericolo di incendi, negli analizzatori portatili e da laboratorio della serie 900 sostituire il fusibile con uno dello stesso tipo e portata.

Avvertenza
 Negli analizzatori online e portatili della serie 900, l'acqua nel sistema IOS può essere calda. Prima di inserire una vial nel sistema IOS, aprire lo sportello e attendere 30 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
 Negli analizzatori online della serie 900 questo simbolo indica la messa a terra di protezione per l'analizzatore.

Avvertenza
 Questo simbolo indica che l'analizzatore deve essere smaltito separatamente dagli altri rifiuti normali, in osservanza con la Direttiva dell'Unione Europea 2002/96/EC per i rifiuti di apparecchiature elettriche ed elettroniche (WEEE).

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

Durante l'attività di manutenzione di componenti all'interno dell'analizzatore, fare in modo che le mani non tocchino il gruppo di siringhe con reagenti se l'analizzatore è acceso. Le siringhe sono controllate da componenti mobili che possono pungere la pelle.

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

Nell'analizzatore vengono utilizzati reagenti pericolosi (persolfato di ammonio e acido fosforico). Lo scarico dallo strumento è acido e deve essere smaltito correttamente. Per ulteriori informazioni, vedere le normative di governo locali e nazionali in vigore.

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 un rendimento in linea con le specifiche su sistemi ad acqua ozonata, acquistare un Ozone Destruct Kit presso GE Analytical Instruments e installarlo nel modo indicato.

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

900 ラボ分析装置およびポータブル分析装置では、火災の危険を引き続き避けるために、同じ型式で定格のフューズと交換してください。

警告

900 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

900 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

このマークのある分析装置は、欧州連合指令 2002/96/EC の廃電気電子機器リサイクル規制（WEEE）に準拠するために、一般廃棄物とは別個に廃棄する必要があります。

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

分析装置の内部にある部品を修理する際、分析装置の電源が入っている場合は、試薬シリンジアセンブリに手を触れないでください。シリンジは、指を挟む危険のある機械的可動部品によって制御されています。

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

分析装置には危険な試薬（過硫酸アンモニウムやリン酸）が使用されています。装置からの排水流は酸性なので、適切に破棄する必要があります。連邦、州、および地方自治体の規制を確認してください。

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

オゾン水システムを使用した場合、仕様に記載されている性能を得るには、オゾン分解キットを GE Analytical Instruments 社から購入し、指示に従って取り付ける必要があります。

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

为预防火灾，在 900 实验室及便携式分析仪中请使用相同类型和规格的保险丝进行更换。

警告

在 900 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 900 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

这个符号表示根据欧盟废电机电子设备 (WEEE) 指令 2002/96/EC，分析仪应以不同于普通废品的方式处理。

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

在分析仪电源打开的情况下，维修分析仪中的部件时，请不要将手靠近试剂洗涤器部件。洗涤器由移动部件控制，可能导致皮肤夹伤。

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

ﾈ郢走ｾﾒﾇﾆ? ｴｰｴｭｭ GE Analytical Instruments USA ｵﾄｹ多ｨﾊｹﾃ」ｬﾒﾇﾆ? 盪ｳｵﾄｱ」ｻ､ｴ?ｳｿﾉﾄﾜｻ睫ｱﾐｱ。」

警告

本分析仪使用危险试剂 （过硫酸铵和磷酸）。仪器排出的废液呈酸性，必须妥善处理。请遵循国家、州／省或地方政府的相关规定。

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

为使臭氧水系统达到规定的性能，必须从 GE Analytical Instruments 购买臭氧解离装置并根据说明安装。

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™ 900 Series Total Organic Carbon Analyzers from GE Analytical Instruments include high-sensitivity Analyzers 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 "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 and a chemical oxidizing agent (ammonium persulfate). 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).

$$(TOC = TC - IC)$$

The Analyzer can be used to monitor water samples ranging from high-purity water containing <0.3 parts per billion (ppb) TOC to water samples containing up to 50 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. Recalibration and validation can be easily performed at the customer's site.

Chapter 2. System Description

System Specifications[2]

System specifications for each model of the Sievers 900 Series TOC Analyzer are provided on the following pages.

[2]Stated analytical performance is achievable under controlled laboratory conditions that minimize operator and standards errors.

Sievers On-line TOC Analyzer

Linear range	0.03 ppb – 50 ppm TOC
Precision	<1% of RSD
Accuracy	±2% or ±0.5 ppb, whichever is greater
Analysis Time	4 minutes
Sample Flow Rate (nominal)	Analysis mode: 0.5 mL/min Fast Flush (between samples): 1.0 mL/min Turbo mode (optional): 1.1 mL/min
Required Sample Line Flow Rate:	50 mL - 300 mL/min (for On-Line Mode)
Power requirements	100-240 ±10% VAC, 100 watts, 50/60 Hz
Fuses	No user-replaceable fuses; built-in circuit breaker
Sample Temperature	1 °C to 95 °C via iOS[3] (withstands short-term steam exposure)
Ambient Temperature	10 °C to 40 °C
Sample Pressure (in IOS System)	Up to 250 psig
Normal Operating Environment	Intended for indoor use only
Maximum Relative Humidity	Up to 95%, noncondensing
Maximum Altitude	3,000 m (9,843 ft)
Calibration Stability	Typically stable for 12 months
Chemical Reagents (prepackaged)	300 mL acid; 300 mL or 150 mL oxidizer
Outputs	Serial (RS-232), USB, parallel printer port, 4–20 mA, two alarms, binary output, Ethernet port
Installation/Overvoltage Category	II
Safety Certifications	CE, ETL listed. Conforms to UL Std. 61010-1 Certified to CSA C22.2 No. 61010-1.
Pollution Degree	2
Display	Color, touch-sensitive LCD
Size	62.4 cm height x 45.2 cm width x 26.4 cm depth (24.6 in x 17.8 in x 10.4 in)
Weight	16.9 kg (37.2 lbs)
IP Rating	IP 45

[3]If the sample temperature and pressure are above 60° C and 100 psi, the Sievers 900 On-Line Analyzer model with the stainless steel iOS is required.

Sievers Laboratory TOC Analyzer

Linear range	0.03 ppb – 50 ppm TOC
Precision	<1% of RSD
Accuracy	±2% or ±0.5 ppb, whichever is greater
Analysis Time	4 minutes
Sample Flow Rate (nominal)	Analysis mode: 0.5 mL/min Fast Flush (between samples): 1.0 mL/min
Power requirements	100-240 ±10% VAC, 100 watts, 50/60 Hz
Fuses	T1.6 A, 250 VAC (SloBlo), size 5 x 20 mm(appliance inlet)
Ambient Temperature	10 °C to 40 °C
Normal Operating Environment	Intended for indoor use only
Maximum Relative Humidity	Up to 95%, non-condensing
Maximum Altitude	3,000 m (9,843 ft)
Calibration Stability	Typically stable for 12 months
Chemical Reagents (prepackaged)	300 mL acid; 300 mL or 150 mL oxidizer
Outputs	Serial (RS-232), USB, parallel printer port, Ethernet port
Installation/Overvoltage Category	II
Safety Certifications	CE, ETL listed. Conforms to UL Std. 61010-1 Certified to CSA C22.2 No. 61010-1.
Pollution Degree	2
Display	Color, touch-sensitive LCD
Size	48.3 cm height x 19.2 cm width x 48.0 cm depth (19.0 in x 7.6 in x 18.9 in)
Weight	14.3 kg (31.5 lbs)

Sievers Portable TOC Analyzer

Linear range	0.03 ppb – 50 ppm TOC
Precision	<1% of RSD
Accuracy	±2% or ±0.5 ppb, whichever is greater
Analysis Time	4 minutes
Sample Flow Rate (nominal)	Analysis mode: 0.5 mL/min Fast Flush (between samples): 1.0 mL/min Turbo mode (optional): 1.1 mL/min
Required Sample Line Flow Rate:	50 mL - 300 mL/min (for On-Line Mode)
Power requirements	100-240 ±10% VAC, 100 watts, 50/60 Hz
Sample Temperature	1 °C to 95 °C via iOS[4] (withstands short-term steam exposure)
Ambient Temperature	10 °C to 40 °C
Normal Operating Environment	Intended for indoor use only
Maximum Relative Humidity	Up to 95%, non-condensing
Maximum Altitude	3,000 m (9,843 ft)
Calibration Stability	Typically stable for 12 months
Chemical Reagents (prepackaged)	300 mL acid; 300 mL or 150 mL oxidizer
Outputs	Serial (RS-232), USB, parallel printer port, 4–20 mA, Ethernet port
Installation/Overvoltage Category	II
Safety Certifications	CE, ETL listed. Conforms to UL Std. 61010-1 Certified to CSA C22.2 No. 61010-1.
Pollution Degree	2
Display	Color, touch-sensitive LCD
Size	35.6 cm height x 22.3 cm width x 46.5 cm depth (14.0 in x 8.8 in x 18.3 in)
Weight	12.5 kg (27.5 lbs)

[4]If the sample temperature and pressure are above 60° C and 100 psi, the Sievers 900 Portable TOC Analyzer with the stainless steel iOS is required.

System Overview

The Sievers 900 Series TOC Analyzers consist of six major subsystems:

1. Sample inlet system and sample pump, including the Integrated On-Line Sampling (IOS) System for the *900 On-Line and Portable TOC Analyzers* and the vial port for the *900 Laboratory TOC Analyzer*
2. Chemical reagent subsystem, including reagent reservoirs and syringe pumps
3. Oxidation reactor
4. Measurement module, comprising:
    - CO_2 transfer modules
    - Conductivity cells
5. DI water loop, comprising:
    - DI water reservoir
    - Ion exchange resin (resin bed)
    - DI water pump
6. Electronics subsystems, comprising:
    - Microprocessors and circuit boards
    - Data outputs

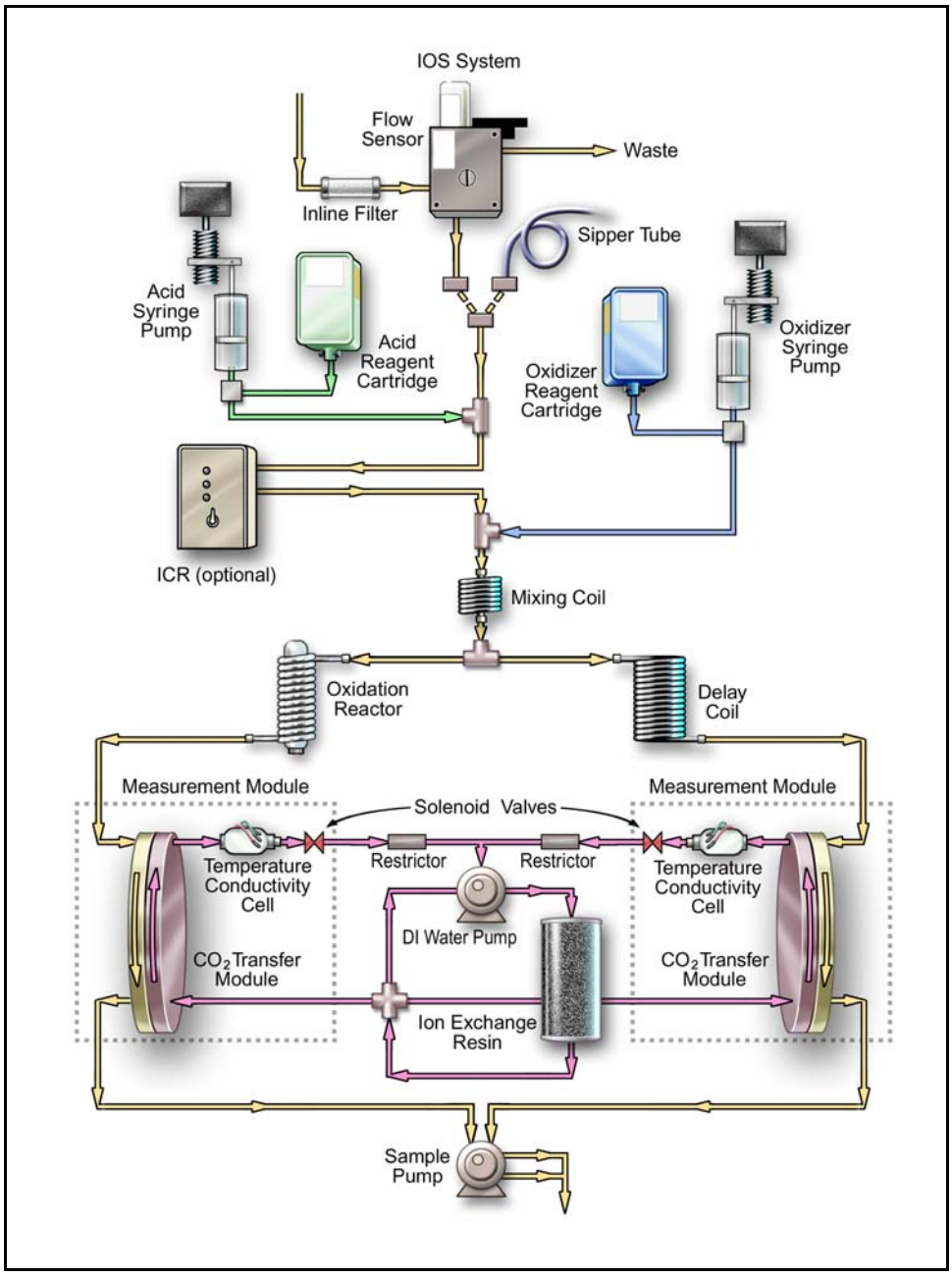


Figure 1: Analyzer Schematic — On-Line and Portable Models (Online mode)

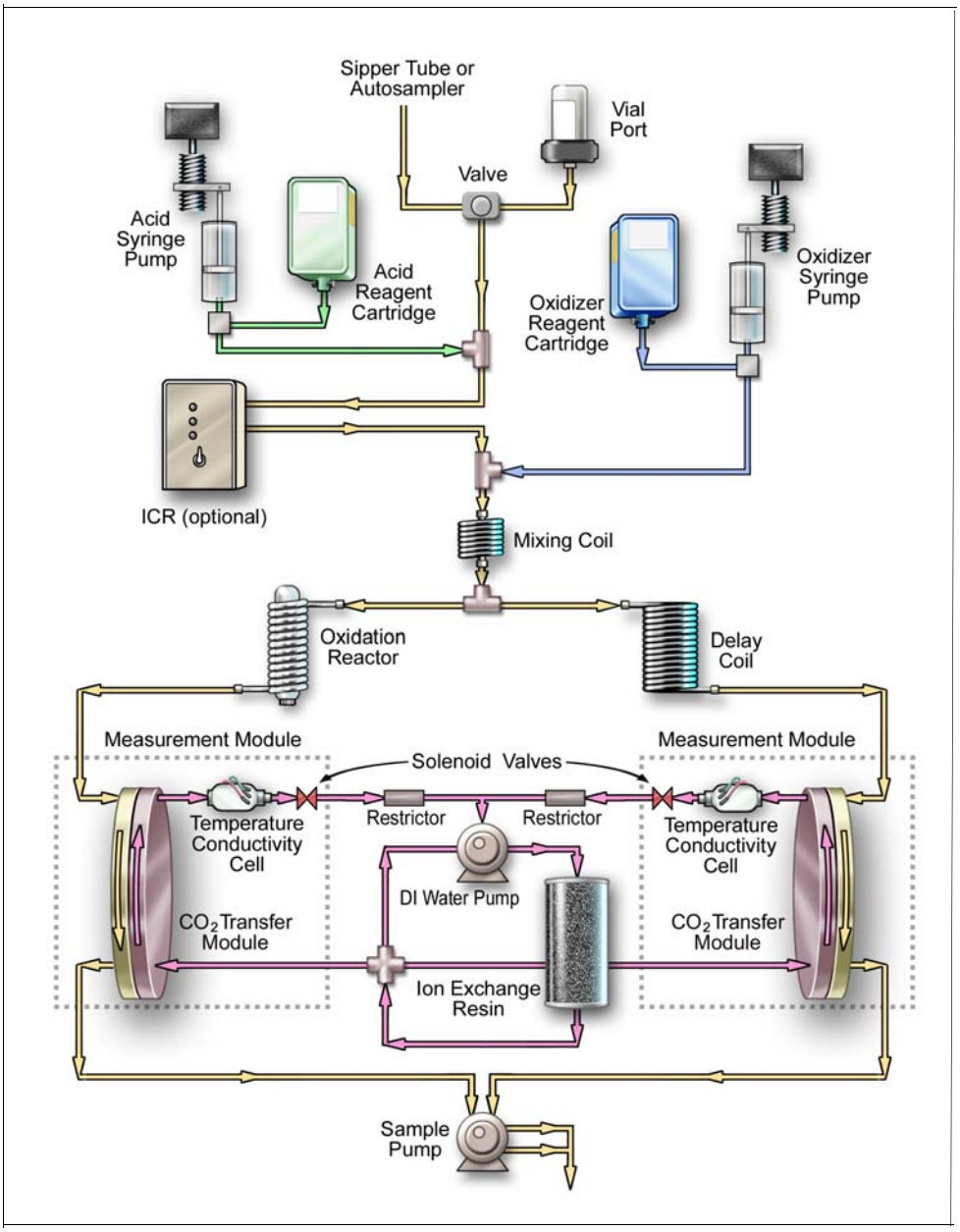


Figure 2: Analyzer Schematic — Laboratory Model with GE Autosampler

A brief description of each major Analyzer component follows.

Sample Flow Path

The Sievers 900 Series TOC Analyzers can measure discrete samples. This feature is specific to the model as follows:

- The *Sievers 900 On-Line TOC Analyzer* measures discrete samples 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 vial port.
- The *Sievers 900 Laboratory TOC Analyzer* measures discrete samples by inserting a filled 40-mL sample vial into the vial port on the front of the Analyzer, or via a sipper tube. The optional GE Autosampler can be used to introduce samples from up to 120 vials in vial racks through the sample inlet port on the left side of the Analyzer.
- The Sievers 900 Portable TOC Analyzer measures discrete samples by inserting a filled 40 mL sample vial into the IOS System or vial port, or via a sipper tube by bypassing the IOS System. The optional GE Autosampler can be used to introduce samples from up to 120 vials in vial racks through the sample inlet port on the back of the Analyzer. Continuous monitoring is accomplished by plumbing a sample line to the inlet of the IOS system.

After sample is introduced into the Analyzer, 6M phosphoric acid (H_3PO_4) (referred to as **Acid** in the user interface) is injected into the sample at the programmed flow rate to reduce sample pH to 2; this allows for accurate measurement of TOC and IC.

If the optional Inorganic Carbon Remover (ICR) unit is utilized, additional acid may need to be added to the sample to remove excess IC by the ICR. In the ICR, IC is removed by vacuum degasification.

The acidified sample is then combined with 15% ammonium persulfate ($(NH_4)_2S_2O_8$) (referred to as **Oxidizer** in the user interface) to promote oxidation of the organics. The sample travels through a mixing coil and on to a stream splitter.

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. The combination of UV light and, depending on the application, persulfate oxidizes the organic compounds in the sample, converting carbon 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 agents in the form of hydroxyl radicals produced by the photolysis of water (eq. 1) and persulfate (eq. 2, 3):

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

$$S_2O_8^{-2} + h\nu\ (254\ nm) \rightarrow 2\ SO_4\cdot^- \qquad (2)$$

$$SO_4\cdot^- + H_2O \rightarrow HSO_4^- + OH\cdot \qquad (3)$$

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

$$\text{Organic Compounds} + OH\cdot \rightarrow CO_2 + H_2O \qquad (4)$$

When the TOC concentration in the sample is low (<1 ppm), complete oxidation can usually be achieved using only the hydroxyl radicals from the photolysis of water (eq. 1) without the addition of persulfate.

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 its respective CO_2 Transfer Module. The CO_2 Transfer Module 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:

$$CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H^+ + HCO_3^- \qquad (5)$$

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 other ions. 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:

$$TOC = TC - IC \qquad (6)$$

Additional System Components

Microprocessor Controller and Electronics

All operations of the Analyzer are controlled by a 32-bit microprocessor. Six proprietary electronic board assemblies monitor and control Analyzer functions:

- **Main 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, interface to USB storage devices, and Ethernet[5]
- **Analog-to-digital conversion board** with integrated signal conditioning circuits for two conductivity and four temperature measurements
- **Color LCD QVGA display** with touch panel
- **Passive interconnect board**
- **ID board** with nonvolatile memory for system specific coefficients

Model Specific:

- *900 On-Line TOC Analyzer* — I/O board with interfaces to external devices via binary output, Ethernet[5], two alarms, and 4-20 mA output
- *900 Portable TOC Analyzer* — I/O board with **interfaces to external devices via Ethernet and 4-20 mA output.**

Data Outputs

Each Analyzer has serial (RS-232), USB, printer ports, and an Ethernet port allowing flexibility for exporting encrypted data 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 212). 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 900 On-line and Portable TOC Analyzers* also have analog outputs (4-20 mA) which can be customized to track specific data values. The *Sievers 900 On-Line TOC Analyzer* has binary output for use with a sample sequencer, binary input to facilitate remote start/stop functions, and alarm capability.

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.

[5]Available with firmware 2.10 and later only.

Major Accessories and Configurations

Inorganic Carbon Remover (ICR) Unit

For water samples containing high levels of inorganic carbon (IC) compared to the TOC levels (such as some municipal water systems, groundwater supplies, and RO permeates), improved accuracy in TOC measurements can be achieved by removing most of the IC prior to TOC measurement. The Sievers 900 ICR consists of a teflon degassing module, a vacuum pump, and a carbon and soda lime trap. In operation, the water sample is introduced into the Analyzer and acid is added to the sample as usual. The stream is then directed through the teflon degasser. Carbon dioxide produced from the reaction of bicarbonate and carbonate with acid is removed from the sample stream by the vacuum. The sample is returned to the Analyzer and is directed by the stream splitter for measurement of IC and TC. Approximately 98% of the IC is removed at concentrations up to 25 ppm. The activated carbon/soda lime trap prevents contamination of the sample stream from organic compounds and CO_2 in the atmosphere.

Typically, if the TOC is 10% or less of the IC concentration, the ICR will be required. For example, if the IC is 1 ppm, then use the ICR if the TOC is 100 ppb or less for accurate TOC measurements. The Analyzer will calculate the TOC/IC ratio for each measurement; if this ratio is less than 0.1, a warning message will be issued and written to the Warnings/Errors list. For further information concerning the ICR, refer to the *Sievers 900 Inorganic Carbon Remover (ICR) Operations and Maintenance manual*.

GE Autosampler System

(Sievers 900 Laboratory and Portable TOC Analyzers Only)

The optional GE Autosampler System consists of:

- GE Autosampler
- Sievers DataPro 900 Software, running on a computer with a Windows® Operating System
- Sievers 900 Laboratory or Portable TOC Analyzer
- Printer (optional)

DataPro 900 software controls both the Analyzer and the GE Autosampler. Vials are screw-capped and have a Teflon-lined septa. A stainless steel needle is used to transfer samples from the sample vials into the Analyzer. Results are displayed and stored on the computer via the DataPro 900 software.

Chapter 3. Installation

Overview

This chapter provides installation instructions for Sievers 900 Series TOC Analyzers, and will help familiarize you with Analyzer design and function for the On-Line, Laboratory, and Portable models. An interior overview diagram of each Analyzer model is available in the "Maintenance" chapter on page 160. If you need additional assistance, contact GE Analytical Instruments Technical Support at 303.444-2009 or 888.245.2595. Installation and training by a qualified service technician can also be provided. Technical Support in the United Kingdom is available at 44 (0) 161 864 6800. In other countries, visit www.geinstruments.co to locate your representative.

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: Hazardous reagents (ammonium persulfate and phosphoric acid) are used in the Analyzer. Before installing the reagents, please read the Material Safety Data Sheets (MSDS) contained in a pouch on the top of the reagent shipping box for proper handling precautions and spill or leak procedures.

The following instructions apply to *all* Sievers 900 TOC Analyzer instrument models, except where noted.

Step 1: Unpack and Inspect the Analyzer

Before you begin

Download the *Operation and Maintenance Manual* from www.geinstruments.com (The optional print version, if purchased, is shipped separately from the instrument.) You can also download the *Validation Support Package* (VSP) Volume 1 from www.geinstruments.com, as needed.

Open the shipping boxes and verify that they contain the following:

1. *Analyzer Quick Start Guide*
2. Sievers 900 Series TOC Analyzer
3. Accessory package:

   (Sievers 900 Laboratory TOC Analyzer)

   - 1/16"-OD Teflon tubing with 1/4" Valco nut and ferrule (for container sampling, also referred to as a "sipper tube")
   - Replacement pump tubing assembly
   - 1/8" OD tubing with 1/8" SwageLok fitting for waste line, approximately 50" long
   - 1/8" OD tubing with 1/8" SwageLok fitting for waste line, approximately 12" long
   - 3/32" Allen wrench, approximately 12" long
   - 1/4" open-end wrench
   - Water bottle (250 mL) with nozzle for filling DI water reservoir
   - USB flash memory drive
   - pH paper
   - 10-mL graduated cylinder
4. Reagent package containing:
   - Acid reagent cartridge
   - Oxidizer reagent cartridge

Note: Do not start the Analyzer until the reagents have been installed and the DI water reservoir has been filled with DI water.

   - Analyzer power cord
   - Certificate of Calibration

(Sievers 900 Portable and On-Line TOC Analyzer)

- 1/4" sample inlet tubing with in-line filter (for sampling through IOS System or vial port)
- 25/32" clamp for 1/4" sample inlet tubing
- 1/16"-OD Teflon tubing with 1/4" Valco nut and ferrule (for container sampling, also referred to as a "sipper tube")
- Replacement pump tubing assembly
- 3/4" OD tubing for waste line (for on-line configuration)
- 1/8" OD tubing with 5/16" SwageLok fitting for waste line (for grab configuration)
- 3/32" Allen wrench
- 1/4" open-end wrench
- 9/16" open-end wrench
- Water bottle (250 mL) with nozzle for filling DI water reservoir
- USB flash memory drive
- pH paper
- Stainless steel metric tubing converter (1/4-in-to-6-mm tube)
- Two PVC conduit connectors ("strain relief" hubs) for conduit wiring (for 900 On-Line Analyzer only)
- Sealing washers for PVC conduit connectors (for 900 On-Line Analyzer only)
- Terminal ring for AC conduit ground wire, 16-14 AWG (for 900 On-Line Analyzer only)
- 1/8" OD tubing with 1/8" Swagelok fitting for waste line, approximately 12" long
- 10-mL graduated cylinder
- Rubber plug for IOS waste line

5. Reagent package containing:
   - Acid reagent cartridge
   - Oxidizer reagent cartridge

Note: Do not start the Analyzer until the reagents have been installed and the DI water reservoir has been filled with DI water.

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

Additional Installation Equipment

To install the Sievers 900 Series TOC Analyzers, the following equipment is also required:

- Grounding strap for ESD protection
- Ethernet cable (optional)

Additionally, equipment needed for the specific model follows:

Sievers 900 On-Line TOC Analyzer:

- Mounting hardware to support the Analyzer (see "Step 3: Select a Location for the Analyzer" on page 57)
- Insulated wire (22-12 American Wire Gauge, rated to 300 Volts) for analog and alarm outputs (optional; see "Installing the Analog Outputs and Alarms" on page 63)
- Insulated wire (18-12 American Wire Gauge, rated to 300 Volts) for AC power conduit (see "Connecting to a Power Supply" on page 72)
- An external circuit breaker or switch that disconnects both poles of the supply voltage, rated appropriately (optional)
- Analog (4-20 mA) recorder (optional)

Sievers 900 Portable TOC Analyzer:

- Analog (4-20 mA) recorder (optional)

Step 2: Complete the Identification Records

Complete the Identification Records section on "Identification Records" on page 2 by recording the date of installation and the Analyzer serial number (found on the left side of the Analyzer).

Step 3: Select a Location for the Analyzer

When selecting a location your Analyzer, refer to information in this section pertaining to your specific model of Analyzer.

Additionally, avoid direct sunlight and extreme temperatures. And, avoid operating at elevated temperatures (greater than 40 °C) prevents proper operation, and operating at low temperatures (10 °C) can cause errors in the measurements.

Sievers On-Line TOC Analyzer

The Sievers 900 On-Line TOC Analyzer is designed to be mounted on a wall or support stand. For an illustration of required clearances, see Figures 3, 4, and 5. 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.

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 64.20 kg (141.50 lbs).

The 900 On-Line Analyzer withstands the hazards of industrial process environments, and the Analyzer enclosure is rated IP 45.

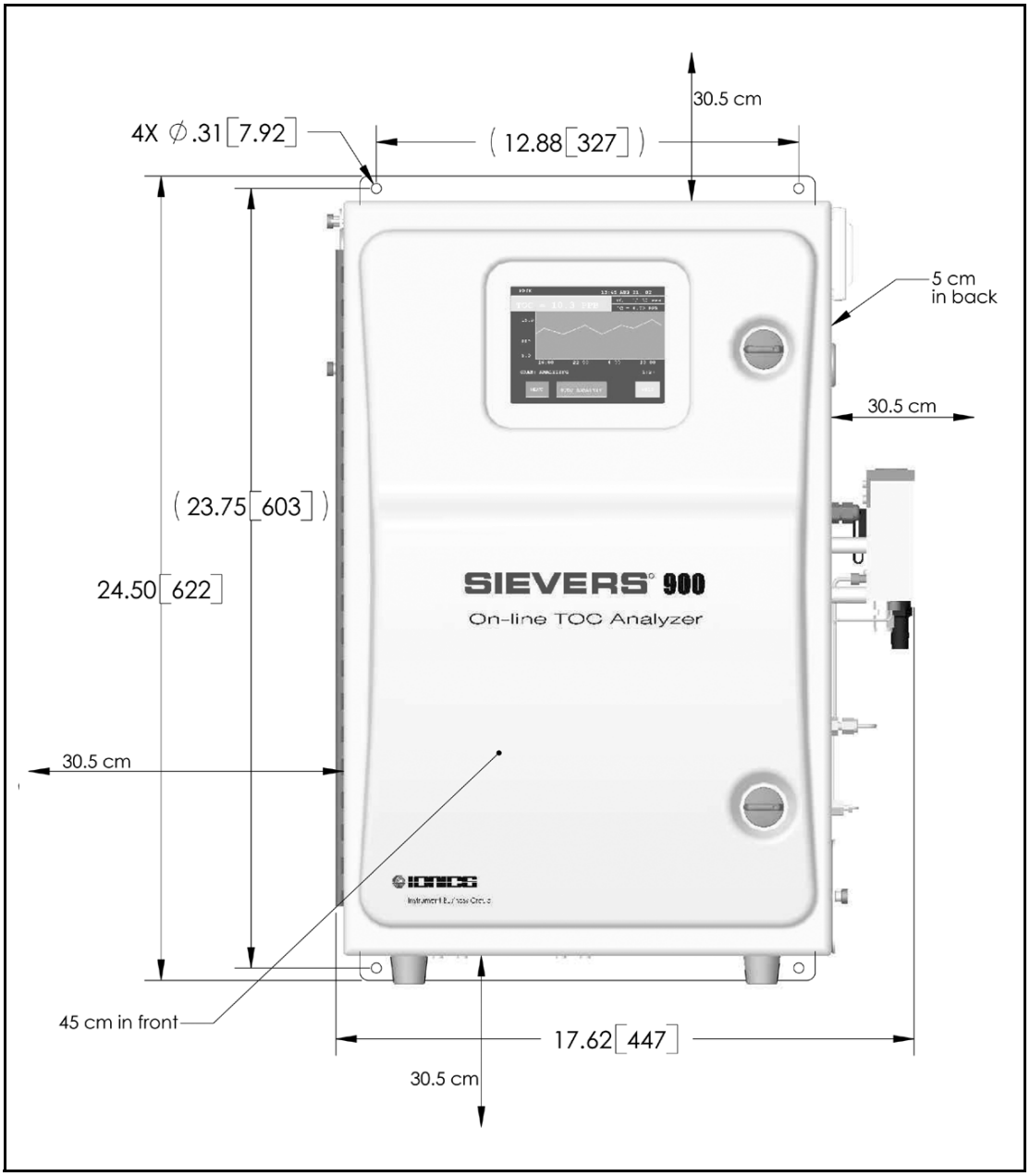


Figure 3: Required Installation Clearances — Sievers 900 On-Line TOC Analyzer

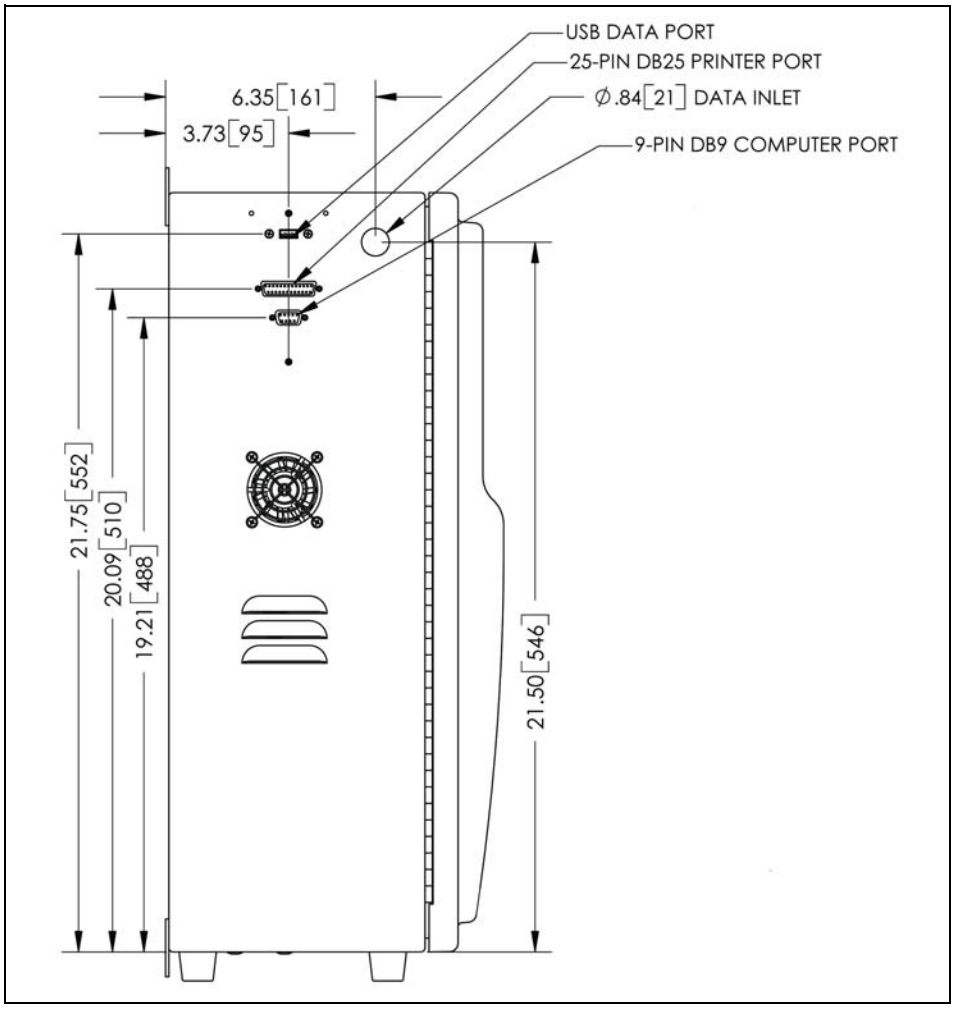


Figure 4: Left Side Dimensions — Sievers 900 On-Line TOC Analyzer

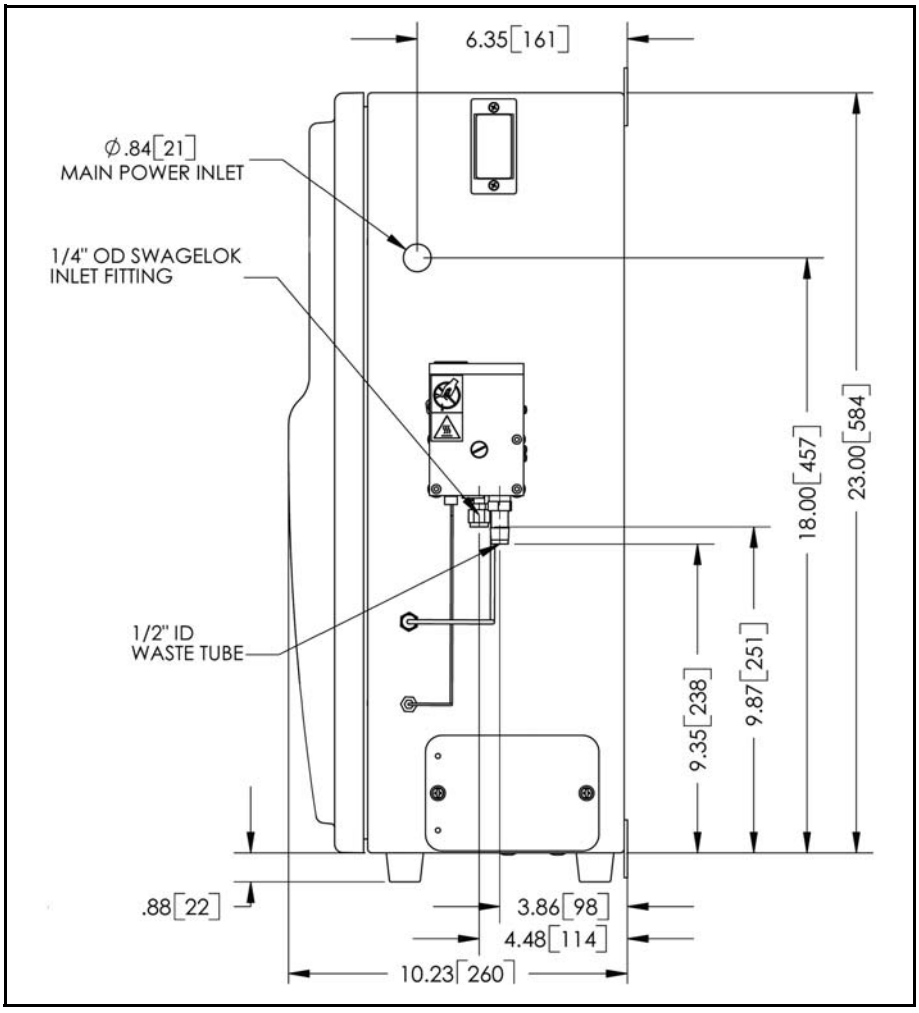


Figure 5: Right Side Dimensions — Sievers 900 On-Line TOC Analyzer

Sievers Laboratory and Portable TOC Analyzers

Place the Analyzer on a clean, unobstructed surface that can accommodate the Analyzer's dimensions and weight. For details, refer to the specifications listed for your specific Analyzer model in Chapter 2, "System Description." For proper heat dissipation, ensure that 16 cm is available at the rear and on both sides of the Analyzer. For Online mode sampling in the Sievers 900 Portable TOC Analyzer, you should place the Analyzer within 3 m of the port or beaker to be tested. If you will be using the Analyzer with an GE Autosampler system, be certain there is adequate space to the left of the Analyzer for the GE Autosampler. Consult the *DataPro 900 + DataGuard Software with GE Autosampler Operation and Maintenance Manual* for details.

Step 4: Install the Reagent Cartridges

The oxidizer and acid reagents are shipped from GE Analytical Instruments in specific packaging for safety in transit. Carefully read the attached MSDS sheets prior to opening the packaging. Within the packaging are two reagent cartridges. Each reagent cartridge is identified with labels that indicate which cartridge contains ammonium persulfate and which cartridge contains phosphoric acid.

Warning

Installation of the reagents requires access to the inside of the Analyzer. To avoid potentially dangerous shock, disconnect the power cord before opening the side panels of the Analyzer.

Warning

To avoid exposure to the chemical reagents, wear acid-resistant gloves, protective clothing, and safety goggles or a face shield when changing the reagent supplies.

Warning

Reagent containers are for single-use only — **do not refill**. Refilling or reusing reagent containers will void all Analyzer and parts warranties and nullify any performance claims.

1. Open the Analyzer, as follows:
   - *Sievers 900 On-Line TOC Analyzer* — Open the front panel by turning the two latches and swinging the panel door to the left.
   - *Sievers 900 Laboratory TOC Analyzer* — Open the side panel by loosening the two preset thumb screws on the back, and then pulling the panel away from the Analyzer.
   - *Sievers 900 Portable TOC Analyzer* — Open the side panels by unscrewing the two Phillips screws set into either side of the handle, and then pulling away from the Analyzer.
2. Locate the reagent enclosure, located at the top left-hand side of the Analyzer as you face the Analyzer, loosen the set screw, and then:
   - *Sievers 900 On-Line TOC Analyzer* — Remove the reagent enclosure cover.
   - *Sievers 900 Laboratory and Portable TOC Analyzers* — Lift the restraining bar.

3. Remove the reagent containers from the packaging. Record the expiration date of the acid and oxidizer, and the volume of the oxidizer in the Notes column, on the **Maintenance Worksheet** (see Table 18 on page 179). You will need to enter these dates into the Analyzer in Step 8.
4. Locate the acid supply line, indicated by the **Acid** label. Attach the PEEK nut to the acid reagent container and tighten finger-tight.
5. Slide the valve on the acid container to the open position by pushing the green button all the way in. Refer to the labeling on the container for proper positioning.
6. Slide the acid container into the reagent enclosure, with the valve pointing down and toward the front of the reagent enclosure.
7. Locate the oxidizer supply line, indicated by the **Oxidizer** label. Attach the PEEK nut to the oxidizer container and tighten finger-tight.
8. Slide the valve on the oxidizer container to the open position by pushing the green button all the way in. Refer to the labeling on the container for proper positioning.
9. Slide the oxidizer container into the reagent enclosure, with the valve pointing down and toward the front of the reagent enclosure.
10. Do one of the following:
    - *Sievers 900 On-Line TOC Analyzer* — Replace the reagent enclosure cover.
    - *Sievers 900 and Laboratory and Portable TOC Analyzers* —Lower the reagent restraining bar to the left to ensure that the reagent containers are secure.
11. Close the door or replace the Analyzer panel(s) and secure the latch or replace and tighten the screws, depending upon the model of the Analyzer.

Step 5: Fill the DI Water Reservoir

Fill the DI water reservoir with DI water, using the squeeze bottle provided in the accessories kit. Refer to Figure 6: Filling the DI Water Reservoir, as needed.

1. Fill the water bottle with DI water.
2. Remove the rubber inlet cover on the DI water reservoir.
3. Slide the bottle nozzle into the inlet hole, and gently squeeze the bottle. Be sure to fill the reservoir until the water reaches the fill line, just below the inlet.
4. Replace the rubber inlet cover. Visually check for leaks from the reservoir after the reservoir has been filled.

Note: The DI water pump will not be properly primed unless you follow the instructions in the section called “Powering the Analyzer On” later in this chapter.

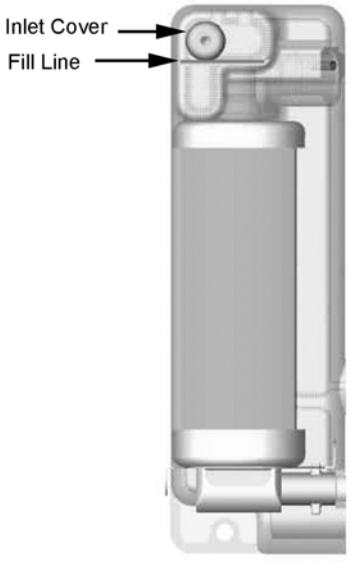


Figure 6: Filling the DI Water Reservoir

Step 6: Install External Devices

Installing the 900 ICR

(Sievers 900 Laboratory and Portable TOC Analyzers Only)

If you will be using an 900 ICR unit with your configuration, install it now. Follow the complete set of instructions in the "Installation" chapter of the ICR's *Operation and Maintenance Manual*. When you are finished, continue with the instructions here.

Installing the Analog Outputs and Alarms

You can install analog outputs and alarms on the *Sievers 900 On-Line and Portable*[6] *TOC Analyzers*. Refer to the specific Analyzer model in this section for installation instructions regarding that model.

[6]Older 900 Portable Analyzers may not have a 4-20 mA output.

Sievers 900 On-Line TOC Analyzer

The Analyzer has three terminal blocks, arranged horizontally in the electrical enclosure inside the Analyzer; remove the enclosure cover by loosening the set screws. 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.

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

Route the cables to the terminal strips through the pass-through port on the left side of the bulkhead. 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.

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

1. The first terminal block (TB2) is for alarm outputs; the maximum load for the alarm ports is 30 VDC at 1.0 A or 125 VAC at 0.5 A.
2. The second terminal block (TB1) provides a binary output signal for use with a sample sequencer device.
3. The third terminal block (TB3) is for serial and 4-20 mA analog outputs; the maximum 4-20 mA load is 600 ohms.

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.

Table 1: Alarm Inputs/Outputs (TB2)

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

* NC = normally closed, NO = normally closed

Table 2: Sample Sequencer Inputs/Outputs (TB1)

Pin Number (from left)	Output
8	Reserved
7	Reserved
6	End of Batch (NO*) (output)
5	End of Batch (NC*) (output)
4	End of Batch (Common) (output)
3	Reserved
2	Reserved
1	Reserved

* NC = normally closed, NO = normally open

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

Pin Number (from left)	Output
12	4-20 mA (- Output)
11	4-20 mA (+ Output)
10	Not used
9	Not used
8	Reserved
7	Reserved
6	Reserved
5	Not used
4	Serial (In)
3	Serial (Out)
2	Serial (ground)
1	Not used

The data from the Analyzer may be recorded using the 4-20 mA output located on TB3. The analog output is calibrated at the factory prior to shipping. Wiring connections are shown in Figure 7: Wiring Diagram for the 4-20 mA Connection.

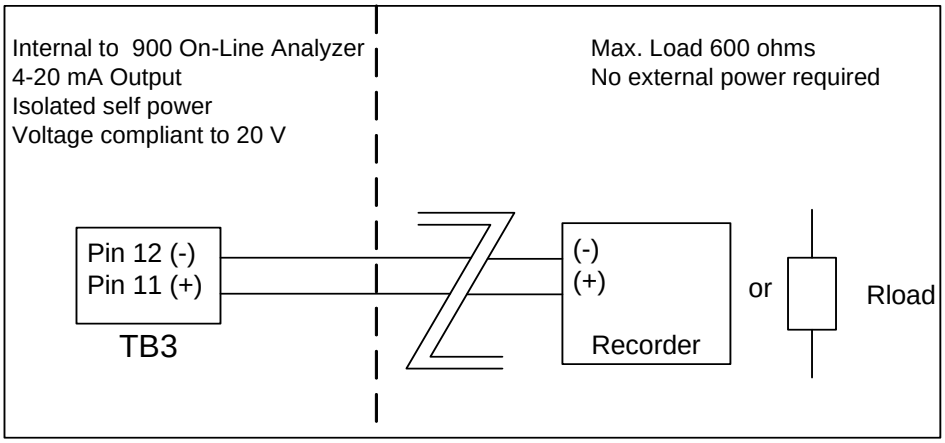


Figure 7: Wiring Diagram for the 4-20 mA Connection

Sievers 900 On-Line and Portable TOC Analyzers

If you will be using 4-20 mA output with your configuration, install it now. The Analyzer has one 4-20 mA output, located on the back of the Analyzer. Wire should be 28-16 AWG, rated to 300 Volts. Strip length should be 8-9 mm (.33 in). To attach the output connections, completely loosen the screw on top of each connection, insert the wire, tighten the screw, and then gently pull on each connection to make sure the connection is secure. The maximum 4-20 mA load is 600 ohms, and power isolation level is 240 VAC rms.

Pin 1 = 4-20 mA + Output
Pin 2 = 4-20 mA - Output

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

If you need to temporarily re-locate the Analyze later, you can remove the output connector by loosening the screws on either side of the wires and pulling the connector straight out from the panel mount. When you replace the connector, be sure to tighten the screws firmly.

A sample wiring connection is shown in Figure 8: Wiring Diagram for the 4-20 mA Connection.

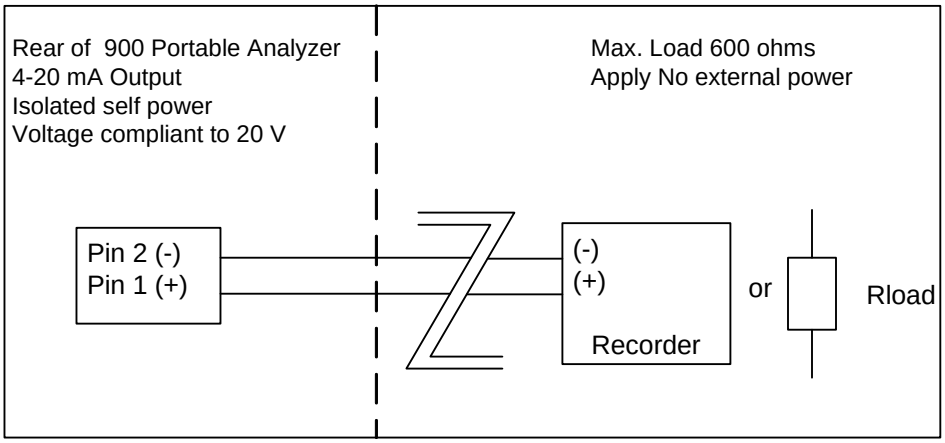


Figure 8: Wiring Diagram for the 4-20 mA Connection

Wiring the Remote Start (Binary Input) Connection

(Sievers 900 On-Line TOC Analyzer Only)

The 900 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. The 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 104.

You can use the binary output on TB1 as a control signal to a sample sequencer device. Once the binary output is wired properly, the Analyzer will automatically provide a 1 second contact closure at the end of every sample analysis. No menu configuration is necessary. The binary output is active in On-Line, Grab, and Turbo modes.

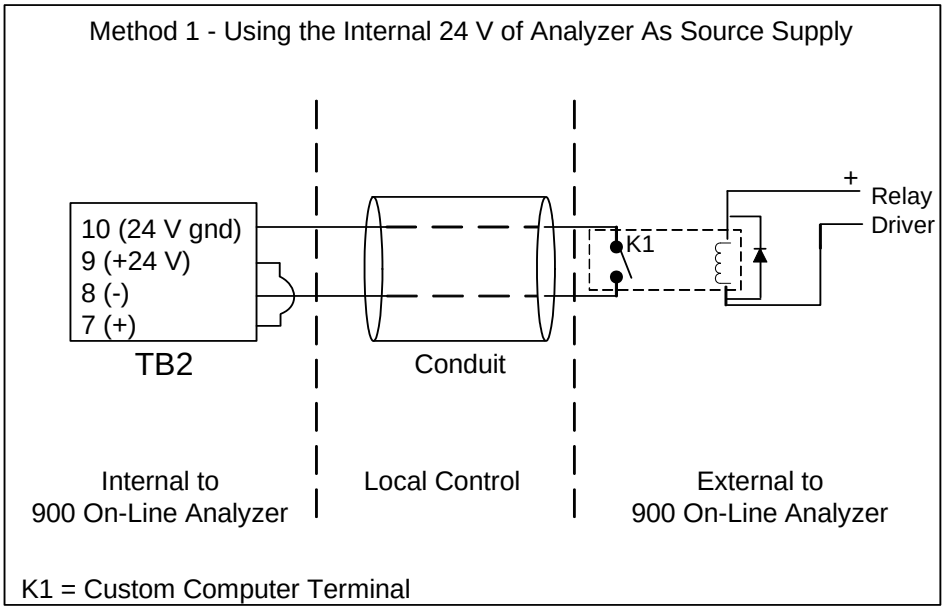


Figure 9: Wiring Option for Binary Input Using Analyzer's Internal Supply

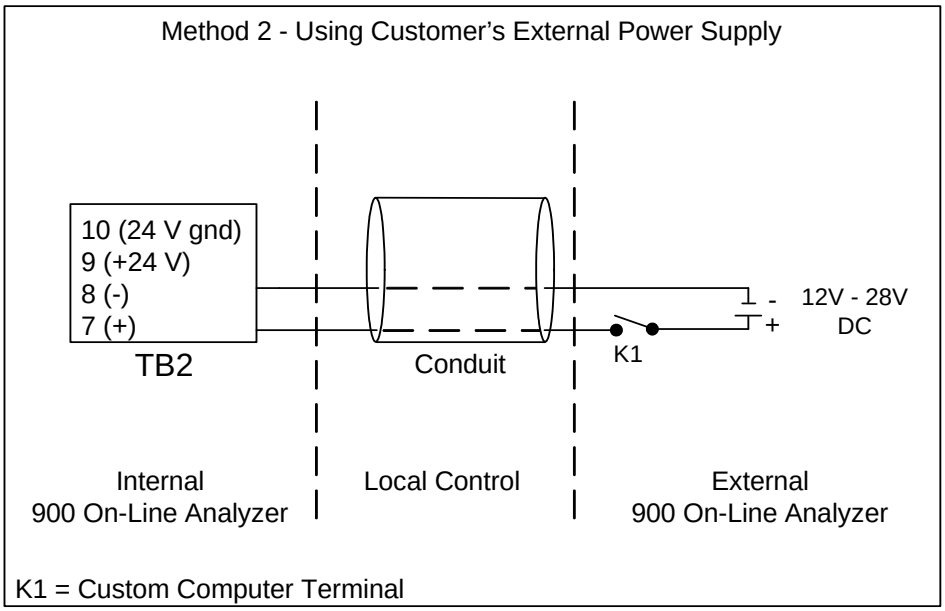


Figure 10: Wiring Option for Binary Input Using External Supply

Wiring the Ethernet Cable

Data from the Analyzer may be exported via Ethernet. Attach one end of the cable to the Ethernet port[7], and then attach the other end of the cable either to an Ethernet port on the your network or to a computer. You must also activate the Modbus feature, as described in "Using the Ethernet Connection and Modbus" on page 105.

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 a Citizen printer 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. For a list of known compatible USB flash memory drives, follow the Sievers 900 TOC Analyzers link on our Web site, www.GEInstruments.com.

To attach the USB flash memory drive, simply slide it into the USB port on the Analyzer. The location of the USB port for each Analyzer model is shown in Figure 11: Input and Output Connectors on page 71.

[7]The case enclosure of older model Sievers 900 Laboratory and Portable TOC Analyzers, manufactured prior to the release of firmware 2.10, does not contain an external Ethernet port.

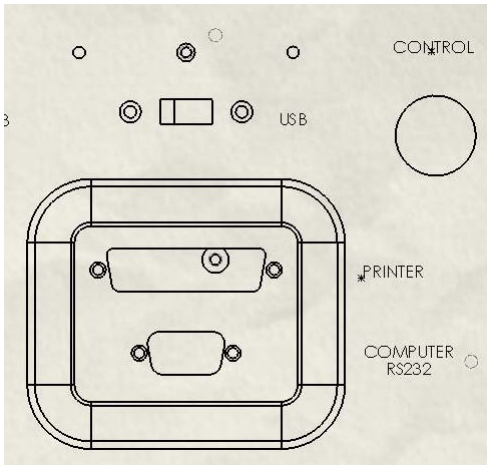
Installing the Serial Connection

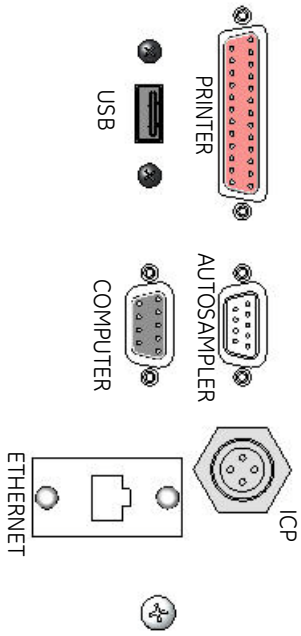
The serial connection is optional and provides an additional means of capturing data from the Analyzer. Serial cables are available at many computer and office supply retail stores. To install the serial connection:

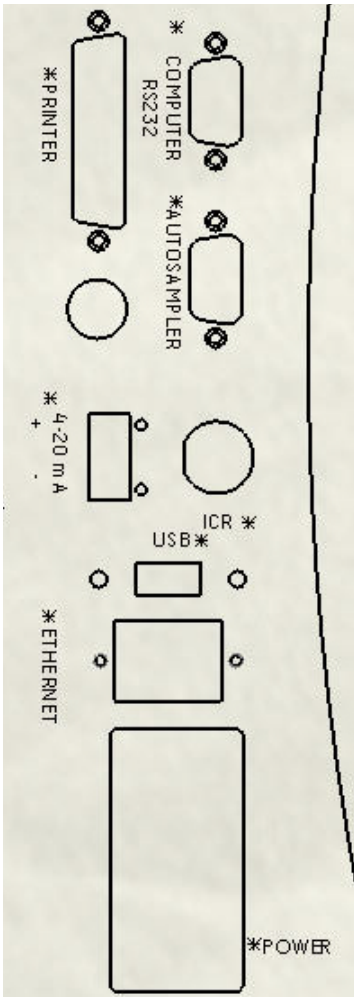
1. Connect the male end of the serial cable to the port on the Analyzer labeled **Computer RS232** and tighten the captive screws.
2. Connect the other end (female end) of the cable to the serial port on your PC, again connecting the captive screws.

Note: Serial communication is supported only for computers running the Windows operating system.

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-485 converter.







Sievers 900 On-Line TOC Analyzer	Sievers 900 Laboratory TOC Analyzer	Sievers 900 Portable TOC Analyzer

Figure 11: Input and Output Connectors

Connecting to a Power Supply

(*Sievers 900 Laboratory and Portable TOC Analyzers)*

Both the *Sievers 900 Laboratory and Portable TOC Analyzers* come supplied with power cords. Attach one end of the power cord to the Analyzer and the other end to a grounded power source. Make sure the cord is seated securely at both ends. Conduit installation instructions follow for the Sievers 900 On-Line TOC Analyzer.

(*Sievers 900 On-Line TOC Analyzers)*

Installation of the *Sievers 900 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. An external switch or circuit breaker is recommended, to facilitate maintenance and servicing of the Analyzer. It 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 pass-through port on the right side of the bulkhead. 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. AC connections inside the Analyzer are made to the top of the terminal strip (see Figure 12: Wiring AC Power Conduit (Arrows Indicate Connection Points)), with the line (brown/black wire) connected to TB3 and neutral (blue/white wire) connected to TB4. 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 8-9 mm (.33 in). When connecting the wire to the terminal block, insert a small flathead screwdriver into the terminal block and lift the screwdriver handle up, so as to provide downward pressure on the terminal block. After connecting the wire, pull on each connection gently to make sure the connection is secure.

Metallic conduit is required for the Analyzer to meet CE Mark electrical requirements.

When the power wiring is complete, close and latch the Analyzer door.

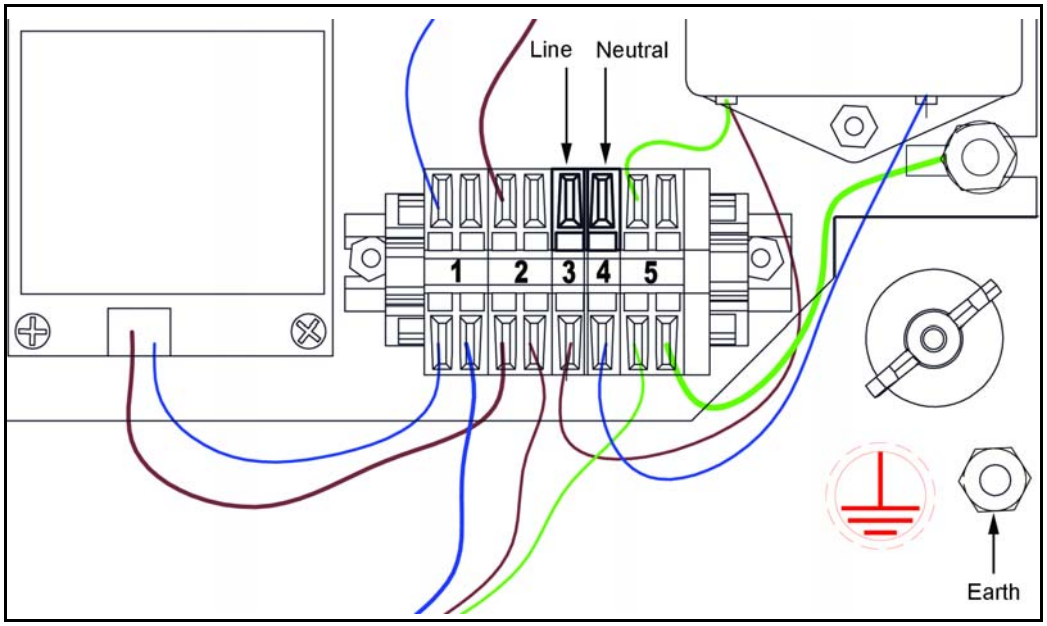


Figure 12: Wiring AC Power Conduit (Arrows Indicate Connection Points)

Step 7: Connect the Sample Inlet System

Next, connect the sample inlet system for either online measuring (*Sievers 900 On-Line and Portable TOC Analyzers*) or grab sampling (*Sievers 900 On-Line, Laboratory, and Portable TOC Analyzers*).

NOTE: If you are using the *Sievers 900 Laboratory* or *Portable TOC Analyzer* with a GE Autosampler, do NOT proceed with this section. Instead refer to the Sievers *DataPro 900 + DataGuard Software with GE Autosampler System — Operation and Maintenance Manual*. The information for connecting the sample tubing to the inlet port is located in the section, "Route the Sample Tubing."

Connections — Online Measuring

(*Sievers 900 On-Line and Portable TOC Analyzers*)

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.

To install the integrated On-Line sample system

1. Connect the 1/4" Teflon tubing with the in-line filter to the sample inlet on the IOS System. 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 IOS System and the DI water reservoir is filled before starting analysis.

2. Connect the 3/4" OD waste line tubing to the waste outlet on the IOS System 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 on the IOS System.
5. After water flow to the IOS 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 IOS. Turn the screw clockwise to decrease flow, and turn the screw counter-clockwise to increase flow.

Installing the Grab Sample Inlet System

Sievers 900 Laboratory TOC Analyzer

For Grab samples, place a 40 mL vial in the Analyzer's vial port and then operate the Analyzer in **Grab** mode (for more information on **Grab** mode, see "Setting the Analyzer Mode" on page 88). You can also collect the sample by connecting one end of a sipper tube to the Inlet port on the side of the Analyze, and then placing the other end of the sipper tube in a sample container.

Sievers 900 On-Line and Portable TOC Analyzers

To sample from a vial, place a 40-mL vial in the IOS System or vial port and operate the Analyzer in **Grab** mode (see "Setting the Analyzer Mode" on page 88 for more information). To run grab samples from a container, you must bypass the IOS System as described in the following steps.

To bypass the IOS system

1. Locate the 1/16" OD stainless steel tubing that runs from the IOS System to the bulkhead fitting labeled **Sample Inlet**. Use a 1/4" open-end wrench to loosen the Valco fitting at the **Sample Inlet** port. Carefully rotate the tubing away from the Analyzer so that tubing is clear of the inlet.
2. Locate the sipper tube (1/16" Teflon tubing with Valco nut) that is provided in the Analyzer's accessories kit.
3. Insert the Valco fitting into the **Sample Inlet** port on the left side of the Analyzer.
4. Tighten the Valco fitting until it is finger-tight, and then tighten an additional 1/8 turn using a 1/4" open-end wrench.
5. Place the open end of the sipper tube in the sample container, making sure that the end of the tubing is immersed in the sample. Place parafilm over the container opening (do not push the sipper tube through the parafilm or you may clog the tube).
6. For Grab mode operation, you can use either of two waste outlet options:
   - To use the 3/4" OD waste tubing, connect the tubing to the waste outlet on the IOS System by sliding the tubing over the barb fitting; place the hose clamp over the waste line, to secure the connection to the waste outlet. A gravity drain must be provided for the waste.
   - To use the 1/8" waste tubing, you must first disconnect the 7/16" nut that connects to the port labeled **Waste**. Attach the Swagelok fitting to the **Waste** port on the back of the Analyzer and tighten 1/4 turn past finger-tight using a 7/16" open-end wrench.

Warning
The waste stream from the Analyzer is acidic and must be disposed of according to local regulations.

If you will be sampling from a container in On-Line mode, you must first disable the flow sensor. For details, see "Configuring the Flow Sensor" on page 111.

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.

Powering the Analyzer On

1. Turn the Analyzer on using the main power switch. The Analyzer should power up and display the Startup screen. Push the **Main** button to display the **Main** screen.
2. The Analyzer may issue the alert, "It has been more than 24 hours since the last measurement. Press Flush to begin the operation." Press the **Cancel** button. You will perform a flush at the end of installation.
3. Turn the Analyzer off. To prime the DI water pump, power must be cycled in the following manner.
4. Wait 30 to 60 seconds and then turn on the power again. Allow the DI pump to circulate water for at least 10 minutes.
5. After 10 minutes, open the Analyzer case and check the tubing that leads to the resin bed (ion exchange column). Most of the air originally in the tubing should be replaced with water. If more than a few small bubbles remain in the tubing, repeat Steps 3 through 5.
6. If necessary, bring the level of DI water in the reservoir back up to the blue line.
7. Close the Analyzer case.
8. Press the **Menu** button.

Note: If the Analyzer emits a noise when you turn it on, or if water does not fill the tubing leading to the resin bed, it is possible the DI water pump was not properly primed. See the section called "Problems with the DI Water Pump" on page 188 for information on priming the pump.

Enabling DataGuard or Password Protection (Optional)

The Sievers 900 Series of TOC Analyzers offers two levels of security, one included with all Analyzers and the other available for purchase as an upgrade from GE Analytical Instruments. The Password Protection feature is included with all Analyzers and provides a basic level of security. The DataGuard feature 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.

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.
2. Press the **Menu** button, select the **Maintenance** tab, and press the **Advanced** button.
3. Press the **Activate Options** button.
4. Press the **OK** button and wait for the Analyzer to detect the USB flash drive.
5. 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.

Naming the Analyzer Location (Optional)

You can assign a name to the Analyzer, and this name will display 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 Reagent Expiration Dates

Because the reagents in your Analyzer are new, you must set the expiration dates so the Analyzer can correctly monitor their consumption:

1. Select the **Maintenance** tab.
2. Press the **Consumables** button.
3. Press the **New Acid** button.
   - Enter the expiration date that was recorded on the **Maintenance Worksheet**: press the **Day** button and use the numeric pad to specify the day of expiration and press **Enter**; repeat for the **Month** and **Year** buttons.
   - Press **Accept** after you have entered the complete expiration date.
   - You will be prompted to confirm the installation of new acid; press the **Confirm** button to continue.
4. Press the **New Oxid** button.
   - The oxidizer has a maximum 90-day life once it is installed. For the expiration date, enter the date 90 days from today, or enter the expiration date on the label and allow the Analyzer to adjust the date to 90 days from today: press the **Day** button and use the numeric pad to specify the day of expiration and press **Enter**; repeat for the **Month** and **Year** buttons.
   - Press the **Amount** button and confirm that the correct volume is selected, either **150 mL** or **300 mL**, as noted on the **Maintenance Worksheet**.
   - Press **Accept** after you have entered the complete expiration date and oxidizer volume.
   - You will be prompted to confirm the installation of new oxidizer; press the **Confirm** button to continue.
5. Press the **Menu** button to exit the screen.

Setting the Analyzer Mode and Reagent Flow Rates

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.
   - Select **On-Line** to measure TOC continuously from a sample stream.

- Select **Grab** to measure TOC directly from a sample flask or the vial port.

For more information on mode selection, see "Setup" on page 88.

2. Press the **Configure** button.

   By default the Analyzer uses the reagent flow rates that are automatically calculated. If you know the specific flow rates you want to use for each reagent, you can manually set the flow rates, according to Table 5 on page 93 and Table 6 on page 93. For more information on setting flow rates, see "Setting Reagent Flow Rates" on page 89.

3. 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. By default, data is stored in the Analyzer's flash memory, so that all measurements will be retained. If you want to change the **Archive Data** setting, follow these steps:

1. Select the **Data** tab.
2. Press the **Setup History** button.
3. Confirm that **Archive Data** is set 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 Step 6, 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 Constants

Calibration constants, reagent flow rates, 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 settings to a comma-separated text file, 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 four buttons, one at a time, to print the different constants.

Set Up Data I/O

If you are installing[8] 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 100 through page 104 for details on configuring these settings.

Step 9: Flushing and Rinsing the Analyzer

Before placing the Analyzer into normal operation, you should perform a reagent flush to remove any gas bubbles that may have formed in the reagent lines and then let the Analyzer run in On-line mode for 12 hours to thoroughly rinse the Analyzer.

For the reagent flush, the Analyzer must be connected to an on-line supply of low TOC (<50 ppb) DI water, either in a continuously flowing stream or from a large flask (1000-2000 mL).

[8]Not all of these I/O features are available in the Sievers Portable TOC Analyzer. Please refer to Chapter 3, "Installation" for the specific input/output features of these models.

Before you begin

If you are using a *Sievers 900 Portable TOC Analyzer* in Grab mode for the flush, you must first bypass the IOS system and then attach a sipper tube to the Sample Inlet port. Refer to “To bypass the IOS system” on page 75 for step-by-step instructions.

To flush and rinse the Analyzer

1. Connect an online supply of DI water to the Analyzer, or connect a sipper tube from a container of DI water to the Analyzer’s inlet port. Make sure that any online source of DI water is open and available to the Analyzer before continuing. Do this by adjusting the needle valve on the IOS.
2. Verify that the Analyzer is powered *On*.
3. If you have an ICR, make sure the lever is set to the **Inline** position
4. Press the **Menu** button, and then select the **Setup** tab.
5. Press the **On-Line** button.
6. Select the **Maintenance** tab, and then press the **Consumables** button.
7. Press the **Flush...** button.
8. Press the **Both** button, and then wait for the flush to complete. The Analyzer will not respond to additional commands until the flush is finished, after about 10 minutes. Do NOT disrupt power to the Analyzer while the flush is in progress.
9. When the flush is complete, turn off power to the Analyzer using the main power switch. Open the Analyzer case and visually inspect the Analyzer for leaks, especially around the DI water reservoir. If a leak is detected, make sure all fittings are tight and secure. Otherwise, close the Analyzer case and power the Analyzer *On*.
10. Press the **Start Analysis** button. Let the Analyzer run for 12 hours.
11. After 12 hours, press the **Stop Analysis** button.
12. Turn off power to the Analyzer with the main power switch. Open the Analyzer case and again visually inspect the Analyzer for leaks, especially around the DI water reservoir. If a leak is detected, make sure all fittings are tight and secure.
13. Remove the rubber inlet cover on the DI water reservoir and use the water bottle to add more DI water, as the initial rinse down uses more DI water than normal operation.
14. Close the Analyzer case.

900 Laboratory TOC Analyzers

The Analyzer is now ready to take TOC measurements. To customize additional settings, refer to Chapter 4, "Basic Analyzer Operation" for details.

The Analyzer is now almost ready to take TOC measurements:

- *To use the Analyzer in an On-Line configuration*, reattach the stainless steel fitting from the IOS. Also, make sure the settings on the **Configure** screen (**Setup** tab → **Configure** button) are correct before starting your analysis. Refer to “Setup” on page 88 for additional details.
- *To use the Analyzer in **Grab** mode*, you do not need to make additional sample configuration changes, however, you must change the analysis mode. Select the **Setup** tab and press the **Grab** button. Also make sure the settings on the **Configure** screen (**Setup** tab → **Configure** button) are correct before starting your analysis. Refer to “Setup” on page 88 for additional details.
- *To sample from a vial*, you must reconnect the IOS System. Disconnect the sipper tube from the **Sample Inlet** port using a 1/4" open-end wrench. Then, attach the stainless steel tubing that runs from the IOS System to the **Sample Inlet** port by tightening the fitting with the 1/4" open-end wrench 1/8 turn past finger-tight.

To customize additional settings, refer to Chapter 4, "Basic Analyzer Operation" for details.

Chapter 4. Basic Analyzer Operation

Overview

The Sievers 900 Series TOC Analyzers utilize a touch-sensitive color LCD for all menu selection activities. An overview of the menu structure is given in "The Menu Screen" on page 87. An overview of hardware features starts on page 113.

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 appears. If Password protection or DataGuard is enabled, you will be required to log in before starting analysis or proceeding to the **Menu** screen.

Note: Some menu options may not be available, depending on the mode in which the Analyzer is operating. In particular, when the Analyzer is performing analysis, menu options that can affect analysis are not available (they appear "grayed out").

Note: If your configuration will include a GE Autosampler system, consult the *DataPro 900 Operation and Maintenance Manual* for details on operating the Analyzer and GE Autosampler with the DataPro software.

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 security or DataGuard is enabled, you will be required to log in before accessing the Menu screen or starting analysis. See "Using Password Protection" on page 117 and "Using DataGuard" on page 118 for more information.

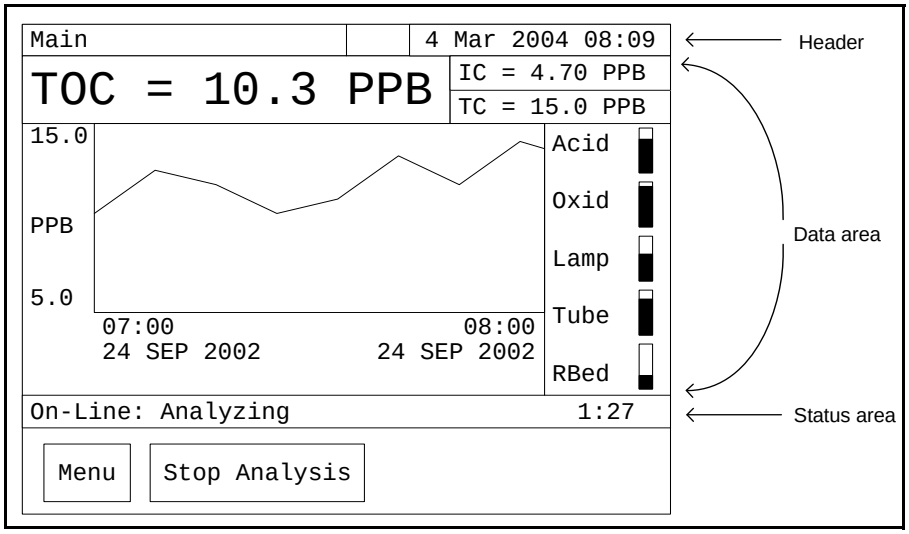


Figure 13: The Main Screen

Note: Unless otherwise noted, the screenshots in this chapter are taken from the *Sievers 900 On-Line TOC Analyzer*. Some buttons may not display on the *Sievers 900 Laboratory and Portable TOC Analyzers*, as noted.

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 ( ) appears when basic Password security is enabled.
   - The Padlock icon ( ) appears when DataGuard is enabled.

- The **W** icon appears when a warning has been issued and the **E** icon appears when an error has been issued. (See "Reviewing Warnings and Errors" on page 107 for more information.)

2. The Data area shows indicators for the status of the Analyzer's primary consumables (see "Displaying Consumables Status" on page 107 for more information). Information about TOC measurements also appears, depending on which mode the Analyzer is in:
   - In On-Line mode, a trend graph appears on the **Main** screen; to change the scale and specify which readings display on the graph, see "Graphing Data History" on page 97.
   - In Grab mode, a table of sample statistics appears on the **Main** screen.
3. The Status area displays information about the current operation mode (On-Line or Grab), 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 mode to **Grab** or **On-Line**, as described in "Setting the Analyzer Mode" on page 88, and have configured mode settings, you are ready to begin taking TOC measurements. Simply press the **Start Analysis** button to begin.

When the Analyzer is in Grab mode, as each measurement is completed the repetition and reject numbers are updated on the **Main** screen and the data from the last measurement are displayed.

When the Analyzer is in On-Line mode, as each measurement is completed the data are plotted on the trend graph on the **Main** screen. To change the way the data display on the graph, see "Graphing Data History" on page 97.

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 on page 116 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 reagent flow rates and, in Grab mode, 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.

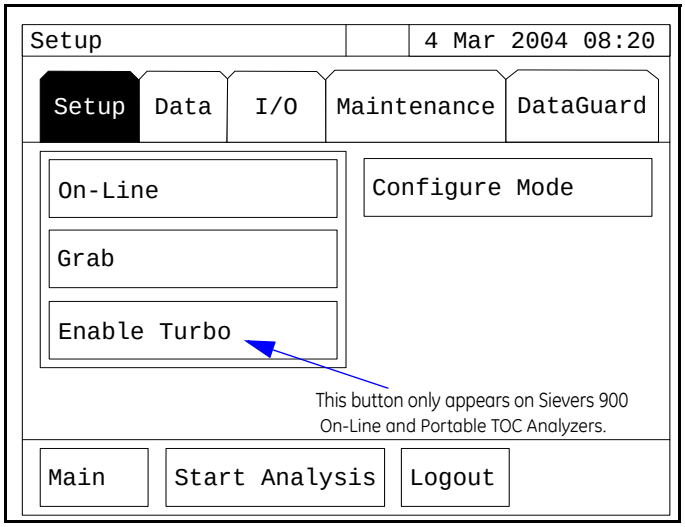


Figure 14: The Setup Tab

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, especially if you use the Autoreagent flow rate setting.

Setting the Analyzer Mode

The Sievers 900 Series TOC Analyzers can operate in two different modes. To set the Analyzer mode, follow these steps:

1. Select the **Setup** tab.
   - Select **On-Line** to measure TOC continuously from a sample stream or sipper tube. If a sipper tube is used, the Flow Sensor must be disabled; see "Configuring the Flow Sensor" on page 111 for details. **On-Line** is the default mode for the Sievers 900 On-Line TOC Analyzer.
   - Select **Grab** to measure TOC directly from a sample flask using the sipper tube attachment or the vial port or IOS. After you select **Grab**, you will need to press the **Configure Mode** button to configure the settings for Grab mode. If you will be sampling from a flask, you will also need to change the sample inlet configuration.

Grab Mode Measurement Settings

When selecting Grab mode, 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 numerical pad appears. 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 numerical pad appears. Enter a number and press the **Enter** button to save the value, or press **Cancel** to retain the current setting without making any changes.
4. Press the **Grab Label** button to assign an alphanumeric label of up to 7 characters to each grab sample. The label appears in the data history. After the analysis completes, the **Grab Label** resets to its default value.

In most cases, this first measurement will be close to the actual TOC but may be outside of the repeatability of the Analyzer. 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.

Setting Reagent Flow Rates

GE Analytical Instruments recommends using the Sievers 900 Series TOC Analyzers in Autoreagent mode to ensure the optimum reagent flow rates. In this mode, the Analyzer will automatically calculate and implement the proper reagent flow rates. This feature greatly simplifies the process of manually determining optimum reagent flow rates. If you have special operating conditions, you can operate the analyzer in Manual Reagents mode, and manually select the proper reagent flow rates for the sample. If you are analyzing ultrapure water (UPW), or have special operating conditions, you can operate the Analyzer in Manual Reagents mode as described in the section “Setting Manual Flow Rates” on page 93. Due to the relatively small changes in TOC in UPW, use of the Autoreagent function will most likely not result in a change to the reagent flow rates.

When the Autoreagent function is active, the Analyzer performs a preliminary measurement of each new sample before it performs the measurements for which results are reported. The preliminary measurement is used by the Analyzer to determine the correct acid and oxidizer flow rates for the subsequent analyses of that sample.

The acid flow rate is set according to the TC and IC concentrations estimated during the preliminary measurement. These concentrations may not exactly match the results of the subsequent analytical measurements, but, because there is a range of acceptable flow rates for any given sample concentration, they are accurate enough to establish the acid flow rate required for the analytical measurements.

Table 4: Acid Flow Rate for Preliminary Measurement with Autoreagent Function

Results of Preliminary Measurement	Selected Acid Flow Rate, µL/min	
	No ICR or ICR Bypassed	ICR Inline
TC < 500 ppb	0.3	N.A.
TC ≥ 500 ppb and IC < 50 ppm	1.0	2.0
IC ≥ 50 ppm	2.0	4.0

To set the oxidizer flow rate during the preliminary measurement, the oxidizer syringe pump is turned on at a high flow rate (>20 µL/min) for a short time, and then is turned off. (The actual flow rate depends on the age of the reagent.) This results in a pulse of persulfate in the sample stream. As this pulse flows into the oxidation reactor, diffusion causes the concentration of persulfate to "spread out." The concentration of persulfate in the UV reactor peaks, and then the concentration gradually decreases. There is a large excess of persulfate at the peak, but the concentration decreases until there is insufficient persulfate to completely oxidize the sample. Somewhere in-between, the persulfate concentration in the UV reactor is the optimum for the concentration of TOC in the sample at that moment.

When the persulfate concentration is the optimum, the maximum amount of CO_2, formed in the UV reactor, permeates through the membrane in the TC channel. If the TOC concentration is 10 ppm or greater, the conductivity at the TC conductivity cell peaks at a time that corresponds to when the persulfate concentration was optimum in the UV reactor. The instrument determines when the maximum conductivity occurs and then calculates the optimum oxidizer flow rate for that sample.

However, samples having lower TOC concentrations produce conductivity plateaus, rather than peaks. For those samples, the instrument calculates the optimum oxidizer flow rate from the conductivities and temperatures that exist during the plateau.

The Autoreagent function compensates for the aging of the persulfate reagent and the UV lamp. It does not compensate for changes in the sample flow rate, such as after the sample pump tubing is replaced. The sample flow rate increases when new tubing is installed, and the flow rate stabilizes after a few days of operation. For that reason, the tubing used in the Sievers 900 Series TOC Analyzers has been "broken in" at the factory so that the flow rate is relatively stable immediately after it is installed.

Still, the sample flow rate will vary from one set of tubing to another. To compensate for this variability, Sievers 900 Series TOC Analyzers can calibrate the sample flow rate so that it is optimized and the same whenever pump tubing is replaced.

The preliminary measurement is necessarily performed differently than a normal analysis because its purpose is to set the reagent flow rates. Therefore, its results are not reported by the Analyzer. It also should be noted that the time before the Analyzer reports its first results for the sample is extended by 14 to 16 minutes. The Autoreagent function is employed most productively when the concentration of the samples to be analyzed is

expected to vary greatly, thus eliminating the need to run duplicate samples in order to determine optimum flow rates.

When the Analyzer is in Grab mode or operating with the Autosampler, and Autoreagent mode is activated, the Analyzer initially performs a preliminary measurement on each new sample vial. Following the preliminary measurement, the Analyzer sets the acid and oxidizer flow rates to be used on that sample, and the analytical measurements are then made in the normal fashion.

When the Autoreagent function is used in the On-line mode, the Analyzer performs a preliminary measurement when analysis is started. Then the Analyzer performs analytical measurements of the sample stream in the normal fashion. The Autoreagent function is not available in Turbo mode.

The acid flow rate is adjusted according to the IC concentration measurements made during those analytical measurements — if the IC concentration increases from 49.9 ppm to 50.0 ppm during the analytical measurements, the acid flow rate will increase from 1.0 to 2.0 mL/min. (The Analyzer makes these adjustments using averages of the IC measurements so that a single measurement of 50.0 ppm IC will not result in an abrupt increase in acid flow.)

Following the preliminary measurement, the Analyzer adjusts the oxidizer flow rate as the TOC concentration changes during the analytical measurements. To do this, the Analyzer calculates the ratio:

$$\frac{\text{Selected Oxidizer Flow Rate, } \mu\text{L/min}}{\text{TOC Measured During Prelim. Meas., ppb}}$$

This ratio is used to calculate the oxidizer flow rates to be used in the analytical measurements. The Analyzer uses an average TOC concentration in this calculation to avoid abrupt changes to the oxidizer flow rate caused by occasional higher or lower TOC measurements.

In the On-line mode, the preliminary measurement is repeated to allow the ratio of oxidizer flow rate to TOC concentration to be updated. The frequency of performing the preliminary measurement should be greater for sample streams that are expected to have more variable compositions. Therefore, the frequency is adjustable, with every 12 hours being the most frequent setting possible.

Persulfate is normally only added for TOC samples above 1 ppm. Below 1 ppm, the hydroxyl radicals formed from the photolysis of water achieve sufficient oxidation and a low oxidizer flow rate (0.1 to 0.7 µL/min) is used.

Manual reagent mode should be selected for samples that are expected to be below 1 ppm. For samples below 500 ppb, it is common to set the oxidizer flow rate to 0 or 0.1 µL/min. Between 500 ppb and 1 ppm, set flow rates manually between 0.1 and 0.7 µL/min. Once established, there should not be a need to modify the flow rates.

Autoreagent mode is optimized for samples > 1ppm TOC where the TOC is unknown or highly variable; it should not be used for samples below 1 ppm as oxidizer injected during the preliminary measurement (used to determine the proper flow rates) can result in bubble formation if the premeasurement sample is very low in TOC. It may take several minutes for the Analyzer to clear these bubbles and return to a stable condition.

If you know the specific flow rates you want to use for each reagent, you can manually set the flow rates, according to Table 5 on page 93 and Table 6 on page 93.

Note: Analysis must be stopped prior to changing the reagent flow rates.

Using the Autoreagent Function

Set up the Autoreagent function by following these steps:

1. Select the **Setup** tab.
2. Press the **Configure Mode** button (see Figure).
3. Make sure the **Reagent** button is set to **Auto**. The Analyzer will automatically calculate the flow rates for both reagents.
4. To modify the automatically calculated acid flow rate, press the **Acid** button and select an adjustment value: **+10%**, **+20%**, **-10%**, or **-20%**. You can also return the value to **Auto**.
5. To modify the automatically calculated oxidizer flow rate, press the **Oxidizer** button and select an adjustment value: **+10%**, **+20%**, **-10%**, or **-20%**. You also can return the value to **Auto**. For municipal water applications whose alkalinity is less than 100 mg/L as $CaCO_3$, we recommend selecting the adjustment value of -20% acid only.

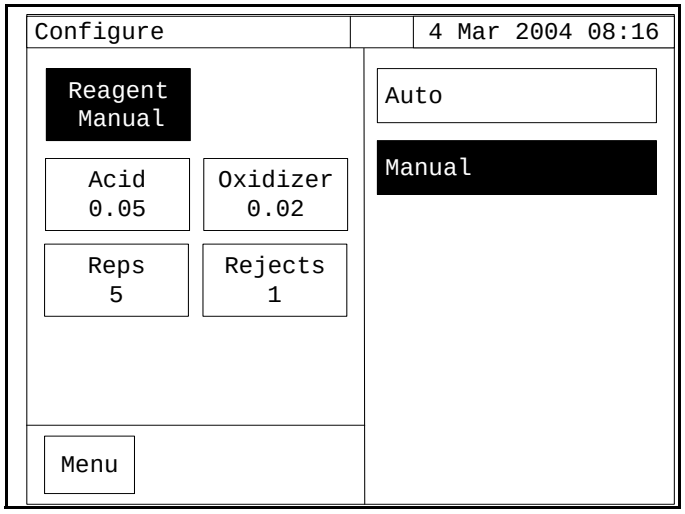


Figure 15: Selecting the Reagent Flow Method

Scheduling Autoreagent Adjustments in On-Line Mode

If you operate in On-Line mode and use the Autoreagent feature, the **Schedule Reagent** value determines how often the Analyzer repeats the preliminary measurement. Set this value by following these steps:

1. Select the **Setup** tab. Make sure On-Line mode is selected.
2. Press the **Configure** button. Make sure the **Reagent** button is set to **Auto**.
3. Press the **Schedule Reagent** button. A numerical pad appears on the right side of the screen. Enter a number to specify how often the Analyzer calculates the automatic reagent values; the unit of measure for the value entered here is hours.
4. Press **Enter** to continue.

Setting Manual Flow Rates

Manually set reagent flow rates by following these steps:

1. Select the **Setup** tab.
2. Press the **Configure Mode** button.
3. Make sure the **Reagent** button is set to **Manual**.
4. Press the **Acid** button and use the keypad to enter a value. Press the **Enter** button to save the value, or press **Cancel** to retain the current setting without making any changes.
5. Press the **Oxidizer** button and use the keypad to enter a value. Press the **Enter** button to save the value, or press **Cancel** to retain the current setting without making any changes.
6. Press the **Menu** button to return to the main **Setup** screen.

Table 5: Recommended Oxidizer Flow Rates

TOC Concentration	Oxidizer Flow Rate
25 - 50 ppm	2.8 - 13.5 µL/min
10 - 25 ppm	1.4 - 7.5 µL/min
5 - 10 ppm	0.7 - 2.8 µL/min
1 - 5 ppm	0.7 - 1.4 µL/min
<1 ppm	0.0 - 0.7 µL/min

Table 6: Recommended Acid Flow Rates

IC Concentration	Acid flow rate with ICR* (high alkalinity)	Acid flow rate without ICR (or with ICR, low alkalinity)
50 - 100 ppm	4.0 µL/min	2.0 µL/min
0-50 ppm	2.0 µL/min	1.0 µL/min
Deionized water	Not applicable	0.3 µL/min

*These flow rates apply to water with very high alkalinity.

Note: GE recommends decreasing the acid flowrate to 1.0 µL/min for municipal water applications with an alkalinity of less than 100 mg/L $CaCO_3$. Always check the pH of your undilluted water to ensure it is below pH3 but not less than pH2.

Understanding Analysis Times

Analysis times in Sievers 900 Series TOC Analyzers vary depending on the type of reagent settings you use, either Autoreagent mode or manual reagents mode. Analysis times for measurements using the Autoreagent setting will be longer (and the volume of sample consumed is greater), as the Analyzer must identify the correct flow rates to use before starting full analysis. Table 7 on page 94 shows a comparison of analysis times based on the reagent setting.

Table 7: Sample Analysis Times

Parameter	Manual Reagent Mode		Autoreagent Mode	
	No ICR or ICR Bypassed	ICR Inline	No ICR or ICR Bypassed	ICR Inline
Time to first measured value	12.2 min	13.7 min	26.4 min	29.5 min
Time for flush and four replicate measurements	24.2 min	25.7 min	38.4 min	41.2 min

Note: Additional time may be required if the reagent syringes must be filled during the analyses.

Managing Data History

The Analyzer stores the TOC measurement data history in RAM. On the **Data** tab, you can configure the way your Analyzer stores and displays the data history; you also can initiate printing and exporting of the data.

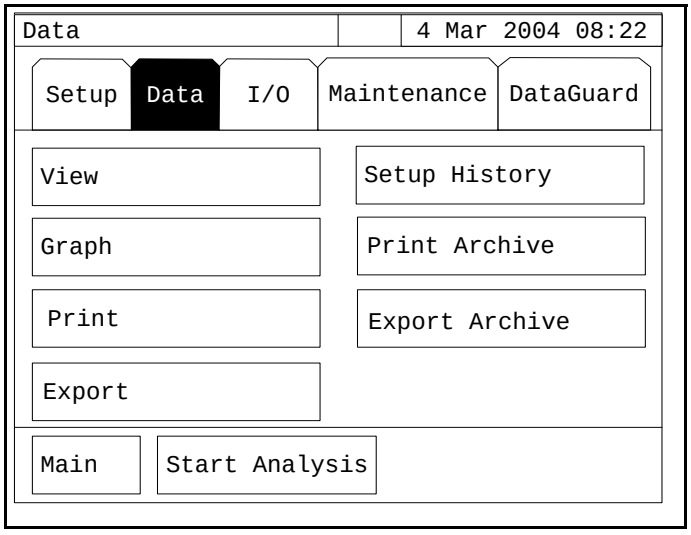


Figure 16: The Data Tab

Setting up Data History

The data history can accomodate approximately 33,000 entries (at least 90 days of usage when the Analyzer is not used in the optional Turbo mode).

1. Select the **Data** tab.
2. Press the **Setup History** button.
3. Set the **Archive Data** option to *On* or *Off*. If you select *Off*, the Analyzer assumes the use of a PC to capture data and data will not be stored on the Analyzer.

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. To set up an automatic download to 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 if you wish to export the data history archive to a file. You will be prompted to connect a storage device to the USB 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 your Analyzer's whether or not analysis is in progress. To display the **Data History** screen, follow these steps:

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/IC/Mode** — Displays TOC and IC data and the mode in which the data was measured.
    - **TOC/IC/TC** — Displays TOC, IC, and TC data.
    - **TOC/Reagents** — Displays TOC data and reagent flow rates.
    - **TOC** — Displays TOC data only.
    - **TOC / Label** — Displays TOC data and the Grab label.

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 17, the first line of data is highlighted, indicating the measurement was taken on March 1, 2004. 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.

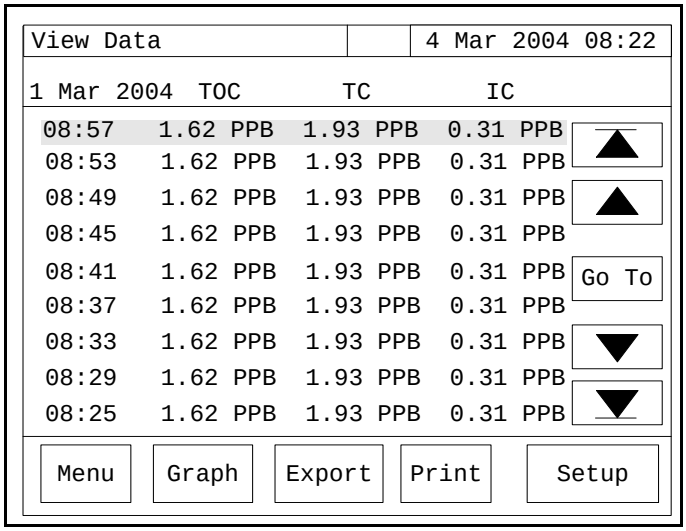


Figure 17: Specifying a Start Date on the View Data Screen

To display a specific portion of the data history, press the **Go To** button, use the numeric 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 **View Data** screen, you also have the option to graph, export, and print data. See the following sections for details on using these screens.

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.

To customize the graph, follow these steps:

1. Select the **Data** tab.
2. Press the **Graph** button to display the data graph (see Figure on page 98).
3. Press the **Setup** button to specify the scale for the graph.
4. 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**.
5. Press the **Y Scale** button to select a TOC range for the Y axis.
   - Select **Auto** to have the Analyzer automatically calculate the appropriate TOC range.
   - Select **Manual** to enter specific TOC values in ppb. Press the **Min** button to enter the minimum TOC value and press the **Max** button to enter the maximum TOC value.
6. Press the **Back** button to save your changes and return to the graph display.
7. Specify which data are displayed on the graph:
   - Press the **TOC** button to graph TOC data.
   - Press the **TOC/IC/TC** button to graph TOC, IC, and TC data.

   A color-coded key appears 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.

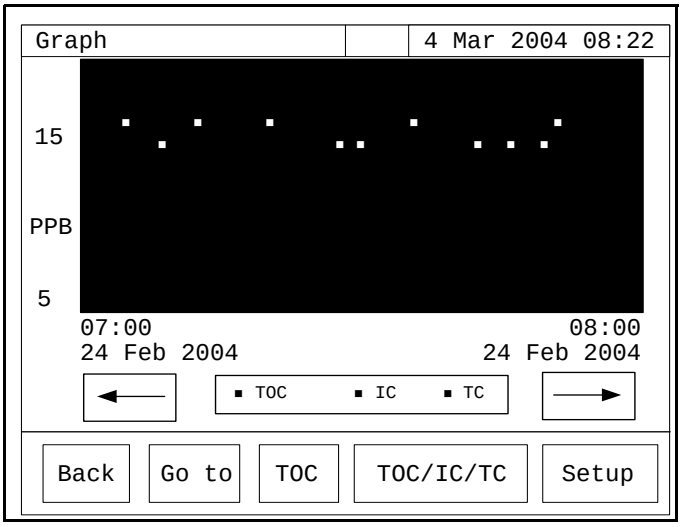


Figure 18: Graphing the Data History

Printing Data History

The Analyzer can print the data history for any valid time range that you specify. To print data, follow these steps:

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/IC/Mode** — Prints TOC and IC data and the mode in which the data was measured.
   - **TOC/IC/TC** — Prints TOC, IC, and TC data.
   - **TOC/Reagents** — Displays TOC data and reagent flow rates.
   - **TOC** — Displays TOC data only.
   - **TOC / Label** — Displays TOC data and the Grab label.
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 104 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 comma-separated format (`.csv`) and contains the following fields: Analysis mode, Date, Time, TOC, TC, IC, Acid, Oxidizer, Reagent mode, IC cell temperature, TC cell temperature, and ICR state. Most

spreadsheet programs, such as Microsoft Excel, can open the `.csv` file without having to go through an import process.

The Analyzer also downloads the audit trail information at the time the data history is exported to a USB.

Setting Up Analyzer Input and Output

Menu selections on the **I/O** tab allow you to configure data for alarms, analog output, binary input, serial output and printing. Older 900 Portable and Laboratory Analyzers may not have a 4-20 mA output.

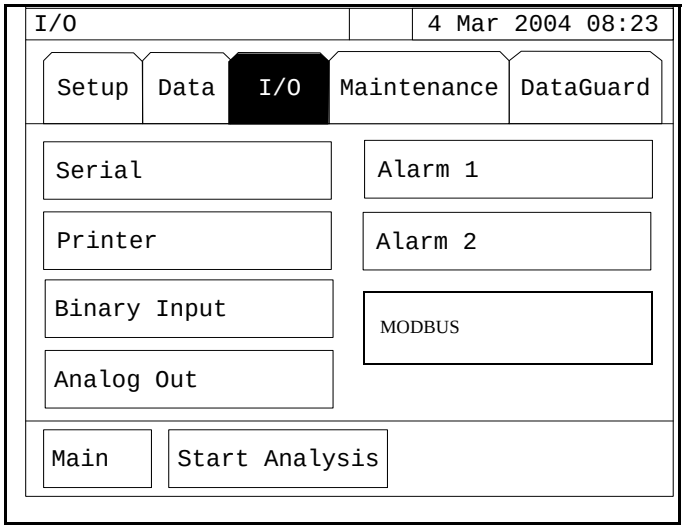


Figure 19: The I/O Tab

Setting Up Analog Output

Select the output range for the 4-20 mA analog output by following the steps below. Instructions for wiring the 4-20mA output can be found in the "Installation" chapter.

1. Select the **I/O** tab.
2. Press the **Analog Out** button.
    - Press the **Min** button to set the minimum value (in ppb), corresponding to the minimum analog voltage. 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), corresponding to the maximum analog voltage. 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 **Error** button to set a value when the Analyzer issues an error (1, 2.5, 4, or 20 mA, or No Change).
- Press the **Warning** button to set a value when the Analyzer issues a warning (1, 2.5, 4, or 20 mA, or No Change).
- Press the **Standby** button to set a value when the Analyzer switches out of analysis mode into standby mode (1, 2.5, 4, or 20 mA, or No Change).

Note: The Analyzer automatically signals the Standby state for alarms and 4-20 outputs during syringe refill, Autozero, and Autoreagent. activities.

- Press the **Value** button to set the output value that will be sent to the analog output. The values can be TOC, TC, or IC. Press the **TOC**, **TC**, or **IC** button and then press **Enter** to change the value, or press **Cancel** to retain the current setting without making any changes.
- Press the **Protocol** button to set the analog output behavior when the Analyzer is running system protocols. Press either the **Analysis Results** or **Standby** button.
- To calibrate the values output via the 4-20 mA outputs, see "Calibrating Analog Output Values" below.

Calibrating Analog Output Values

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

1. Open the Analyzer door (*900 On-Line)* or access the terminal block on the back of the Analyzer (*900 Portable*) and connect wiring from the 4-20 mA outputs on TB 3 to a digital multimeter.
2. Select the **I/O** tab.
3. Press the **Analog Out** button.
4. Press the **Calibrate** button.
5. Press the **Adjust** button for the 4 mA voltage.
6. Press the **Increase** or **Decrease** button to change the value. You can change the rate at which the Analyzer applies the adjustment by changing the selection under the **Rate** button.
7. 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.
8. Press the **Adjust** button for the 20 mA value.
9. Press the **Increase** or **Decrease** button to change the value. You can change the rate at which the Analyzer applies the adjustment by changing the selection under the **Rate** button.
10. Check the value that is output to the multimeter. If the reading is not 20 mA ± 0.01 mA, go back to Step 8 and adjust the value. Repeat until the multimeter measures 20 mA ± 0.01 mA.
11. Disconnect the multimeter wires from TB3 and return the Analyzer to normal operation.

Setting Up Serial Output

To download data from the Analyzer directly to a computer, you must enable the **Output** option and set the **Baud Rate** for the serial (RS-232) port.

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**.

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 Hyper terminal to communicate with the Analyzer, see "Using HyperTerminal" on page 212 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-485 converter. You can also use an Ethernet connection.

Interpreting Serial Output

When serial output is set to **On**, for every measurement the Analyzer outputs the data show in Table 8.

Table 8: Data Fields Output to the Serial (RS-232) Port

Field Number	Value
1	Mode
2	Date
3	Time
4	TOC (ppb)
5	IC (ppb)
6	TC (ppb)
7	Acid (µL/min)
8	Oxidizer (µL/min)
9	Warning/Error message, if generated

To view the data, you will need to use a communications program on your PC. For additional information, see the Appendix section called "Using HyperTerminal" on page 212.

For example, a successful measurement would output as follows:

```
On-Line,22 SEP 2005,10:03:31,10.3,4.7,15.0,0.7,0.7,
   1         2          3      4   5    6    7   8   9
```

```
Grab ,22 SEP 2005,10:03:31,10.3,4.7,15.0,0.7,0.7,
        2          3      4   5    6    7   8   9
```

TOC Label (Port 1)

When the Analyzer takes a successful measurement, the Warning/Error value (Field 9) is null. If a Warning or Error is generated, the output would be as follows:

```
 ,22 SEP 2005, 10:01:07, , , , , , Warning 2 - Analog Warning
1       2         3     4 5 6 7 8              9
```

Also, in a warning or error condition, some values are not output because a measurement does not take place.

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

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 or Ethernet (port 23). For information on establishing a connection, consult Appendix C: Connecting to a PC. 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**.
The serial port should be set to the following:

Bits Per Second: 9600

Data Bits: 8

Parity: None

Stop Bits: 1

Flow Control: Hardware

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 **Citizen, Seiko, or Epson**. If no printer is attached to the Analyzer, choose **No Printer**.
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

(Sievers 900 On-Line TOC Analyzer Only)

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.

When DataGuard is enabled, you can enable or disable **Binary Input**. However, the Analyzer adds an audit trail entry when binary starts and stops analysis in order to comply with 21 CFR Part 11.

Setting Alarm Values

(Sievers 900 On-Line TOC Analyzer Only)

The Analyzer has two customizable alarm outputs that can be triggered if the measured TOC, TC, or IC exceeds a set value or if a warning or error occurs. By default, both 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 63.

1. Select the **I/O** tab.
2. Press the **Alarm 1** or **Alarm 2** button.
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** — The alarm is triggered when a specified value is exceeded. If you select a Value of **TOC**, **TC**, or **IC**, press the **Level** button to set the alarm threshold.
    - **Warn/Error** — The alarm is triggered when the Analyzer issues a warning or error.
    - **Error** — The alarm is triggered when the Analyzer issues an error.
    - **Warning** — The alarm is triggered when the Analyzer issues a warning.
    - **Break In** — The alarm is triggered after five unsuccessful log in attempts by a single User ID. See "Reactivating Inactivated User Accounts" on page 122 for more information.
    - **Response Limit** — The alarm is triggered when the TOC level exceeds the expected value (in PPB) as determined by the last system suitability verification. For more information, see "Performing Pharma Tests" on page 142.
    - **Standby** — The alarm is triggered when the Analyzer enters standby (non-analysis) mode. For example, this alarm can be triggered when the Analyzer becomes idle, or when the reagent syringe is filling and thus analysis has paused.
5. Press the **Menu** button when you are done.

Using the Ethernet Connection and Modbus

Before data can be exported via Ethernet, you must enable Modbus and configure the Analyzer's IP address. The connection can be made using a fixed IP address or a dynamic IP address acquired through the DHCP communications protocol.

Note: *You may need assistance from your network administrator or Information Technology (IT) department to set the IP address correctly for your network*

For more information, refer to Appendix B: Modbus Map.

1. Select the **I/O** tab.
2. Press the **Modbus** button. The **Modbus** screen appears.

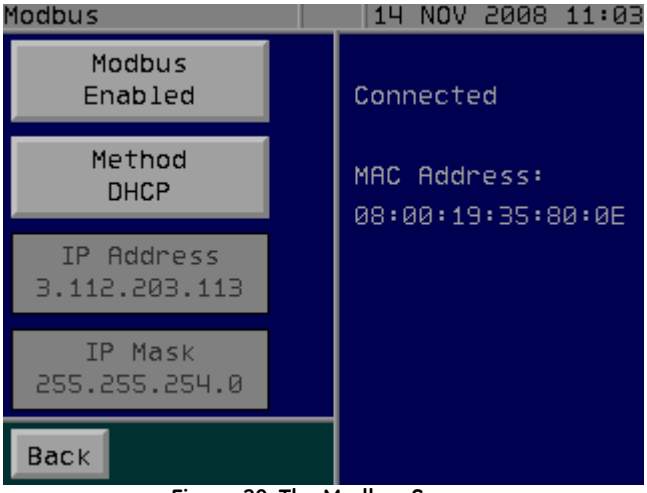


Figure 20: The Modbus Screen

3. Press the **Modbus** button, and select **Enabled.**
4. Press the **Method** button and select either **DHCP** or **Fixed**. If you select **Fixed**, press the **IP Address** and **IP Mask** buttons and enter the appropriate addresses.
5. Press the **Back** button.

When exporting data via the Ethernet port, configure HyperTerminal to work in TCP/IC and use Port 23.

When connected to your PLC, the 900 series Analyzers will utilize Modbus. The Modbus Map is located in Appendix B: Modbus Map. Set up the polling of the PLC to communicate via the registers listed in the Modbus Map.

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, Pharma tests, and other advanced features. Refer to Chapter 6, "Calibration, Verification, and System Suitability" for more information on these functions. You can also access the system information screen from this tab.

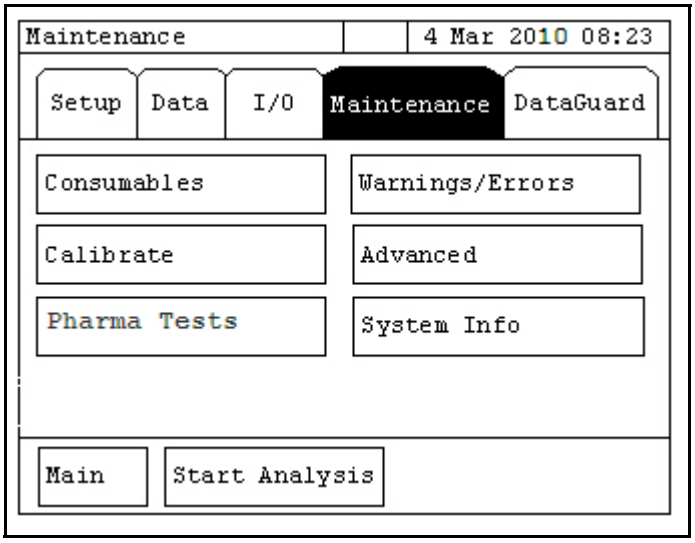


Figure 21: The Maintenance Tab

Displaying Consumables Status

The **Main** screen displays an overview graphic that indicates the relative life status of the Analyzer's consumables: UV lamp, pump tubing, resin bed, acid, and oxidizer. The reagents' status is based on remaining calendar life and an estimate of remaining volume (based on the history of usage), whichever is most limiting. 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 and either the expiration date, the total days of usage, or the usage remaining.

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 Expiration Date for New Consumables" on page 176.

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 some 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 appears in the **Menu** screen header when a warning has been issued and the **E** icon appear when an error has been issued; if both a warning and an error has 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

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.
   - **Export** — Send the warning/error to the serial (RS-232) or USB port.
   - **Print** — Send 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 is given in “Warnings and Error Messages” on page 182.

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.

Printing the Current Constants Values

Calibration constants, reagent flow rates, and other key parameters are stored in RAM. 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.

Changing the Display Mode

By default, the Analyzer displays the last TOC value in the largest size font on the main screen. If your application prioritizes IC or TC, you can change the display appropriately 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. Depending on which value you want displayed in the large font, select **TOC**, **IC**, or **TC**.

Naming the Analyzer Location

You can assign a name to the Analyzer that appears 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**.

Adjusting Display Contrast Settings

On newer versions of the 900 TOC Analyzer, the contrast cannot be displayed, and the **Contrast Adjust** button will be grayed out. On older models, however, the contrast 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.

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**.

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 131.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button, select the **Maintenance** tab, and press the **Calibrate** button.
3. Press the **Program Autozero** button.
4. Press the **State** button and select **On**.
5. Press the **Frequency** button and use the numeric 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 TOC Autozero.
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.

Selecting the Program Language

Sievers 900 TOC Analyzers are loaded with three program languages, including English, Chinese (Simplified), and Japanese.

To switch to a new program language

1. Select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advanced Setup** button.
4. Press the **Select Language** button. The Select Language screen appears.
5. Press the button for the new language.

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 197.

Configuring the Flow Sensor

Sievers 900 On-Line and Portable TOC Analyzers

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 placed 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. If flow stops and power to the Analyzer is interrupted, the Analyzer automatically attempts to restart analysis when power is restored.

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

Setting the Analyzer Clock and Time Zone

You can set the Analyzer clock by following these steps:

1. Select the **Maintenance** tab, and then press the **Advanced** button.
2. Press the **Clock** button. The **Clock** screen appears.
3. Press each date component button, enter the appropriate value, and press the **Enter** button.
4. Press the **Menu** button to return to the **Advanced** screen, and then press the **Advanced Setup** button. The **Advanced Setup** screen appears.
5. Press the **Time Zone** button, and specify the time zone via the two buttons on this screen:
   - **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 numeric 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.

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

Basic Hardware Operation Issues

Opening the Analyzer Case

The Sievers 900 Series TOC Analyzer cases are easy to open to facilitate routine maintenance tasks:

Sievers 900 On-Line TOC Analyzer

Open the Analyzer front panel by turning the two latches and swinging the panel door to the left; you will need to use a screwdriver or coin to release the bottom latch. 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 and the reagent enclosure at the left, are protected by covers. Remove the covers by loosening the set screws with a Phillips screwdriver. When closing, make sure that all the interior covers are back in place prior to closing the door.

Sievers 900 Laboratory TOC Analyzer

Open the Analyzer side panel using a screwdriver to loosen the two preset thumb screws on the back, and then pulling the panel away from the Analyzer. When closing the panel, be sure to seat it properly on the Analyzer before attempting to tighten the thumb screws. Tighten the screws finger-tight, and then tighten an additional 1/8 turn with a screwdriver.

Sievers 900 Portable TOC Analyzer

Open the side panels by unscrewing the two Phillips screws set into either side of the handle. Then, pull the panels away from the Analyzer. When closing the side panels, slide the foot tabs into the slots before replacing the two Phillips screws.

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. If you purchased an Ethernet upgrade for an older instrument, but the upgrade does not include a new display, a contrast adjustment may be required to the touch screen. In this case, a **Contrast** button appears on the **Advanced Setup** screen.

The IOS System

Sievers 900 On-Line and Portable TOC Analyzers

The Integrated On-Line Sampling (IOS) System (see Figure 22) provides a convenient sample inlet for on-line sample sources and standards in 40 mL vials. When the IOS System is being used, the stainless steel tubing must connect the IOS System to the **Sample Inlet** port.

When the Analyzer is configured in an on-line configuration, you do not need to change the configuration to analyze a standard with the IOS System. Simply stop analysis, slide the IOS System door open, wait 30 seconds for sample to drain from the IOS System, and then insert the 40-mL vial containing the standard.

After water flow to the IOS System has been established, the flow rate should be adjusted so that flow out of the waste line is between 30 - 300 mL/min. The flow rate 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.

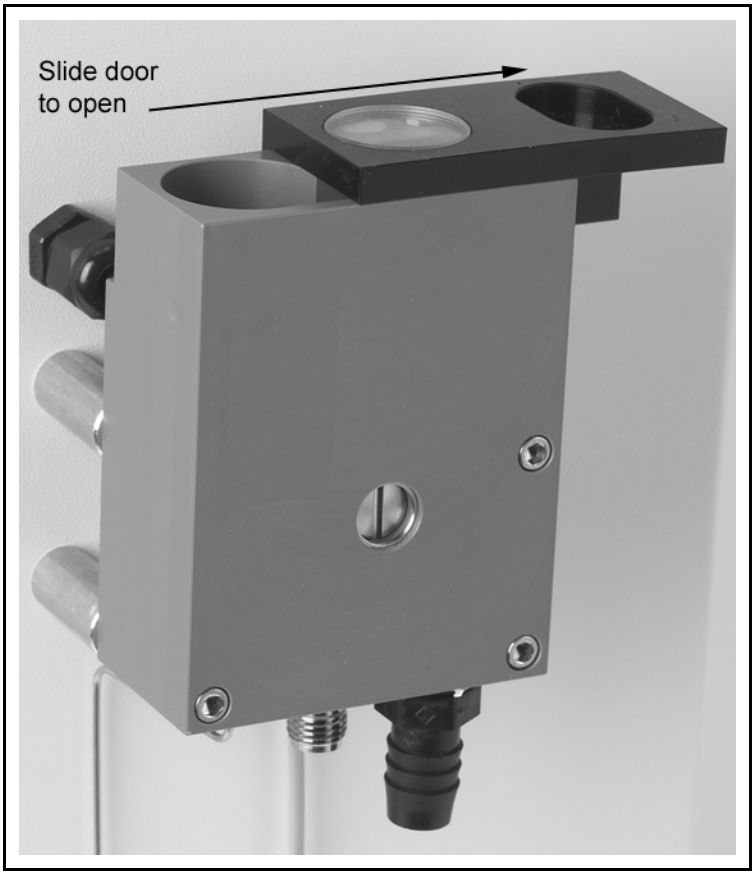


Figure 22: The IOS System

Always stop analysis before opening the 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 sharp needles designed to pierce the septa of sample vials. Do not put fingers or inappropriate materials into the IOS System.

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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.

Chapter 5. Password Protection and DataGuard

Overview

The Sievers 900 Series of TOC Analyzers offers two levels of security, one included with all Analyzers and the other available as an optional upgrade from GE Analytical Instruments.

The Password Protection feature is included with all Analyzers and provides a basic level of security. Password Protection allows for the use of one User ID and Password, which users are required to enter before starting and stopping analysis or gaining access to menu screens.

The DataGuard feature is available as an upgrade directly from GE Analytical Instruments. DataGuard encompasses the same functionality as the Password Protection feature, but adds support for regulation 21 CFR Part 11 by maintaining an audit trail for all user operations and allows for the use of 100 unique User IDs.

With DataGuard enabled, access is further restricted based on the User Levels assigned by the administrator. Figure 23: "Menu Map with Minimum User Level" on page 116 lists the minimum User Level required to access each of the Analyzer's menu screens.

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

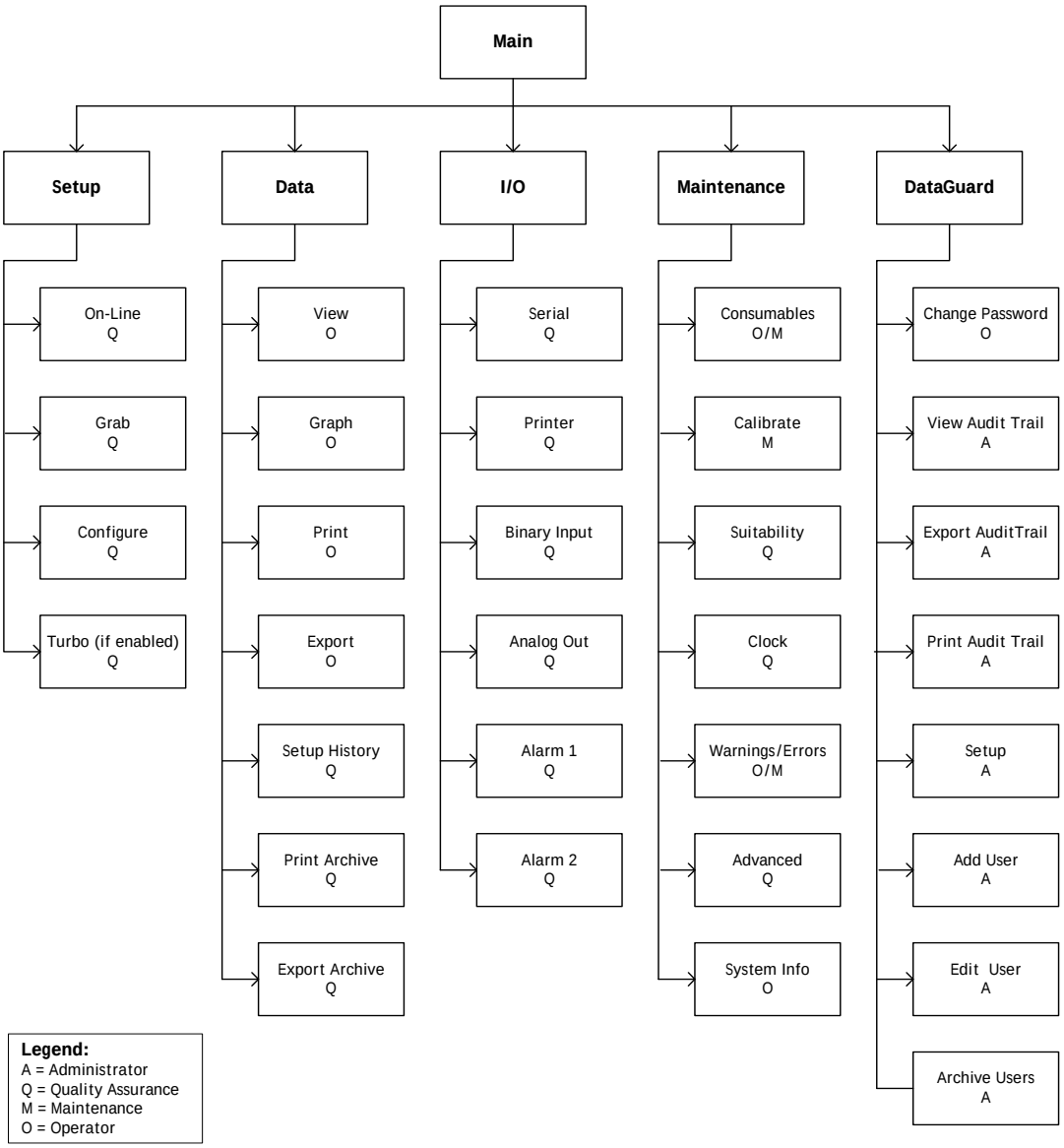

Figure 23: Menu Map with Minimum User Level

Using Password Protection

Enabling Password protection ensures that only authorized personnel access the Analyzer. Once Password security is enabled, all users must enter the default User ID and Password.

Enabling Password Protection

Enable Password protection by following the steps below.

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

   When Password security is accepted, the Analyzer security settings are immediately activated and you will be required to log in to the Analyzer with the default administrator User ID and Password.
3. Press the **Login** button and use the on-screen keyboard to enter the Login ID and Password.

   User ID: ADMIN

   Password: GEAI

   After Password has been enabled, you may want to specify the settings, as described below.

Changing 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 now activated, and you will need to use it starting with the next login.

Configuring Password Settings

After Password has been enabled, 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 user is automatically logged out. The default is 5 minutes. You can enter a value in the range of 1 to 30 minutes. This feature is automatically disabled by the Analyzer during audit trail archiving activities.
- **Password Min Len** — 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.

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 appears, press **OK**.

Password protection is immediately disabled. Note that if you decide to re-enable Password protection, you will need to use the Password that was active at the time Password protection was disabled; if you changed the Password from the default administrative Password, you should write down the changed Password and store it in a secure location in case you want to re-enable Password protection in the future.

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

   When the DataGuard is activated, the Analyzer security settings are immediately activated and you will be required to log in to the Analyzer with the default administrator User ID and Password.

   User ID: ADMIN

Password: GEAI

6. Press the **Login** button and enter the default administrator Login ID. Press **Enter**.
7. 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:

8. Press the **Menu** button and select the **DataGuard** tab.
9. Press the **Add User** button.
10. Specify a new User ID for the administrator and press the **Enter** button.
11. Specify the Password for the administrator User ID and press **Enter**.
12. Verify the Password and press **Enter**.
13. Press the **User Level** button and select **Administrator**.
14. Press the **Password Expired** button and select **False**.
15. Press the **Menu** button.
16. Press the **Logout** button. You will now use the new administrator account and delete the default account.
17. Press the **Login** button and enter the new User ID and Password you just created.
18. Select the **DataGuard** tab.
19. Press the **Edit User** button.
20. Use the arrow buttons to highlight the default administrator account and press **OK**.
21. Press the **User Status** button and select **Inactive**.
22. Press the **Menu** button to return to the **Menu** screen.

Note: After 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" on page 120), 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 appears 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 appears 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 23: "Menu Map with Minimum User Level" on page 116 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 122 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 122 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: Require a new user to change the Password upon log in so that it will be easy to remember and unknown to the administrator.

   - **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).

Note: Require a new user to change the Password upon log in so that it will be easy to remember and unknown to the administrator.

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.

Note: Require the user to change the Password upon log in so that it will be easy to remember and unknown to the administrator.

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 10 on page 125 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 accommodate approximately 6,000 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 6,000 entries. When the audit trail is almost full, a message will appear requiring that the audit trail be archived (either by printing or exporting). After printing or exporting, you will be prompted to erase the archived data from the instrument. Press **OK** to erase the data or **Cancel** to keep and overwrite.

The audit trail output format is shown in Table 9.

Table 9: Audit Trail Output Format

Field #	Field Contents	Format/Notes	Example
1	User ID	11 alpha-numeric characters (columns 1-11)	ADMIN 01
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
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 01

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 10: Record of User IDs

User ID	User's Name	Date Created	Date Archived

Chapter 6. Calibration, Verification, and System Suitability

Overview

This chapter describes the calibration and verification procedures for Analyzers running in On-Line or stand-alone Grab mode without the use of an Autosampler. I**f your Analyzer has Turbo mode enabled, do not follow these instructions**; refer instead to Chapter 9, "Turbo Operation" for Turbo calibration instructions.

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

The Model 900 TOC Analyzers can be calibrated using one of two methods: single-point calibration at 1, 5, 10, 25 *or* 50 ppm; or multi-point calibration at 1, 5, 10, 25 *and* 50 ppm. GE Analytical Instruments recommends that the Analyzer be calibrated in the field using a single-point calibration at a concentration that encompasses the range of interest. For customers typically operating below 1 ppm, GE Analytical Instruments recommends selecting the 1 ppm single-point calibration. Multi-point calibration calibrates the Analyzer over its entire operating range, and is available as an alternative procedure for customers. If you will be using the Autoreagent function, you must perform a multi-point calibration. The autoreagent function should not be used in applications where samples are expected to be less than 1ppm.

The Sievers 900 Series TOC Analyzers facilitate 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 vials, sampled via

the Analyzer's IOS System or vial port (*Sievers 900 Portable or On-Line TOC Analyzers*) or vial port (*Sievers 900 Portable Laboratory TOC Analyzer).*

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

Note: If the Analyzer does not have access to a continuous water supply (e.g., it is configured for Grab mode), one 40-mL vial of low-TOC (<50 ppb) DI water will be required for a reagent syringe flush prior to calibration.

If you use the Autoreagent feature, Autoreagent verification also should be performed, but only after the sample flow rate has been calibrated, and the Multi-Point TOC Calibration has been calibrated and verified.

Required Calibration Supplies

The number of standards required for the calibration procedure depends on whether you choose a multi-point or single-point calibration. Standards vials are inserted into the IOS System or vial port as prompted by the Analyzer's on-screen instructions. Refer to Table 11 through Table 14 for the standards required for multi-point calibration, single-point calibration, calibration verification, and system suitability.

A multi-point calibration should require approximately 5.5 hours to complete, and single-point calibration should require approximately 1.5 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 combined Calibration & Verification Sets. All standards are provided in 40-mL vials. Standard sets for validation (System Suitability, Accuracy & Precision, Linearity, Robustness, and Specificity can be purchased individually, or as a combined Validation Set.

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 161866 9337 or office@GEInstruments.co.uk.

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

Sievers multi-point calibration standards sets include all TOC and IC standards shown in Table 11.

Table 11: Standards Required for Multi-Point Calibration

TOC Calibration Standards
Calibration Blank
1 ppm TOC (as KHP)
5 ppm TOC (as KHP)
10 ppm TOC (as KHP)
25 ppm TOC (as KHP)
50 ppm TOC (as KHP)
IC Calibration Standards
1 ppm IC (as Na_2CO_3)
5 ppm IC (as Na_2CO_3)
10 ppm IC (as Na_2CO_3)
25 ppm IC (as Na_2CO_3)
50 ppm IC (as Na_2CO_3)

Note: 1 ppm = 1 mg C/L, 1 ppb = 1 µg C/L

Sievers single-point calibration standards should be purchased in a concentration that is appropriate for your application; sets include one vial of reagent water and one vial each of TOC and IC in the selected concentration. For customers typically operating below 1 ppm, GE Analytical Instruments recommends selecting the 1 ppm single-point calibration. The available concentrations are shown in Table 12.

Table 12: Standards Required for Single-Point Calibration

TOC Calibration Standards
Calibration Blank
1, 5, 10, 25, or 50 ppm TOC (as KHP)
IC Calibration Standards
1, 5, 10, 25, or 50 ppm IC (as Na_2CO_3)

Note: 1 ppm = 1 mg C/L, 1 ppb = 1 µg C/L

Calibration verification standards also should be purchased in a concentration that is appropriate for your application; sets include one vial of reagent water blank and one vial each of TOC and IC in the selected concentration. The available concentrations are shown in Table 13.

Table 13: Standards Required for Calibration Verification

Verification Standards (TOC and IC)
Verification Blank
500 ppb or 1, 2, 5, 10, 25, or 50 ppm TOC (as sucrose)
500 ppb or 1, 2, 5, 10, 25, or 50 ppm IC (as Na_2CO_3)

Note: 1 ppm = 1 mg C/L, 1 ppb = 1 µg C/L

System suitability standards sets include the standards shown in Table 14.

Table 14: Standards Required for System Suitability Verification

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

Note: 1 ppm = 1 mg C/L, 1 ppb = 1 µg C/L

Autoreagent calibration standards sets include the standards shown in Table 15.

Table 15: Standards Required for Autoreagent Calibration

Reagent Water
25 ppm TOC (as KHP)
50 ppm TOC (as nicotinamide)
25 ppm IC (as Na_2CO_3)

Note: 1 ppm = 1 mg C/L, 1 ppb = 1 µg C/L

Autoreagent verification standards sets include the standards shown in Table 16.

Table 16: Standards Required for Autoreagent Verification

Reagent Water
25 ppm TOC (as sucrose)
50 ppm TOC (as sucrose)
50 ppm IC (as Na_2CO_3)

Note: 1 ppm = 1 mg C/L, 1 ppb = 1 µg C/L

Preparing for Calibration

Export Current Constants

Prior to performing any calibration procedure, export the current constants, in the event they need to be re-loaded or referred to in the future. To export the constants, follow these steps:

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

   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.

Note: If you want to manually calculate the Single-Point Calibration formulas for your records, you must print the Calibration History from the Analyzer before and after performing the new calibration, in order to have access the values of the TC Slope and IC Slope.

Perform Annual Maintenance Tasks

Before calibrating the Analyzer, perform annual maintenance tasks as appropriate, such as replacing the sample pump tubing, UV lamp, chemical reagents, and resin bed. In particular, if the calibration coincides with the Analyzer's annual maintenance, first replace the consumables before proceeding; for more information, see "Replacing the Ion Exchange Resin (Resin Bed)" on page 170.

Perform a TOC Autozero

The optional TOC Autozero corrects for minor differences in the response of the two CO_2 sensors. This adjustment is critical only for the determination of low-level TOC concentrations. **Only perform this procedure before calibrating the Analyzer if you regularly analyze samples with TOC <50 ppb**.

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.

The TOC Autozero can require between 1-12 hours to complete, but it typically requires less than 2 hours when the Analyzer has been measuring water containing 50 ppb TOC or less.

Note: The TOC Autozero is part of the calibration procedure only if the Analyzer is being used with water that is less than 50 ppb TOC. If the Analyzer is being used off-line or to analyze water that is greater than 50 ppb, you do not need to perform a TOC autozero.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, make sure the lever is in the **Inline** position.
3. Press the **Menu** button, select the **Maintenance** tab and press the **Calibrate** button.
4. Press **Run TOC Autozero**.
5. Make sure that a water source is connected and press **Start**.
6. Wait for the TOC Autozero to complete before proceeding with the calibration.

Perform a Sample Flow Rate Calibration

Prior to calibrating the Analyzer, replace the pump tubing as part of the annual maintenance on the Analyzer (see “Replacing the Sample Pump Tubing” on page 168). Then, perform a sample flow rate calibration, as described in this section.

Before proceeding, make sure you have saved the current Analyzer system settings, as described in “Export Current Constants” on page 131.

For the sample flow rate calibration, you will need the following items from the Analyzer's accessories kit:

- 10-mL graduated cylinder
- 1/8" OD tubing with 1/8" Swagelok fitting for waste line, approximately 12" long
- Plug for IOS waste line

Perform the sample flow rate calibration as follows:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button. Select the **Maintenance** tab, and then press the **Calibrate** button.
3. Press the **Flow Rate Cal** button.
4. Ensure the Analyzer is connected to a source of water, and then press **Next** to continue.
5. The Analyzer will then flush the acid and oxidizer out of the sample line.

6. When the flush is completed, the Analyzer will prompt guide you to attach the 12" waste line (from the Analyzer's accessories kit).

   To install the 12" waste line, your must first disconnect the 7/16" nut that connects to the port labeled **Waste** on the side of the Analyzer and gently pull the tubing aside; attach the rubber plug to this tubing. Attach the 12" waste line by securing the fitting with a 7/16" open-end wrench.

   When the 12" waste line is installed, press **Next** to continue.

7. The Analyzer will fill the waste line with sample water.

8. When the waste line is filled, the Analyzer will instruct you to insert the end of the waste line in a dry 10-mL graduated cylinder. Do so, and then press **Next** to continue.

9. The Analyzer will pump water into the 10-mL graduated cylinder for exactly 10 min. Then the Analyzer will stop pumping, and it will ask you if the collection of the water was satisfactory (for example, no spilling occurred no substantial air bubbles were observed).
   If you want to repeat the water collection, dry the graduated cylinder and press **Repeat**. If the water collection was satisfactory, press **Next** to continue.

10. Measure the volume of water in the graduated cylinder to the nearest 0.1 mL. Using the keypad on the display, enter the volume and press **Enter**. The volume should be between 3.0 and 7.0 mL; if it is not, follow the on-screen prompts to resolve the problem.

11. The Analyzer will automatically adjust the sample flow rate, and it will request you to verify that the adjustment is accurate. To do so, first drain and dry the 10-mL graduated cylinder. After you replace the waste line into the graduated cylinder, press **Next** to continue.

12. The Analyzer will pump water into the 10-mL graduated cylinder for exactly 10 min. Then the Analyzer will stop pumping, and it will ask you if the collection of the water was satisfactory. If you want to repeat the water collection, dry the graduated cylinder and press **Repeat**. If the water collection was satisfactory, press **Next** to continue.

13. Measure the volume of water in the graduated cylinder to the nearest 0.1 mL. Enter the volume using the keypad on the display, then press **Enter**.

14. The sample flow rate calibration summary screen is then displayed. The Analyzer indicates if the sample flow rate calibration passed or failed based on the following criterion:

    - the adjusted sample flow rate must be between 0.48 and 0.52 mL/min

    If this condition is satisfied, press **Apply** to accept the sample flow rate calibration and continue.

    If this condition is not satisfied, press the **Cancel** button to reject the sample flow rate calibration. You may need to perform the sample flow rate calibration procedure again. However, first check that the sample tubing has been installed correctly. Also, look for any leaks inside the Analyzer and correct them. Consult the chapter called "Troubleshooting" (starting on page page 181) to determine if there is another problem with the Analyzer.

15. Disconnect the 12" waste line and restore the original waste line.

To remove the 12" waste line, use a 7/16" open-end wrench to loosen the fitting from the **Waste** port on the side of the Analyzer; store the 12" waste line in a secure, clean place. Then, reattach the stainless steel tubing by removing the rubber plug and securing the 7/16" nut to the **Waste** port.

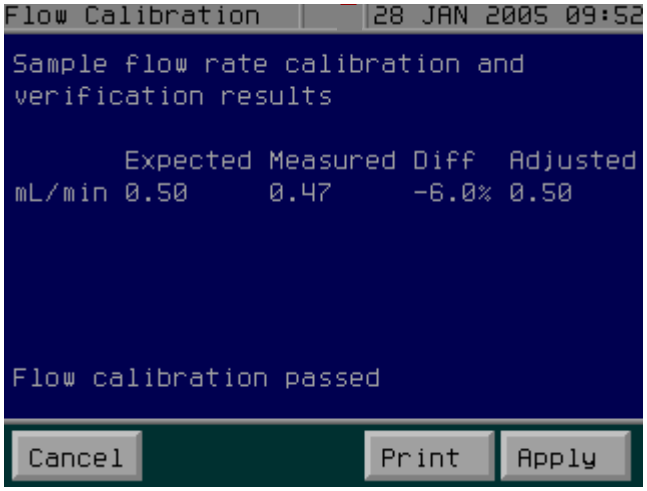

Figure 24: The Sample Flow Rate Calibration Summary Screen

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 vial to protect against introducing foreign particles, TOC, and conductivity.

You can trace the use of each standard by recording the lot number on the applicable Calibrate screen.

After following these steps, proceed either to “Performing a Single-Point Calibration” below or to “Performing a Multi-Point Calibration” on page 137.

Performing a Single-Point Calibration

Before performing a single-point calibration, save the current Analyzer system settings and evaluate whether a TOC Autozero is required, as described under the section called "Preparing for Calibration" on page 131.

GE Analytical Instruments recommends selecting a standards concentration that encompasses the normal range of TOC measurement for your application.

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

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, place the lever into the **Bypass** position. If you leave the lever in the **Inline** position, a warning message will display later.
3. Select the **Maintenance** tab and press the **Calibrate** button.
4. Press the **Single Pt Cal** button.
5. If you have not performed a reagent flush in the last 8 hours, you must perform one now. Make sure the Analyzer is connected to a water supply and press **Yes**.

   If you have performed a reagent flush in the last 8 hours, press **No** to skip the flush and proceed to Step 6.
6. When the flush is complete, press **OK** to continue. Open the bag containing the standards vials, and avoid touching the septa to protect against introducing foreign particles.
7. Press the **Cal. Standard** button, select the concentration of the standard you will be measuring, and push **Next**.

   At this point, the prompts on the Analyzer's display screen will help guide you through the calibration process.

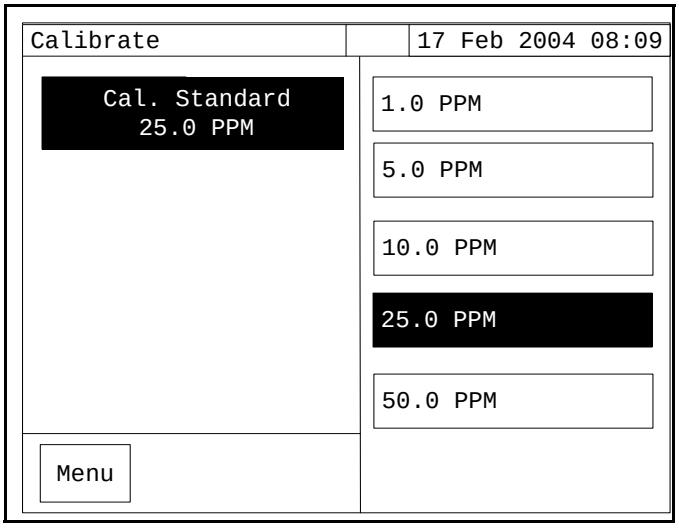

Figure 25: Selecting the Concentration for a Single-Point Calibration

8. To enter the lot number of the standard vial, press **Lot.** The alpha or numeric keyboard appears. Press the **Number** or **Alpha** button to toggle to the other keyboard, as needed.)
9. Use the keyboard(s) to enter the lot identifier, and then press **Enter**. The Calibrate screen appears.
10. Insert the Calibration Blank into the IOS System or vial port, and press **Next**.
11. When prompted, remove the Calibration Blank from the IOS System or vial port, insert the TOC Calibration Standard (as KHP), and press **Next**.
12. When prompted, remove the TOC Calibration Standard (as KHP) from the IOS System or vial port, insert the IC Calibration Standard (as Na_2CO_3), and press **Next**.
13. After the IC Calibration Standard (as Na_2CO_3) has been analyzed, the calibration summary screen is displayed. The Analyzer indicates if the calibration passed or failed based on the following criterion:

    - The % Diff for the IC standard is ±10% or less.

    If this condition is satisfied, press **Apply** to accept the calibration and continue.

    If this condition is not satisfied, 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 181 to determine if there is a problem with the Analyzer.

    Percent difference is calculated as follows:

$$\%\ \text{Diff} = \frac{\text{Measured Concentration - Expected Standard Concentration}}{\text{Expected Standard Concentration}} \times 100\%$$

    The Expected TC Concentration equals the Certified TOC Concentration of the standard, plus the measured TOC Concentration in the Calibration Blank, plus the Measured IC Concentration of the standard.

$$\text{TCexp} = \text{TOCstd} + \text{TOCblank} + \text{ICstd}$$

    Expected IC is the measured value, with the lamp off, from the TC channel for the IC standard, using the new TC calibration. The summary screen also displays the measured values using the existing calibration, the difference between measured and expected values and the values that would be obtained using the new calibration values (adjusted values).

$$\text{ICexp} = (\text{TCreported} + \text{TOCoffset}) \times \frac{\text{New TCslope}}{\text{Old TCslope}} - \text{TOC offset}$$

Note: If you want to manually calculate the Single -Point Calibration formulas for your records, you must print the Data History and the Calibration Constants from the Analyzer before and after performing the new calibration, in order to have access the values of the TC Slope and IC Slope.

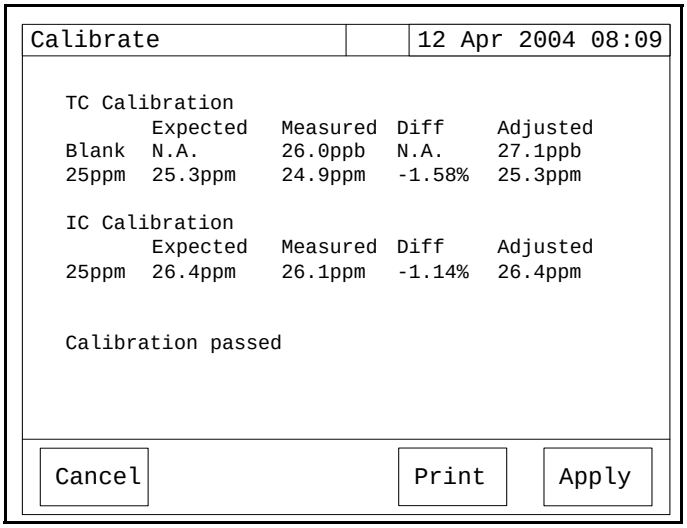

Figure 26: Reviewing TC and IC Values from a Single-Point Calibration

14. Remove the IC Calibration Standard from the IOS System or vial port.
15. You should now verify the calibration. Proceed to "Performing a Calibration Verification" on page 140 for instructions.

Performing a Multi-Point Calibration

Before performing a multi-point calibration, save the current Analyzer system settings and evaluate whether a TOC Autozero is required, as described under the section called "Preparing for Calibration" on page 131.

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

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, place the lever into the **Bypass** position. If you leave the lever in the **Inline** position, a warning message will display later.
3. Press the **Menu** button, select the **Maintenance** tab, and then press the **Calibrate** button.
4. Press the **Multi Pt Cal** button.
5. Do one of the following:
   - If you have not performed a reagent flush in the last 8 hours, you must perform one now. Make sure the Analyzer is connected to a water supply and press **Flush**. When the flush is complete, press **OK** to continue.
   - If you have performed a reagent flush in the last 8 hours, press **Skip** to ignore a flush.

6. At this point, the prompts on the Analyzer's display screen will help guide you through the calibration process. Open the bag containing the standards vials, and avoid touching the septa to protect against introducing foreign particles.
7. To enter the lot number of the standard vial, press **Lot.** The alpha or numeric keyboard appears. Press the **Number** or **Alpha** button to toggle to the other keyboard, as needed.)
8. Use the keyboard(s) to enter the lot identifier, and then press **Enter**. The Calibrate screen appears.
9. Insert the Calibration Blank into the IOS System or vial port, and press **Next**.
10. When prompted, remove the Calibration Blank from the IOS System or vial port, insert the 1 ppm TOC Calibration Standard (as KHP), and press **Next**.
11. When prompted, remove the 1 ppm TOC Calibration Standard (as KHP) from the IOS System or vial port, insert the 5 ppm TOC Calibration Standard (as KHP), and press **Next**.
12. When prompted, remove the 5 ppm TOC Calibration Standard (as KHP) from the IOS System or vial port, insert the 10 ppm TOC Calibration Standard (as KHP), and press **Next**.
13. When prompted, remove the 10 ppm TOC Calibration Standard (as KHP) from the IOS System or vial port, insert the 25 ppm TOC Calibration Standard (as KHP), and press **Next**.
14. When prompted, remove the 25 ppm TOC Calibration Standard (as KHP) from the IOS System or vial port, insert the 50 ppm TOC Calibration Standard (as KHP), and press **Next**.
15. After the 50 ppm TOC Calibration Standard (as KHP) has been analyzed, you will be prompted to enter the IC standards. Remove the 50 ppm TOC Calibration Standard (as KHP) from the IOS System or vial port, insert the 1 ppm IC Calibration Standard (as Na_2CO_3), and press **Next**.
16. When prompted, remove the 1 ppm IC Calibration Standard (as Na_2CO_3) from the IOS System or vial port, insert the 5 ppm IC Calibration Standard (as Na_2CO_3), and press **Next**.
17. When prompted, remove the 5 ppm IC Calibration Standard from the IOS System or vial port, insert the 10 ppm IC Calibration Standard (as Na_2CO_3), and press **Next**.
18. When prompted, remove the 10 ppm IC Calibration Standard from the IOS System or vial port, insert the 25 ppm IC Calibration Standard (as Na_2CO_3), and press **Next**.
19. When prompted, remove the 25 ppm IC Calibration Standard (as Na_2CO_3) from the IOS System or vial port, insert the 50 ppm IC Calibration Standard (as Na_2CO_3), and press **Next**.
20. After the 50 ppm IC Calibration Standard (as Na_2CO_3) has been analyzed, the calibration summary screen is displayed (see Figure 27 and Figure 28). Toggle between the values for each channel by pressing the **IC Data** and **TC Data** buttons. The Analyzer indicates if the calibration passed or failed based on the following criteria:

    - The R^2 is $\geq$0.990.
    - The % Diff for each IC standard is ±10% or less.

    If these conditions are satisfied, press **Apply** to accept the calibration and continue.

If these conditions are not satisfied, 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 181 to determine if there is a problem with the Analyzer.

The % Difference value is calculated as follows:

$$\% \text{ Diff} = \frac{\text{Measured Concentration - Expected Standard Concentration}}{\text{Expected Standard Concentration}} \times 100\%$$

The Expected TC Concentration equals the Certified TOC Concentration of the standard, plus the measured TOC Concentration in the Calibration Blank, plus the Measured IC Concentration of the standard.

$$TCexp = TOCstd + TOCblank + ICstd$$

The IC standards are measured with the UV lamp off. Under those conditions, the readings of the TC channel are expected to match the readings of the IC channel. Therefore, the Expected IC concentration equals the measurement made by the TC channel, while the Measured IC concentration equals the measurement made by the IC channel.

21. Remove the 50 ppm IC Calibration Standard from the IOS System or vial port.
22. You should now verify the calibration. Proceed to "Performing a Calibration Verification" on page 140 for instructions.

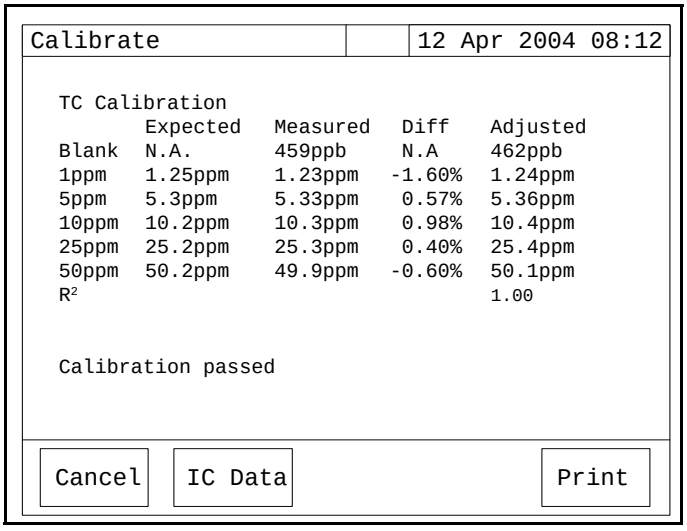

Figure 27: TC Values Summary Screen in a Multi-Point Calibration

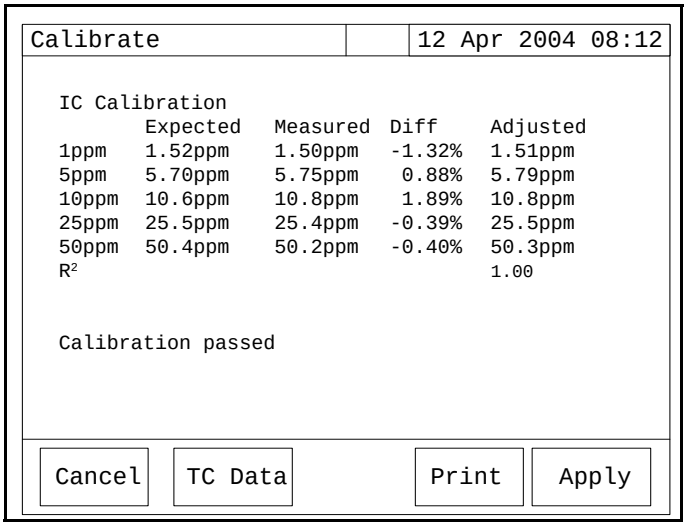

Figure 28: IC Values Summary Screen in a Multi-Point Calibration

Performing a Calibration Verification

Use the verification 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 tubing, UV lamp, resin bed, or reagents, and after calibration.

The same verification procedure is used whether a multi-point or single-point calibration was performed. Verification occurs at a single concentration, which you can select. Choose a concentration that is appropriate for your application. Verification can be repeated at multiple concentrations if it is desirable to verify the entire analytical range of the instrument instead of verification near the range of interest only.

Follow these steps to perform a calibration verification:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, make sure the lever is in the **Bypass** position. If you leave the lever in the **Inline** position, a warning message will display later.
3. Press the **Menu** button, select the **Maintenance** tab, and then press the **Calibrate** button.
4. Press the **Verify** button.
5. Do one of the following:
   - If you are performing the verification immediately after the calibration, press the **Skip** button to avoid flushing the reagent syringes. When the flush is complete, press **OK** to continue.
   - If there has been at least an eight-hour delay between performing the calibration and starting the verification, make sure the that Analyzer is connected to a water supply press **Flush** to perform a reagent flush now.

6. When the flush is complete, press **OK** to continue. Open the bag containing the standards vials, and avoid touching the septa to protect against introducing foreign particles.
7. Press the **Ver. Standard** button, select the concentration of the standard you will be measuring, and then push **Next**.

   At this point, the prompts on the Analyzer's display screen will help guide you through the verification process.
8. Insert the Verification Blank into the IOS System or vial port and press **Next**.
9. When prompted, remove the Verification Blank from the IOS System or vial port, insert the TOC Verification Standard (as sucrose), and press **Next**.
10. When prompted, remove the TOC Verification Standard (as sucrose) from the IOS System or vial port, insert the IC Verification Standard (as Na_2CO_3), and press **Next**.
11. After the IC Verification Standard (as Na_2CO_3) has been analyzed, the Verification summary screen is displayed. The Analyzer indicates if verification passed or failed based on the following criteria:
    - RSD for the TOC standard is ≤3%.
    - Blank has no criteria.
    - RSD for the IC standard is IC ≤3% and TC ≤3%.
    - TOC % Diff is ±7% or less for a 500 ppb or 1 ppm TOC standard.
    - TOC % Diff is ±5% or less for a 2, 5, 10, 25, or 50 ppm TOC standard.
    - IC % Diff is ±7% or less for a 500 ppb or 1 ppm IC standard.
    - IC % Diff is ±5% or less for a 2, 5, 10, 25, or 50 ppm IC standard.

    If these conditions are not satisfied and verification fails, you may need to perform the calibration and then the verification procedures again. However, first consult the chapter called "Troubleshooting" on page 181 to determine if there is a problem with the Analyzer.

    The % Difference value is calculated as follows:

$$\%\ \text{Diff} = \frac{\text{Measured Concentration - Expected Standard Concentration}}{\text{Expected Standard Concentration}} \times 100\%$$

    The Expected TC Concentration equals the Certified TOC Concentration of the standard, plus the measured TOC Concentration in the Calibration Blank.

$$\text{TOCexp} = \text{TOCstd} + \text{TOCblank}$$

    The IC standards are measured with the UV lamp off. Under those conditions, the readings of the TC channel are expected to match the readings of the IC channel. Therefore, the Expected IC concentration equals the measurement made by the TC channel, while the Measured IC concentration equals the measurement made by the IC channel.
12. Press the **OK** button to continue.
13. Remove the vial from the IOS System or vial port and slide the door closed.

14. If you have an ICR unit, return the lever to the **Inline** position.
15. If you use the Autoreagent feature, perform an Autoreagent calibration (proceed to "Performing an Autoreagent Calibration" on page 144).

Performing Pharma Tests

The Sievers 900 Series TOC Analyzers are designed to make Pharma tests easy. The Analyzer firmware performs all functions necessary to meet USP Chapter <643> or EP Chapter 2.2.44 or JP 16 specifications. The response efficiency and response limit are automatically calculated.

To perform the System Suitability Verification

While the System Suitability Verification is running, the Analyzer will display TOC value in real time on the screen.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, make sure the lever is in the **Bypass** position.
3. Select the **Maintenance** tab, and then press the **Pharma Tests** button. The **Pharma Tests** menu screen appears.
4. Press the **Suitability** button. At this point, the prompts on the Analyzer's display screen will help guide you through the system suitability verification process.
5. To enter the lot number of the standard vial, press **Lot.** The alpha or numeric keyboard appears. Press the **Number** or **Alpha** button to toggle to the other keyboard, as needed.
6. Use the keyboard(s) to enter the lot identifier, and then press **Enter**. The Calibrate screen appears.
7. Open the bag containing the standards vials, and avoid touching the septa to protect against introducing foreign particles.
8. Insert the Reagent Water (Rw) into the vial port or IOS System, and press **Next**.
9. When prompted, remove the Reagent Water (Rw) from the vial port or IOS System. Insert the 500 ppb Sucrose Standard (Rs), and press **Next**.
10. When prompted, remove the 500 ppb Sucrose Standard (Rs) from the vial port or IOS System, insert the 500 ppb Benzoquinone Standard (Rss), and press **Next**.
11. After the 500 ppb Benzoquinone Standard Solution (Rss) has been analyzed, the System Suitability Values screen is displayed. 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:

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

12. Press either the **Apply** or **Cancel** buttons, depending on whether you want the new data to be saved as the Analyzer's response limit.

    If you apply the Response Limit, this new value determines when to trigger the Analyzer's Response Limit alarm, when activated (see "Setting Alarm Values" on page 103).

13. Remove the vial from the vial port or IOS System and slide the door closed.
14. If you have an ICR unit, return the lever to the **Inline** position.

To perform the JP Protocol

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, make sure the lever is in the **Bypass** position.
3. Select the **Maintenance** tab, and then press the **Pharma Tests** button. The **Pharma Tests** menu screen appears.
4. Press the **JP Protocol** button. At this point, the prompts on the Analyzer's display screen will help guide you through the system suitability verification process.
5. To enter the lot number of the standard vial, press **Lot.** The alpha or numeric keyboard appears. Press the **Number** or **Alpha** button to toggle to the other keyboard, as needed.)
6. Use the keyboard(s) to enter the lot identifier, and then press **Enter**. The Calibrate screen appears.
7. Open the bag containing the standards vials, and avoid touching the septa to protect against introducing foreign particles.
8. Insert the Reagent Water (Rw) into the vial port or IOS System, and then press **Next**.
9. When prompted, remove the Reagent Water (Rw) from the vial port or IOS System. Insert the 500 ppb Sodium Dodecyl Benzene Sulfonate (SDBS) Standard, and press **Next**.
10. After the 500 ppb SDBS Solution has been analyzed, the JP16 Protocol Values screen appears. The Analyzer indicates if the JP16 Protocol passed or failed[9] based on the following criteria:
    - TOC Blank Average $\leq$ 250 ppb
    - Blank-Corrected Average $\geq$ 450 ppb.
11. Remove the vial from the vial port or IOS System, and slide the door closed.
12. If you have an ICR unit, return the lever to the **Inline** position.

[9]The Pass/Fail test uses rounded values.

Performing an Autoreagent Calibration

If you use the Autoreagent function, you should perform an Autoreagent Calibration after you have performed annual maintenance on the Analyzer, including a sample flow rate calibration (page 132), Analyzer Multi-Point Calibration (page 137), and Multi-Point Calibration Verification (page 140). You must first perform a multi-point calibration before performing the autoreagent calibration. The autoreagent function should not be used in applications where samples are expected to be less than 1 ppm.

When you are ready to perform the Autoreagent calibration, follow the steps described in "Preparing for Calibration" on page 131 and then follow this procedure:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, make sure the lever is in the **Bypass** position.
3. Press the **Menu** button, select the **Maintenance** tab, and then press the **Calibrate** button.
4. Press the **Autoreagent Cal** button.
5. To enter the lot number of the standard vial, press **Lot.** The alpha or numeric keyboard appears. Press the **Number** or **Alpha** button to toggle to the other keyboard, as needed.)
6. Use the keyboard(s) to enter the lot identifier, and then press **Enter**. The Calibrate screen appears.
7. Open the bag containing the standards vials, and avoid touching the septa to protect against introducing foreign particles. At this point, the prompts on the Analyzer's display screen will help guide you through the Autoreagent calibration process.
8. Insert the Reagent Water into the IOS System or vial port, and press **Next**.
9. When prompted, remove the Reagent Water from the vial port or IOS System, insert the 25 ppm TOC (as KHP) standard, and press **Next**.
10. When prompted, remove the 25 ppm TOC (as KHP) standard from the vial port or IOS System, insert the 50 ppm TOC (as nicotinamide) standard, and press **Next**.
11. When prompted, remove the 50 ppm TOC (as nicotinamide) standard from the vial port or IOS System, insert the 25 ppm IC (as Na_2CO_3) standard, and press **Next**
12. The Autoreagent calibration summary screen is displayed. This screen presents data obtained during preliminary measurements of the standards. (See page 90 for a description of the preliminary measurement.)

    The peak times measured for the 25 ppm and 50 ppm TOC Standards are listed first. The median peak time for each TOC Standard is used in the Autoreagent calibration. The difference between the two peak times is a criterion to determine if the Autoreagent calibration passed or failed. The median peak time of the 50 ppm TOC Standard must be from 20 to 100 seconds less than the median peak time of the 25 ppm TOC Standard.

    The summary screen then lists the measurements made on the 25 ppm IC Standard. Four measurements of the IC Standard were made after the preliminary measurement. The first of these is rejected, as in any calibration procedure. The remaining three measurements are statistically evaluated using the Q-test, and one of those three measurements may be rejected. The average of the two to

three valid measurements is presented as the IC Expected Concentration. The TC Expected Concentration is calculated the same way. The RSDs of the valid IC and TC measurements also are listed.

The summary screen lists the average of ten preliminary measurements made at the IC and TC channels, along with the RSD of those preliminary measurements.

The Analyzer indicates if the Autoreagent Calibration passed or failed based on the following criteria:

- The median peak time of the 50 ppm TOC Standard is from 20 to 100 seconds less than the median peak time of the 25 ppm TOC Standard.
- The RSD of the valid expected IC and TC concentration measurements is 3% or less.
- The RSD of the IC and TC preliminary measurements is 5% or less

13. If the acceptance criteria are satisfied, press **Apply** to accept the Autoreagent calibration and continue.
14. Remove the 25 ppm IC (as Na_2CO_3) Standard from the IOS System or vial port.
15. You should now verify the Autoreagent calibration. Proceed to "Performing an Autoreagent Verification" on page 145 for instructions.

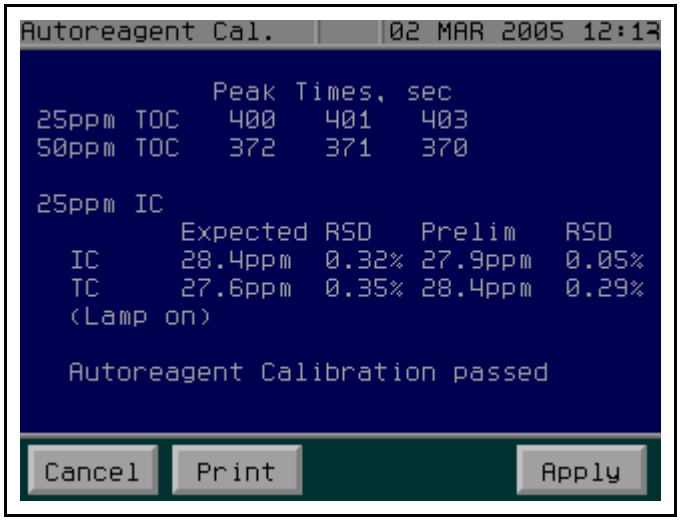

Figure 29: The Autoreagent Calibration Summary Screen

Performing an Autoreagent Verification

Use the Autoreagent verification to confirm the Analyzer's current Autoreagent calibration is accurate. GE Analytical Instruments recommends performing the Autoreagents verification after replacement of pump tubing and after Autoreagent calibration.

The sample flow rate calibration (see page 132) should always be performed after replacement of the pump tubing and before the Autoreagents verification.

To perform the Multi-Point Calibration and Autoreagent calibration verification, follow this procedure:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, make sure the lever is in the **Bypass** position.
3. Press the **Menu** button, select the **Maintenance** tab, and then press the **Calibrate** button.
4. Press the **Autoreagent Ver** button.
5. To enter the lot number of the standard vial, press **Lot.** The alpha or numeric keyboard appears. Press the **Number** or **Alpha** button to toggle to the other keyboard, as needed.)
6. Use the keyboard(s) to enter the lot identifier, and then press **Enter**. The Calibrate screen appears.
7. Open the bag containing the standards vials, and avoid touching the septa to protect against introducing foreign particles.

   At this point, the prompts on the Analyzer's display screen will help guide you through the Autoreagent calibration verification process.
8. Insert the Reagent Water into the IOS System or vial port, and press **Next**.
9. When prompted, remove the Reagent Water from the vial port or IOS System, insert the 25 ppm TOC (as sucrose) standard, and press **Next**.
10. When prompted, remove the 25 ppm TOC (as sucrose) standard from the vial port or IOS System, insert the 50 ppm TOC (as sucrose) standard, and press **Next**.
11. When prompted, remove the 50 ppm TOC (as sucrose) standard from the vial port or IOS System, insert the 50 ppm IC (as Na_2CO_3) standard, and press **Next**
12. The Autoreagent verification summary screen is displayed (see Figure). This screen presents data obtained during the analysis of the standards using the Autoreagents function.

    The Expected TOC Concentrations for the 25 ppm and 50 ppm TOC Standards are listed first. These concentrations are the certified concentrations of the standards (i.e., 25.0 ppm and 50.0 ppm, respectively).

    The measured TOC concentrations are the average of the last three measurements made on each standard, using the acid and oxidizer flow rates selected by the Autoreagent function. The RSD of each measurement is listed, along with the % difference between the measured and expected concentrations.

    The % Difference is calculated as follows:

$$\%\ \text{Diff of TOC Standards} = \frac{\text{Measured Conc. - Expected Standard Conc.}}{\text{Expected Standard Conc.}} \times 100\%$$

    The summary screen then lists the preliminary measurements made at the IC and TC channels for the 50 ppm IC Standard. The % Difference between the preliminary measurements at the IC channel and the TC channel also is shown, and is calculated as follows:

$$\%\ \text{Diff of IC Standard} = \frac{\text{Prelim. IC Conc. - Prelim. TC Conc.}}{\text{Prelim. TC Conc.}} \times 100\%$$

The Analyzer indicates if the Autoreagent calibration verification passed or failed based on the following criteria:

- RSD of the last 3 valid TOC readings for the 25 and 50 ppm TOC standards is 5% or less
- % Diff of the 25 and 50 ppm TOC standards is ±5% or less
- % Diff between the IC and TC preliminary measurements (for the 50 ppm IC standard) is ±10% or less (as compared to the TC value)

13. Press the **OK** button to continue.
14. Remove the 50 ppm IC (as Na_2CO_3) Standard from the vial port or IOS System.
15. If you have an ICR unit, return the lever to the **Inline** position.

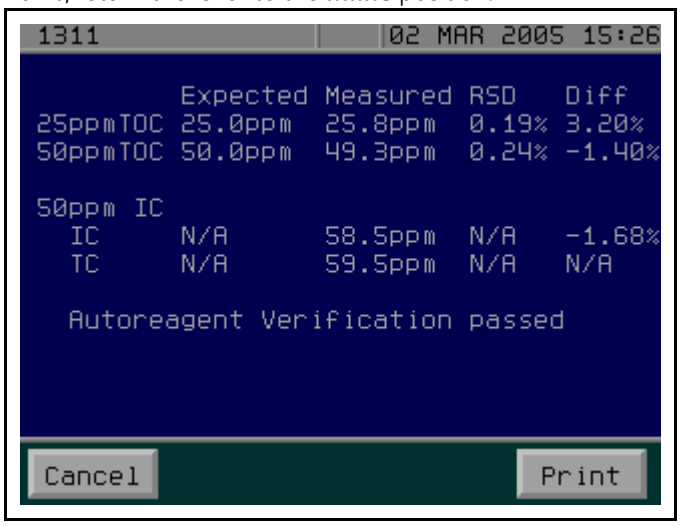

Figure 30: The Autoreagent Verification Summary Screen

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, and **Sys Suit** for system suitability results. These results also are included when you export the data history.

Worksheets

Worksheets for the Calibration, Verification, System Suitability, and Pharma Tests protocols follow:

Sample Flow Rate Calibration Worksheet

Company Name _____ Date _____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____

Sample pump tubing replaced before sample flow rate calibration (Y/N): _____ (Line 1)

Enter data for the sample flow rate calibration:

	Expected	**Measured**	**% Diff**	**Adjusted**
mL/min:	0.50	_____	_____	_____

$$\% \text{ Diff} = \frac{\text{Measured Flow Rate - 0.50}}{0.50} \times 100\%$$

Flow rate calibration pass/fail based upon the following criteria:

- The **Adjusted** sample flow rate is 0.48 to 0.52 mL/min

Sample Flow Rate Calibration Results: ☐ Passed ☐ Failed

Sample Flow Rate Calibration Action: ☐ Applied ☐ Canceled

Single-Point Calibration Worksheet

Company Name _____ Date _____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____

TOC Autozero Performed (Y/N): _____ (Line 1)

Reagent Flush Performed (Y/N): _____ (Line 2)

Concentration of Standard: _____ (Line 3)

Enter data for the TC Calibration:

	Expected	**Measured**	**% Diff**	**Adjusted**
Blank	N/A	_____	_____	_____
_____	_____	_____	_____	_____

Enter data for the IC Calibration:

	Expected	**Measured**	**% Diff**	**Adjusted**
_____	_____	_____	_____	_____

$$\% \text{ Diff} = \frac{\text{Measured Concentration - Expected Standard Concentration}}{\text{Expected Standard Concentration}} \times 100\%$$

Calibration pass/fail based upon the following criterion:

- The % Diff value for each IC standard is ±10% or less.

Calibration Results: ☐ Passed ☐ Failed

Calibration Action: ☐ Applied ☐ Canceled

Multi-Point Calibration Worksheet

Company Name _____ Date _____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____

TOC Autozero Performed (Y/N): _____ (Line 1)

Reagent Flush Performed (Y/N): _____ (Line 2)

Enter data for the TC Calibration:

	Expected	**Measured**	**% Diff**	**Adjusted**
Blank	N/A	_____	_____	_____
1 ppm	_____	_____	_____	_____
5 ppm	_____	_____	_____	_____
10 ppm	_____	_____	_____	_____
25 ppm	_____	_____	_____	_____
50 ppm	_____	_____	_____	_____
R^2				_____

Enter data for the IC Calibration:

	Expected	**Measured**	**% Diff**	**Adjusted**
1 ppm	_____	_____	_____	_____
5 ppm	_____	_____	_____	_____
10 ppm	_____	_____	_____	_____
25 ppm	_____	_____	_____	_____
50 ppm	_____	_____	_____	_____
R^2				_____

$$\%\ \text{Diff} = \frac{\text{Measured Concentration - Expected Standard Concentration}}{\text{Expected Standard Concentration}} \times 100\%$$

Calibration pass/fail based upon the following criteria:

- The R^2 is ≥0.990.
- The % Diff value for each IC standard is ±10% or less.

Calibration Results: ☐ Passed ☐ Failed

Calibration Action: ☐ Applied ☐ Canceled

Verification Worksheet

Company Name _____ Date _____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____

Concentration of Standard: _____ (Line 1)

Reagent Flush Performed (Y/N): _____ (Line 2)

Enter data for the TOC Verification:

	Expected	Measured	RSD	% Diff
Blank	N/A	_____	_____	_____
_____	_____	_____	_____	_____

Enter data for the IC Verification:

	Expected	Measured	RSD	% Diff
_____	_____	_____	_____	_____

$$\% \text{ Diff} = \frac{\text{Measured Concentration - Expected Standard Concentration}}{\text{Expected Standard Concentration}} \times 100\%$$

Pass criteria:

- RSD for the TOC standard is £3%.
- Blank has no criteria.
- RSD for the IC standard is IC £3% and TC £3%.
- TOC % Diff is ±7% or less for a 500 ppb or 1 ppm TOC standard.
- TOC % Diff is ±5% or less for a 2, 5, 10, 25, or 50 ppm TOC standard.
- IC % Diff is ±7 or less% for a 500 ppb or 1 ppm IC standard.
- IC % Diff is ±5% or less for a 2, 5, 10, 25, or 50 ppm IC standard.

Verification Results: ☐ Passed ☐ Failed

System Suitability Worksheet

Company Name _____ Date _____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____

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

Indicate whether the response efficiency results were applied or canceled:

☐ Apply ☐ Cancel

JP Protocol Worksheet

Company Name _____ Date _____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____ Standards Expiration Date _____

Standards Set Lot No. _____

TOC Blank Average _____ _____ (Line 1)

SDBS Average _____ _____ (Line 2)

SDBS Blank-Corrected Average _____ _____ (Line 3)

SDBS Average (Line 2) – TOC Blank Average (Line 1) = SDBS Blank-Corrected Average (Line 3)

Acceptance Criteria for JP Protocol:

- TOC Blank Average ≤ 250 ppb
- Blank-Corrected Average ≥ 450 ppb

☐ Pass ☐ Fail

Autoreagent Calibration Worksheet

Company Name _____ Date _____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____

Standard	Peak Time (sec)		
25 ppm TOC			
50 ppm TOC			

25 ppm IC Standard	Expected Conc. (ppm)	RSD (%)	Prelim. Meas. (ppm)	RSD (%)
IC				
TC				

Autoreagent calibration pass/fail based upon the following criteria:

- The median peak time of the 50 ppm TOC Standard is from 20 to 100 seconds less than the median peak time of the 25 ppm TOC Standard.
- The RSDs of the valid expected IC and TC concentration measurements are 3% or less.
- The RSDs of the IC and TC preliminary measurements are 5% or less

Autoreagent Calibration Results: ☐ Passed ☐ Failed

Autoreagent Calibration Action: ☐ Applied ☐ Canceled

Autoreagent Verification Worksheet

Company Name _____ Date _____

Analyst Name _____ Firmware Version _____

Analyzer Serial Number _____

TOC Standard	Expected TOC (ppm)	Measured TOC (ppm)	RSD (%)	% Diff
25 ppm TOC	25.0			
50 ppm TOC	50.0			

50 ppm IC Standard	Preliminary Measurement	% Diff
IC		
TC		NA

$$\%\ \text{Diff of TOC Standards} = \frac{\text{Measured Conc. - Expected Standard Conc.}}{\text{Expected Standard Conc.}} \times 100\%$$

$$\%\ \text{Diff of IC Standard} = \frac{\text{Prelim. IC Conc. - Prelim. TC Conc.}}{\text{Prelim. TC Conc.}} \times 100\%$$

The Analyzer indicates if the Autoreagent verification passed or failed

Autoreagents Verification pass/fail based upon the following criteria:

- RSD of the last 3 valid TOC readings for the 25 and 50 ppm TOC standards is 5% or less
- % Diff of the 25 and 50 ppm TOC standards is ±5% or less
- % Diff between the IC and TC preliminary measurements (for the 50 ppm IC standard) is ±10% or less (as compared to the TC value)

Autoreagent Verification Results: ☐ Passed ☐ Failed

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 17 below for the recommended maintenance schedule. Chemical reagents, the in-line filter, UV lamp, and pump tubing **must** be purchased from GE Analytical Instruments. The use of reagents from other sources or failure to replace the reagents on the prescribed replacement schedule will invalidate the Analyzer's warranty.

If you need additional assistance, contact GE Analytical Instruments Technical Support at 800.255.6964. Training by a qualified service technician also can be provided. Technical Support in the United Kingdom is available at 44 (0) 161 864 6800. In other countries, visit www.geinstruments.co to locate your representative.

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 18 on page 179).

This following applies to *all* Sievers 900 TOC Analyzer instrument models, except where noted.

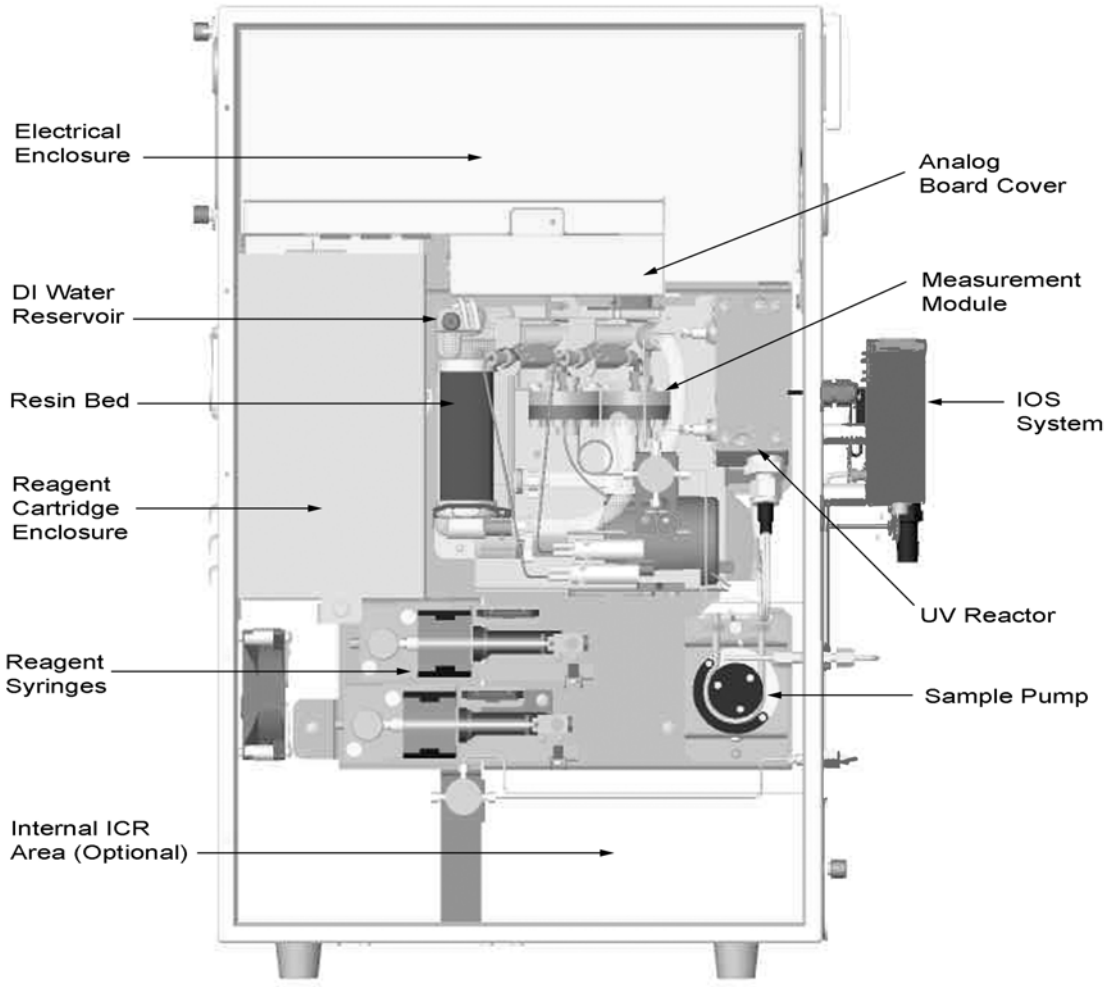

Figure 31: Interior Overview — Sievers 900 On-Line TOC Analyzer

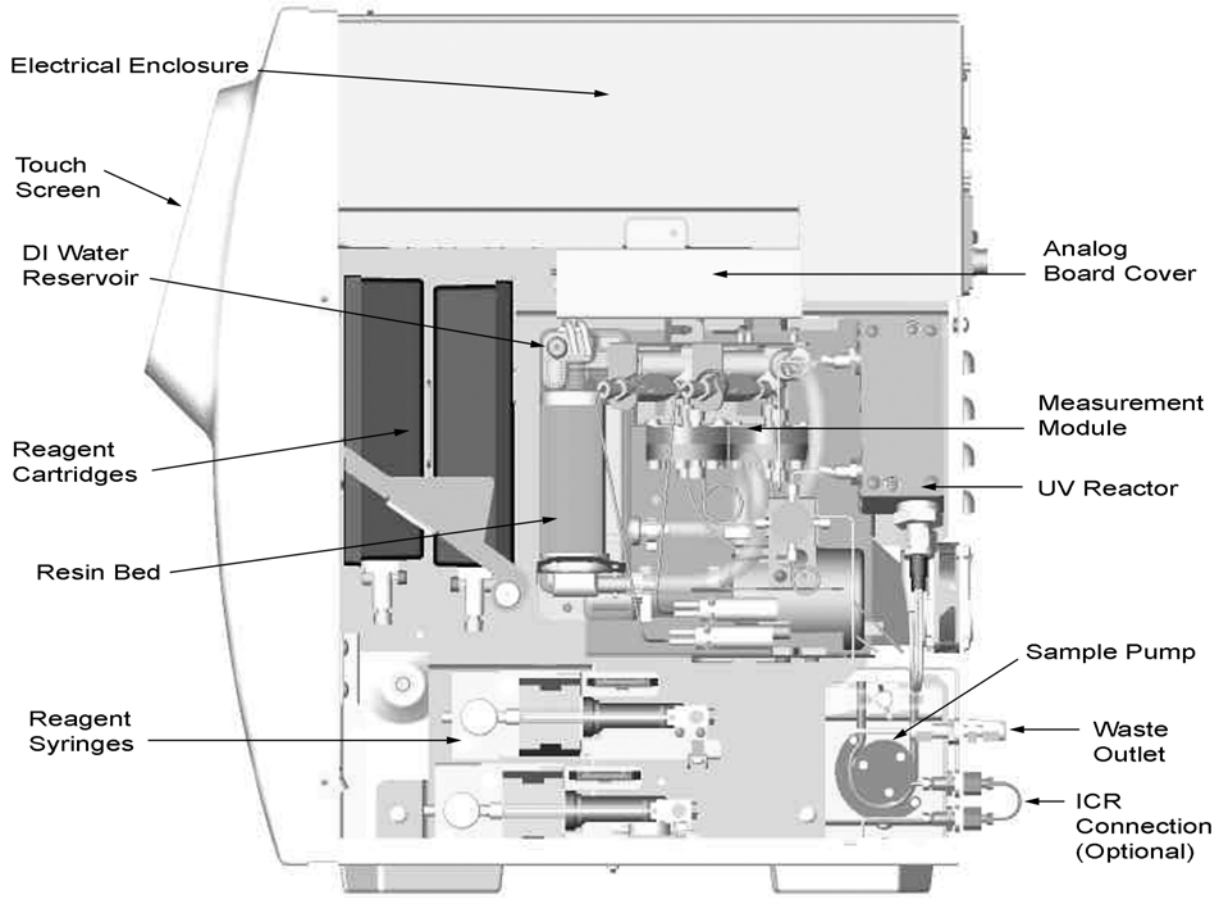

Figure 32: Interior Overview — Sievers 900 Laboratory TOC Analyzer

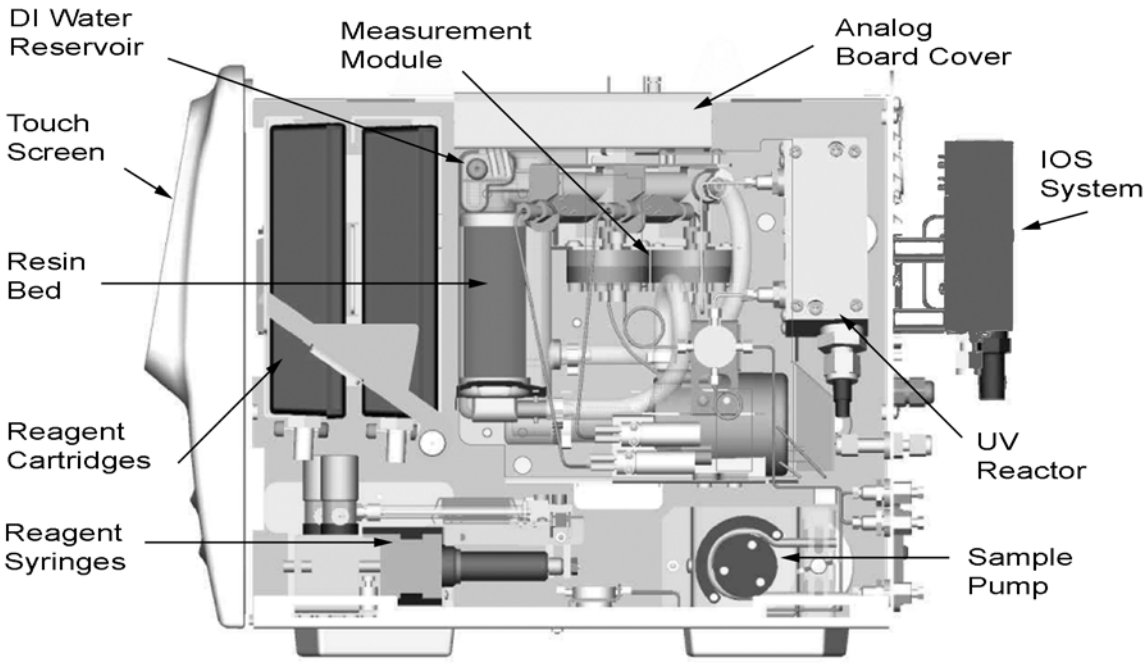

Figure 33: Interior Overview — Sievers 900 Portable TOC Analyzer

Table 17: Replacement Schedule for Sievers 900 Series Analyzer Consumables

Description	Typical Operating Life
DI Water Reservoir	Refill as needed (check when replacing reagents or UV lamp)
Oxidizer	3 calendar months maximum (depends on flow rate)
Acid	12 calendar months maximum (depends on flow rate)
UV lamp	6 months
Sample pump tubing	12 months
Resin Bed	Typically 12 Months (depends on water quality)
Inline filter (On-Line mode only)	Replace as needed (depends on water quality)

Checking and Refilling the DI Water Reservoir

The level of the DI water reservoir should be checked periodically and refilled as needed. For this procedure, you will need the water bottle from the TOC accessories kit filled with DI water. Refer to Figure 34 as needed.

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

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 case and locate the DI water reservoir.
4. Locate the fill line on the DI water reservoir, just below the rubber inlet cover. The line indicates the maximum water level. If you notice a gap between the water level and the fill line, you need to add DI water to the reservoir.
5. Remove the rubber inlet cover.
6. 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 reservoir. Fill the reservoir until the water level reaches the fill line.

Warning
Do not over-fill the DI water reservoir.

7. Replace the inlet cover by gently pushing it back into place on the reservoir.
8. If you need to replace other consumables, follow the procedures listed in the appropriate sections of this chapter. Otherwise, close the Analyzer case.

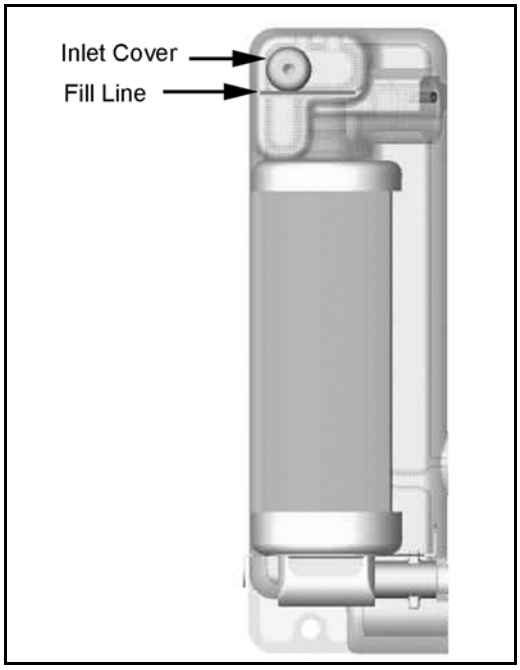

Figure 34: Filling the DI Water Reservoir

Replacing the Chemical Reagents

The oxidizer and acid reagents **must** be purchased from GE Analytical Instruments to ensure product purity and operating life. The use of reagents from other sources or failure to replace the reagents on the prescribed replacement schedule will invalidate the Analyzer's warranty.

Warning
Reagent containers are for single-use only: do not refill. Refilling or reusing reagent containers will void all Analyzer and parts warranties and nullify any performance claims.

Warning
To avoid exposure to the chemical reagents, wear acid-resistant gloves, protective clothing, and safety goggles or a face shield when changing the reagent supplies.

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 case and locate the reagent enclosure. Loosen the set screw and remove the reagent enclosure cover.

4. For each cartridge that you are replacing:
   - Remove the cartridge from the enclosure.
   - Push the red button to close the valve.
   - Loosen the PEEK nut and disconnect the cartridge from the reagent syringe tubing.

Warning
Acid or oxidizer may spill from the containers if the valves are not closed.

Note: Reagent containers need to be disposed of according to local regulations. All reagent containers are shipped with Material Safety Data Sheets (MSDS). These sheets will provide instructions. GE Analytical Instruments can not accept containers for disposal.

5. Remove the new reagent container(s) from the packaging. Record the expiration date of the acid and oxidizer and the volume of the oxidizer in the Notes column on the **Maintenance Worksheet** (see Table 18 on page 179); you also will need to enter these dates into the Analyzer later.
6. For each reagent, follow these steps:
   - Locate the supply line for the reagent you are replacing, indicated by the **Acid** or **Oxidizer** label on the tubing.
   - Attach the appropriate PEEK nut to the reagent container and tighten finger-tight.
   - Press the green button all the way in to open the valve on the reagent container. Refer to the labeling on the container for proper positioning.
   - Slide the container into the reagent enclosure, with the valve pointing down and toward the front of the reagent enclosure. Be careful to move tubing and wires out of the way while sliding the cartridges into the enclosure, so you do not inadvertently crimp tubing or loosen cable connections.
7. Replace the reagent enclosure cover and tighten the set screw until it is finger-tight.
8. 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.
9. Power the Analyzer *On*.
10. Enter the installation and expiration dates for the reagents by following the procedures in "Setting the Installation or Expiration Date for New Consumables" on page 176 to ensure that the Analyzer correctly tracks the life of the new reagents.
11. To reduce the possibility of bubbles, perform a flush of the reagent syringes before resuming normal operation. Refer to "Flushing the Reagent Syringes" on page 177 for details.

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 and locate the UV lamp enclosure at the right of the Analyzer. The UV enclosure has a brass nut at the bottom of the enclosure and a gray wire with a black connector extending from the nut.
4. Disconnect the black power connector from the power supply by turning the connector and then carefully pulling the two halves of the plug apart.
5. Loosen the brass nut on the UV enclosure. The nut should only be finger-tight, and a wrench should not be necessary.
6. Slowly slide the UV lamp out of the enclosure.

7. 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.
8. 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.

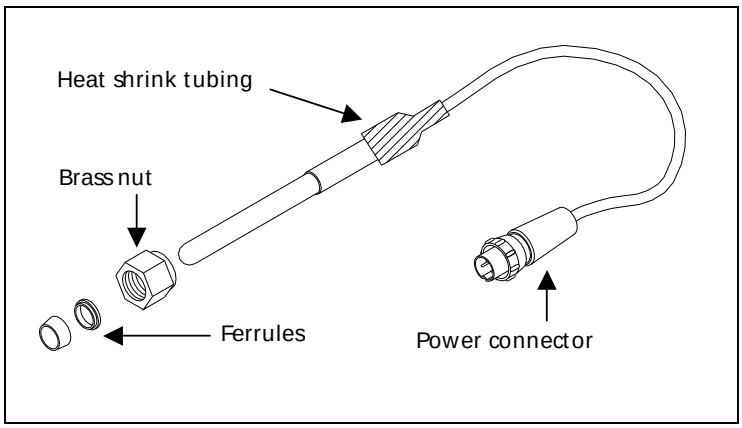

Figure 35: Relative Positioning of Components in the UV Lamp Assembly

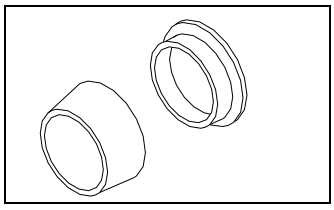

Figure 36: UV Lamp Ferrule Orientation Detail

9. Carefully slide the lamp assembly into the enclosure until you reach the heat shrink tubing. Stop if you feel any resistance, and realign the lamp in the reactor.
10. Tighten the brass nut finger-tight. While tightening the nut, make sure it stays level with the heat shrink tubing (Figure 35). Do **not** use a wrench.
11. 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.
12. Record the installation date for the lamp in the service log (see Table 18 on page 179).
13. 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.
14. Plug in the main power cord and turn the Analyzer on with the main power switch.

15. Enter the installation date for the UV lamp by following the procedures in "Setting the Installation or Expiration Date for New Consumables" on page 176.
16. After changing the UV lamp, perform a calibration verification (see "Performing a Calibration Verification" on page 140).

Replacing the Sample Pump Tubing

The tubing for the sample pump loses elasticity over time and must be replaced annually to ensure proper flow rates. The tubing 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 pump tubing 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
To avoid exposure to the acidified water in the tubing, wear acid-resistant gloves, protective clothing, and safety goggles or a face shield, when changing the pump tubing.

Have paper towels available during the procedure in case water leaks from the old pump tubing during the removal process. For an illustration of the parts mentioned below, refer to Figure 37 on page 169.

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Turn off the Analyzer by using the main power switch and unplug the power cord.
3. Open the Analyzer case and locate the sample pump and tubing support bracket. The support bracket is a plastic piece just above the pump.
4. Loosen the wing nut in the center of the bracket. If loosening the bracket does not allow you to remove the tubing in Step 8 below, then you will need to remove the bracket completely and should take careful note of the bracket's orientation.
5. Remove the left Allen screw on the semicircular occlusion plate on the sample pump.
6. Rotate the occlusion plate downward so it is out of the way.
7. Follow the sample pump tubing to the pieces of green restrictor tubing from the transfer modules. Disconnect the pump tubing from both pieces of the green restrictor tubing by pulling on the pump tubing while supporting the green restrictor tubing.
8. Disconnect the other end of the pump tubing from the waste outlet attached to the Analyzer bulkhead.

9. Remove the pump tubing from the pump, and then safely dispose of the old tubing.
10. Use a paper towel to clean up any liquid that may have spilled inside the Analyzer.

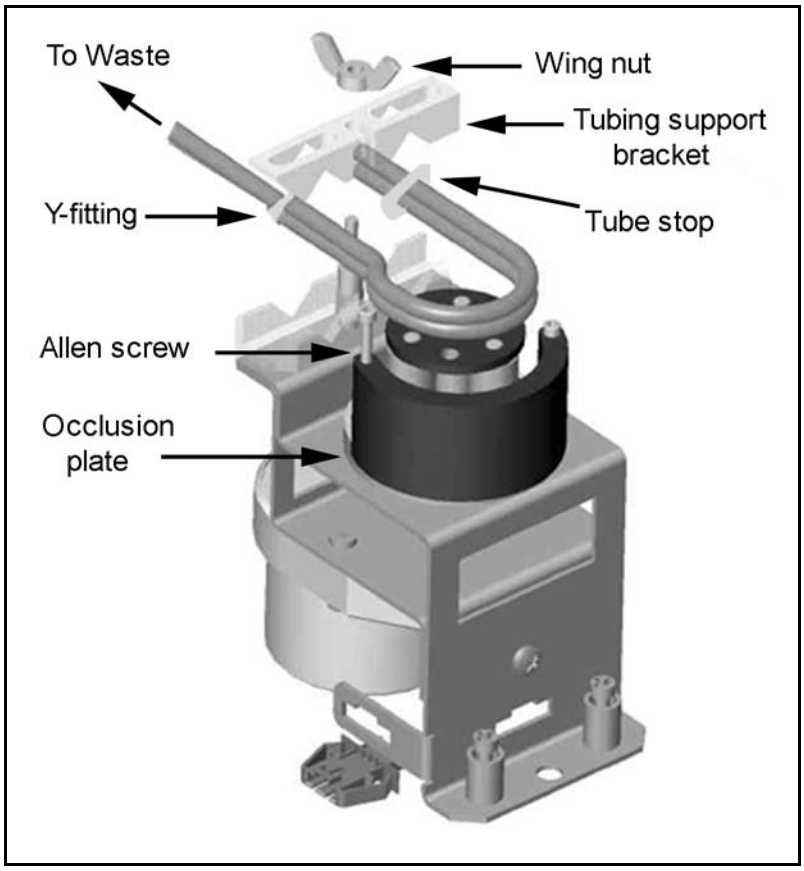

Figure 37: Replacing the Sample Pump Tubing

11. Remove the new pump tubing from the shipping container.
12. Connect the single end of the new tubing (below the Y-fitting) to the waste outlet on the Analyzer bulkhead (connect as much of the tubing as possible, or approximately 1/4" to 1/2" onto the waste fitting).
13. Position the tubing in the left slot of the support bracket.
14. Run the tubing counter-clockwise through the sample pump. Loosen the second screw on the occlusion plate if necessary. The tubing should sit side-by-side; be careful not to twist the tubing, and make sure it sits on the center of the rollers so it is even all around the pump.
15. Pull the tubing through the sample pump so there is no slack in the tubing.
16. Position the tube stop just above the right slot of the support bracket.
17. Tighten or, if necessary, replace the top piece of the bracket and secure with the wing nut. Do not pinch the tubing with the support bracket, and continue to ensure that there is no slack in the tubing.

18. Slide the occlusion plate upward and secure the left Allen screw.
19. Attach the two ends of sample pump tubing to either of the two pieces of green restrictor tubing that lead to the transfer modules (attach the pump tubing about 1/4" onto the restrictor tubing).
20. Tuck the tubing into the Analyzer so it is out of the way.
21. Record the installation date for the pump tubing in the service log (see Table 18 on page 179).
22. If you need to replace other consumables, follow the procedures listed in the appropriate sections of this chapter. Otherwise, replace the Analyzer case.
23. Plug in the main power cord and turn the Analyzer on with the main power switch.
24. Enter the installation date for the pump tubing by following the procedures in "Setting the Installation or Expiration Date for New Consumables" on page 176.
25. GE Analytical Instruments recommends that you now perform a sample flow rate calibration, as described on page 132.

Replacing the Ion Exchange Resin (Resin Bed)

The ion exchange resin (resin bed) depletes over time. With typical Analyzer use, the resin bed should be replaced after every 12 months of operation. To replace the resin bed, you will need the new resin bed; paper towels; and the water bottle from the accessories kit.

The procedure differs slightly depending on whether your Analyzer has the silver-colored bracket or the brass-colored bracket. Follow the procedure appropriate for your Analyzer's configuration.

If the DI pump cavitates (makes noises), follow the installation priming steps located in "Powering the Analyzer On" on page 76,

Resin Bed Replacement with a Silver-Colored Bracket

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Turn off the Analyzer by using the main power switch.
3. Remove the top of the water bottle and empty out any water in the bottle. Keep the water bottle available.
4. Remove the new resin bed from the packaging. The resin bed comes with a red plug inserted into the port at the bottom of the bed; remove this plug and keep it available.
5. Open the Analyzer case and locate the resin bed. The resin bed sits slightly in front and to the left of the DI reservoir (refer to Figure on page 172 for positioning of the elements in the resin bed that are discussed in the following steps).
6. Have a paper towel available to absorb water that may leak from the resin bed. Immediately after performing the next step, you will need to insert the plug into the bottom port on the resin bed to prevent additional water from leaking out.

7. Remove the DI water connector from the bottom of the resin bed as follows: rotate the connector tubing until the small tab is no longer extending through the slot on the set plate; then, pull the tubing out of the resin bed (do not remove the black clip from the tubing). After you remove the tubing from the resin bed, hold the tubing so that the nozzle faces up, to prevent water from leaking.
8. Insert the red plug into the port at the bottom of the old resin bed.
9. Place the water connector tubing into the water bottle.
10. Remove the rubber vent cover from the DI water reservoir. Let the water from the DI water reservoir completely drain into the bottle. When water stops flowing, remove the tubing from the water bottle and set it aside. Use the paper towels to dry any water that leaks out of the water connector tubing.
11. Remove the existing resin bed by pressing down on the metal set plate and then pulling the resin bed downward and away from the DI water reservoir. Safely discard the old resin bed.

Warning
Dispose of the resin bed in accordance with federal, state, or local government regulations.

12. Remove the red cap from the top of the new resin bed.
13. Depress the metal set plate and insert the post at the top of the new resin bed up into the DI water reservoir. When the resin bed is securely in place, release the set plate.
14. Attach the DI water connector tubing to the bottom of the new resin bed, making sure that the tab extends through the slot on the set plate by rotating the tubing.
15. Replace the top of the water bottle and fill the DI water reservoir to the fill line with DI water.
16. Replace the rubber vent cover on the DI water reservoir.
17. Record the installation date for the resin bed in the service log (see Table 18 on page 179).
18. If you need to replace other consumables, follow the procedures listed in the appropriate sections of this chapter. Otherwise, close the Analyzer case.
19. Turn the Analyzer on with the main power switch.
20. Enter the installation date for the new resin bed. Press the **Menu** button, select the **Maintenance** tab, press the **Consumables** button, press the **New...** button, and then press the **RBed** button (see "Setting the Installation or Expiration Date for New Consumables" on page 176 for additional details, if necessary).
21. Before resuming normal operation, check for leaks.

    After resuming normal operation it may take up to 12 hours for the resin bed to rinse down; during this time you may experience higher than normal IC values. If high IC values persist, then you should perform a Conductivity Autozero; follow the instructions in "Conductivity Autozero" on page 196.
22. After about 12 hours of operation, check the interior of the Analyzer for leaks, and add water to the DI water reservoir, if necessary.

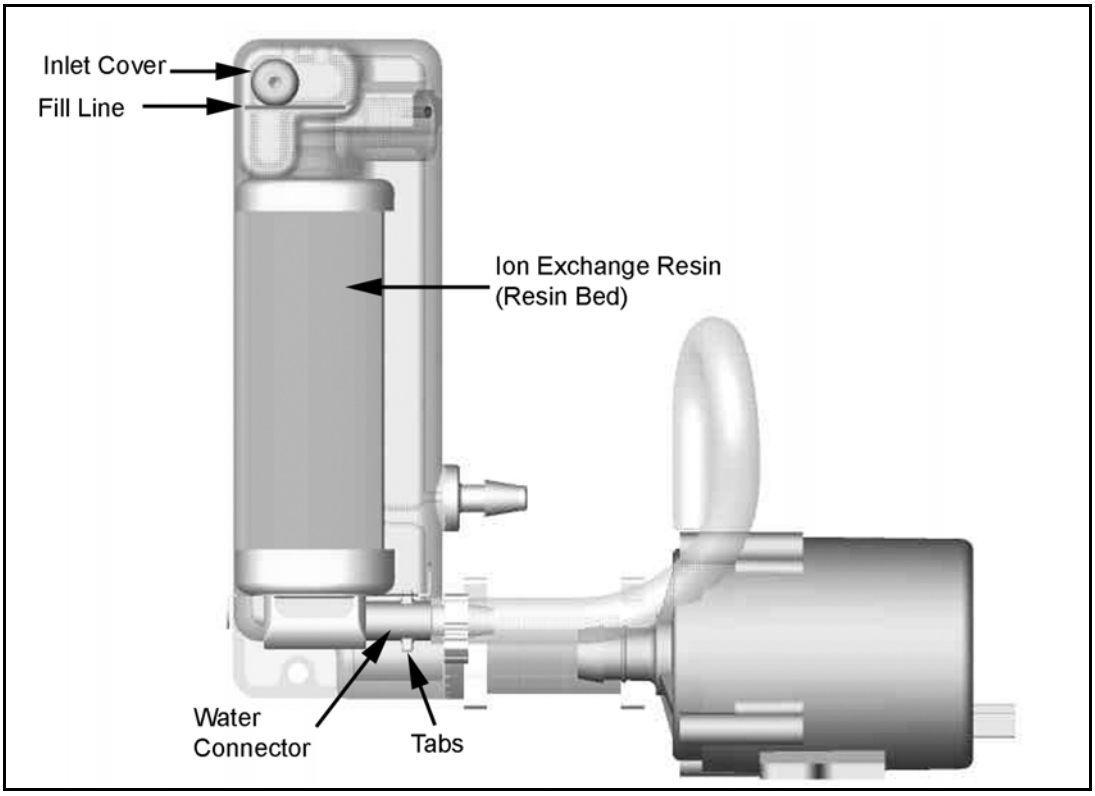

Figure 38: Resin Bed Connections

Resin Bed Replacement with a Brass-Colored Bracket

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Turn off the Analyzer by using the main power switch.
3. Remove the top of the water bottle and empty out any water in the bottle. Keep the water bottle available.
4. Remove the new resin bed from the packaging. The resin bed comes with a red plug inserted into the port at the bottom of the bed; remove this plug and keep it available.
5. Open the Analyzer case and locate the resin bed. The resin bed sits slightly in front and to the left of the DI reservoir (refer to Figure on page 174 for positioning of the elements in the resin bed that are discussed in the following steps).
6. Remove the metal resin bed cover by loosening the Phillips screw.
7. Pull the resin bed down and out of the DI water reservoir.
8. Have a paper towel available to absorb water that may leak from the resin bed. Immediately after performing the next step, you will need to insert the red plug into the bottom port on the resin bed to prevent additional water from leaking out.

9. Remove the DI water connector from the bottom of the resin bed by rotating and gently pulling the water connector nozzle out of the bottom port. After you remove the tubing from the resin bed, hold the tubing so that the nozzle faces up, to prevent water from leaking.
10. Insert the red plug into the port at the bottom of the old resin bed, and then dispose of the old resin bed.

Warning
Dispose of the resin bed in accordance with federal, state, or local government regulations.

11. Place the water connector tubing into the water bottle.
12. Remove the rubber vent cover from the DI water reservoir. Let the water from the DI water reservoir completely drain into the bottle. When water stops flowing, remove the tubing from the water bottle and set it aside. Use the paper towels to dry any water that leaks out of the water connector tubing.
13. Remove the red cap from the top of the new resin bed.
14. Attach the DI water connector tubing to the bottom of the new resin bed
15. Slide the new resin bed up into the bracket, making sure the port at the bottom of the resin bed points to the right.
16. Replace the metal resin bed cover by securing the screw.
17. Replace the top of the water bottle and fill the DI water reservoir to the fill line with DI water.
18. Replace the rubber vent cover on the DI water reservoir.
19. Record the installation date for the resin bed in the service log (see Table 18 on page 179).
20. If you need to replace other consumables, follow the procedures listed in the appropriate sections of this chapter. Otherwise, close the Analyzer case
21. Turn the Analyzer on with the main power switch.
22. Enter the installation date for the new resin bed. Press the **Menu** button, select the **Maintenance** tab, press the **Consumables** button, press the **New...** button, and then press the **RBed** button (see "Setting the Installation or Expiration Date for New Consumables" on page 176 for additional details, if necessary).
23. Before resuming normal operation, check for leaks.

    After resuming normal operation it may take up to 12 hours for the resin bed to rinse down; during this time you may experience higher than normal IC values. If high IC values persist, then you should perform a Conductivity Autozero; follow the instructions in "Conductivity Autozero" on page 196.
24. After about 12 hours of operation, check the interior of the Analyzer for leaks, and add water to the DI water reservoir, if needed.

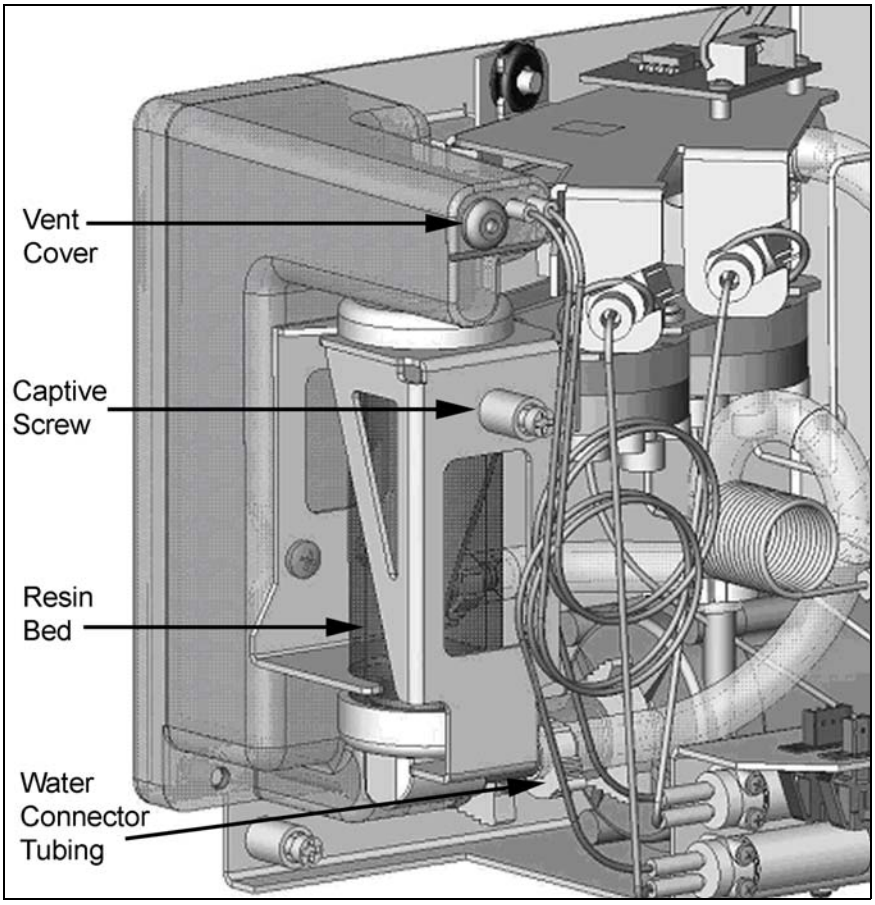

Figure 39: Brass-Colored Resin Bed Bracket

Replacing the In-Line Filter Element

Sievers 900 On-Line and Portable TOC Analyzers

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.

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

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. 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.

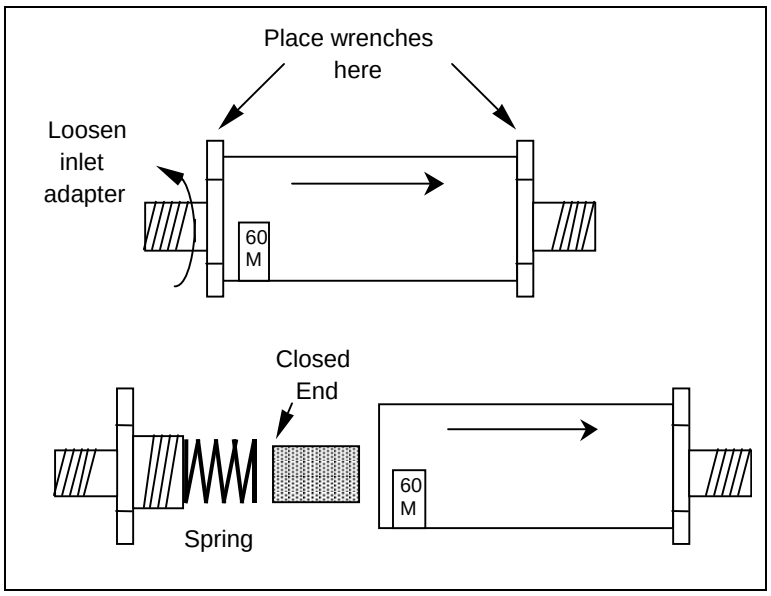

Figure 40: Replacing the In-Line Filter Element

Setting the Installation or Expiration Date for New Consumables

When you replace a consumable, you must enter the date of installation or expiration to 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.
    - If you 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.
    - If you choose **New Acid**, enter the expiration date that was listed on the acid packaging: press the **Day** button and use the numeric pad to specify the day of expiration and press **Enter**; repeat for the **Month** and **Year** buttons. Press **Accept** after you have entered the complete expiration date. You will be prompted to confirm the installation of new acid; press the **Confirm** button to continue.
    - If you choose **New Oxidizer**, enter the expiration date that was listed on the oxidizer packaging: press the **Day** button and use the numeric pad to specify the day of expiration and press **Enter**; repeat for the **Month** and **Year** buttons. Press the **Amount** button and confirm that the correct volume is selected, either **150 mL** or **300 mL**. Press **Accept** after you have entered the complete expiration date. You will be prompted to confirm the installation of new oxidizer; press the **Confirm** button to continue.

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 “Using Password Protection” on page 117 or “Using DataGuard” on page 118 for more information.

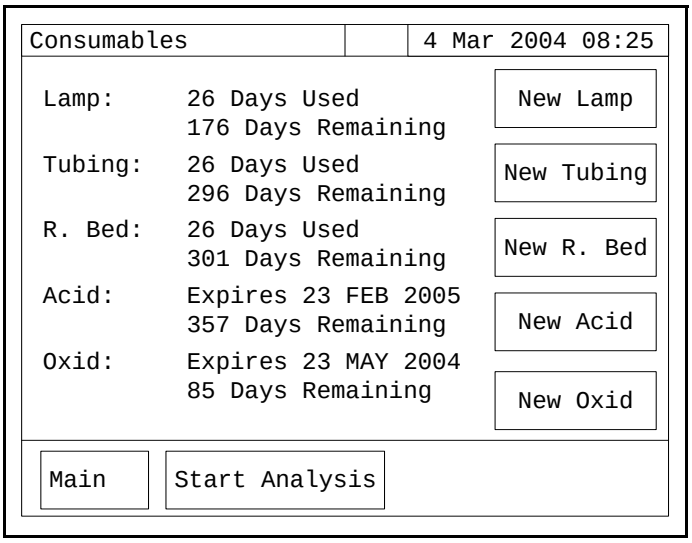

Figure 41: The Consumables Screen

Flushing the Reagent Syringes

If the Analyzer has not been used for over 24 hours, the decomposition of persulfate can produce oxygen bubbles in the syringe pump and the reagent addition lines. To prevent bubbles from entering the sample stream and interfering in the TOC measurement, a reagent flush is used to remove the bubbles and fill the syringe with fresh reagent. A reagent flush also is recommended after installing new chemical reagents.

For the reagent flush, it is recommend that the Analyzer must be connected to a water supply. A 40-mL vial of water, or on-line water, may be used for the reagent flush.

To initiate a syringe flush

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Make sure the Analyzer is connected to a water supply.
3. Press the **Menu** button and select the **Maintenance** tab.
4. Press the **Consumables** button.
5. Press the **Flush...** button.
6. Press either the **Acid**, **Oxid**, or **Both** button, depending on which syringe(s) you want to flush.

7. Make sure a water source is connected to the Analyzer and press the **Flush** button.
8. Wait for the flush to complete. The **Flush** button will change colors to show that the process is underway and the Analyzer will not respond to additional commands. Do not disrupt power to the Analyzer while the flush is in progress.
9. When the flush is complete, a message will display. Press **OK** to continue.
10. If you used a vial for the flush, remove it from the IOS System after the flush has finished.

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. Methanol, or Isopropyl Alcohol may be used, but ensure 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 18: Sievers 900 Series TOC Analyzer 1-Year Maintenance Worksheet

Item	Period	Installation Date	Expiration Date	Notes/volume
Oxidizer supply	Initial Install			
Acid supply	Initial Install			
DI water reservoir	Initial Install		**N/A**	
Oxidizer supply	3 months			
Acid supply	3 months			
DI water reservoir	Initial Install		**N/A**	
UV Lamp	6 months			
Oxidizer supply	6 months			
Acid supply	6 months			
DI water reservoir	Initial Install		**N/A**	
Oxidizer supply	9 months			
Acid supply	9 months			
DI water reservoir	Initial Install		**N/A**	
Pump Tubing	12 months			
UV Lamp	12 months			
Oxidizer supply	12 months			
Acid supply	12 months			
Resin Bed	12 months			
DI water reservoir	Initial Install		**N/A**	

NOTE: Interval suggestions are based on typical use. Reagent consumption depends on flow rate settings.

The DI water reservoir 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 _____

A copy of this worksheet should be completed for each year the Analyzer is in service. The worksheet is available from the GE Analytical Instruments web site (www.GEInstruments.com).

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 888.245.2595. Installation and training by a qualified service technician can also be provided. Technical Support in the United Kingdom is available at 44 (0) 161 864 6800. In other countries, visit www.geinstruments.co to locate your representative. This following applies to *all* Sievers 900 TOC Analyzer instrument models, except where noted.

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

3 - Acid Warning

Message: "The estimated amount of acid is less than 10%. Confirm the amount is low. Order a new acid container."
Explanation: Based on the flow rate and history of usage, the Analyzer estimates that only 10% of the acid reagent is remaining. Order a new acid container from GE now to avoid down time when the acid is exhausted.

4 - Oxid Warning

Message: "The estimated amount of oxidizer is less than 10%. Confirm the amount is low. Order a new oxidizer container."
Explanation: Based on the flow rate and history of usage, the Analyzer estimates that only 10% of the oxidizer reagent is remaining. Order a new acid container from GE now to avoid down time when the oxidizer is exhausted.

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 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 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 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 appears 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 when the Analyzer is not in the optional Turbo mode). This warning appears 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 accommodate approximately 1,200 entries. This warning appears 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).

12 - High IC

Message: "The ratio of TOC to IC is less than 0.1. You may need an ICR unit for this application."
Explanation: This warning appears when the IC value is 10 times higher than the TOC value. If the message persists, you may be experiencing high enough IC levels to merit using an ICR unit in your configuration. This message also can be generated when analyzing samples with low concentrations of TOC; if the TOC measurements are negative, you may need to perform a TOC Autozero.

13 - Acid Warning

Message: "The estimated acid life is less than 15 days. Order a new acid container."
Explanation: Based on the expiration date, the Analyzer estimates that only 15 days of acid life remain. Order a new acid container from GE now to avoid down time when the acid expires.

14 - Oxid Warning

Message: "The estimated oxidizer life is less than 15 days. Order a new oxidizer container."
Explanation: Based on the expiration date, the Analyzer estimates that only 15 days of oxidizer life remain. Order a new oxidizer container from GE now to avoid down time when the oxidizer expires.

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 - Acid Warning

Message: "The acid reagent needs to be replaced."
Explanation: Based on the flow rate and history of usage, the Analyzer estimates that the acid reagent has been completely consumed. Perform a visual check to confirm that there is no remaining acid before continuing analysis and order a new acid container from GE now.

17 - Oxid Warning

Message: "The oxidizer reagent needs to be replaced."
Explanation: Based on the flow rate and history of usage, the Analyzer estimates that the oxidizer reagent has been completely consumed. If you use oxidizer, perform a visual check to confirm that there is no remaining oxidizer before continuing analysis and order a new oxidizer container from GE now.

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.

19 - Acid Warning

Message: "The acid reagent has exceeded its recommended life. Replace the container."
Explanation: Based on the expiration date, the Analyzer estimates that the acid has expired. Order a new acid container from GE now."

20 - Oxid Warning

Message: "The oxidizer reagent has exceeded its recommended life. Replace the container."
Explanation: Based on the expiration date, the Analyzer estimates that the oxidizer has expired. If you use oxidizer, order a new oxidizer container from GE now."

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 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 now."

24 - ICR Vacuum Decrease

Message: "Inspect data for instability. If ICR fault light remains lit for more than 30 minutes, refer to the 900 ICR Manual."
Explanation: This error generally appears when the ICR is not creating a vacuum but is set to Inline. Refer to the 900 ICR *Operation and Maintenance Manual* for troubleshooting suggestions.

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.

27 - Acid Delivery Warning

Message: "Analysis was restarted due to a disruption in acid delivery."
Explanation: The Analyzer restarted analysis when acid delivery was disrupted. As a result, the data history may reflect a delay of several minutes between measurements, but no user action is required.

28 - ICR, Acid Delivery

Message: "The ICR or acid delivery system is not operating correctly."
Explanation: The ICR or acid delivery system is not operating correctly. You may need to contact Technical Support to confirm that these systems are functioning properly.

41 - System Restore Error

Message: "Failed to restore system."
Explanation: The attempt to restore the system settings failed. Make sure the USB drive that contains the saved system settings is attached to the Analyzer properly and try to restore again. If the error occurs again, try copying the files on the USB drive to a different USB drive, and then attempt to restore system settings again using the new USB drive. If the error message persists, contact GE Analytical Instruments 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.

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.

49 - USB Error

Message: "A problem has been detected with the USB device. Please refer to the 900 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 900 TOC Analyzers link on our Web page, www.GEInstruments.com.

50 - Unstable Measurements Error

Message: "Unstable measurements detected during calibration/verification. Please refer to the 900 Oper. and Maint. Manual for recommendations."
Explanation: This error appears 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 187 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, stop analysis and 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 appears 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 appears 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 appears 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 - ICR Error

Message: "A problem has been detected with the ICR. Check the ICR indicator lights. Refer to the 900 ICR Manual for recommendations."
Explanation: This error generally appears when the ICR is not creating a vacuum but is set to Inline. Refer to the 900 ICR *Operation and Maintenance Manual* for troubleshooting suggestions.

56 - Acid Syringe Error

Message: "Error detected with the acid syringe. Inspect the syringe and cables. Refer to the 900 Oper. and Maint. Manual for recommendations."
Explanation: This error appears when the syringe is not positioned in the location expected by the Analyzer. Confirm that the syringe's electrical connection is securely fastened and that no tubing is obstructing the syringe's movement. Turn the Analyzer off and on and restart analysis. If the error persists, contact Technical Support.

57 - Oxid Syringe Error

Message: "Error detected with the oxid syringe. Inspect the syringe and cables. Refer to the 900 Oper. and Maint. Manual for recommendations."
Explanation: This error appears when the syringe is not positioned in the location expected by the Analyzer. Confirm that the syringe's electrical connection is securely fastened and that no tubing is obstructing the syringe's movement. Turn the Analyzer off and on and restart analysis. If the error persists, contact Technical Support.

64 - Fatal Error

Message: "Multiple errors within 24 hours. Contact GE."
Explanation: This error appears when multiple fatal errors, which require you to reset the Analyzer, occur within 24 hours. Contact Technical Support.

65 - Main Board Error

Message: "An error has been detected on the Main Board. Please refer to the 900 Oper. and Maint. Manual. Contact GE if problem persists."
Explanation: A communication error with the main 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 900 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 appears when a software error occurs in the 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.
- If the Analyzer is taking measurements, confirm that water is flowing from the waste outlet.
- If you are experiencing erratic TOC readings, confirm that the pH of the waste stream is not too high (see "pH of Sample Stream is Too High" on page 195 for details).
- Confirm that all cables are securely attached to the Analyzer.
- If you are sampling from 40 mL vials, confirm that the needle in the IOS System is not obstructed. Loosen the 1/4" fitting at the **Sample Inlet** port and check that water flows out of the stainless steel tubing when water is in the IOS System.

Internal Inspection

- Check for leaks throughout the Analyzer; there should not be moisture on the inside floor of the Analyzer case.
- Confirm that oxidizer and acid remain in the reagent containers; also confirm that the valve on each reagent container is open.
- Check the reagent syringes to make sure no large air bubbles are present (a small bubble does not adversely affect analysis). Also inspect the syringes for leaks, and confirm that the plunger moves during analysis. If excessive bubbles are present, a reagent flush should be performed.
- Confirm that the sample pump is turning. If the pump is turning, sample should be flowing from the waste stream.
- Check to make sure there are no leaks in the DI system, especially at valves and the stream splitters.

- Confirm that the DI water reservoir is full.
- 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.

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's main power switch is a circuit breaker. If conditions cause the breaker to be switched to the Off position during normal operation, simply press the switch into the On position to resume operation; if the Analyzer was taking measurements when the power interruption occurred, it will automatically resume analysis when power is restored. If you are unable to switch the breaker to the On position (e.g., it repeatedly switches back to the Off position), you should contact Technical Support for assistance.

Problems with the DI Water Pump

If the Analyzer is making a loud squealing sound or if water is not filling the tubing that leads to the resin bed, it is likely that the DI water pump has not been properly primed. To prime the pump, you will need the water bottle from the Analyzer's accessories kit and a bottle or tray to collect water.

1. Make sure the Analyzer is powered on.
2. Remove the Lower tube (Item 1 in Figure 42) from the bottom of the resin bed. Place the tube into a bottle or tray, as water will drain from this tube.
3. Remove the inlet cover on the DI water reservoir (Item 3 in Figure 42). Water will drain from the tube when you remove the inlet cover.
4. When water starts flowing through the tube, replace the inlet cover.
5. Connect the tube back to the resin bed.
6. If necessary, add water to the DI water reservoir with the water bottle.
7. Wait 1 to 5 minutes and then turn off the Analyzer.
8. Wait 1 minute, and then power the Analyzer on. If you observe small bubbles in the tubing that leads to the resin bed, tap the tubes to dislodge the bubbles.
9. Allow the DI water pump to circulate water for at least 10 minutes.
10. After 10 minutes, open the Analyzer case and check the tubing that leads to the resin bed (ion exchange column). Most of the air originally in the tubing should be replaced with water. If more than a few small bubbles remain in the tubing, repeat Steps 6 through 9.

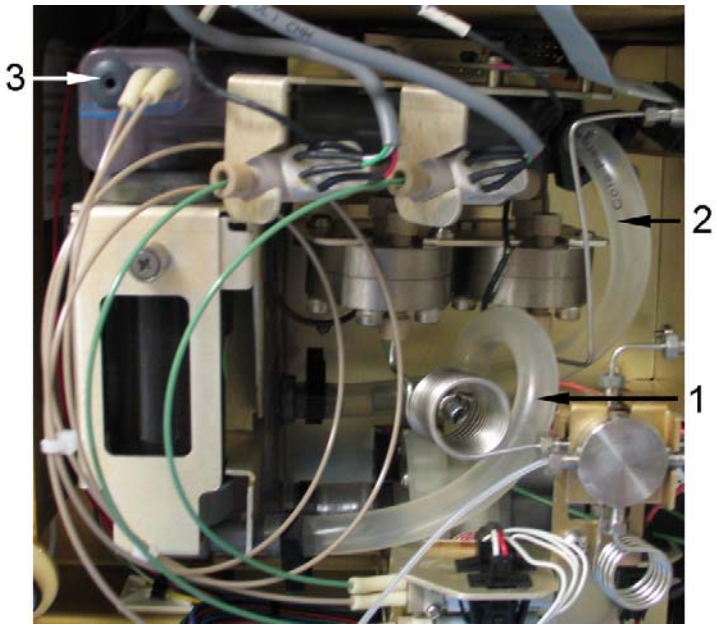

Figure 42: The DI Water Loop

To troubleshoot a lack of flow through the Analyzer, follow the steps in the next three sections: "Checking the Sample Pump," "Checking the Inlet Tubing," and "Backflushing the Analyzer."

Checking the Sample Pump

While the Analyzer is operating, open the cover 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.

Checking the Inlet Tubing

If sampling from a container, you can confirm that sample is properly being drawn in to the Analyzer by introducing a small air bubble into the tubing and then tracking its movement. Simply remove the tubing from the liquid level in the container for a few seconds, and then replace the tubing. You should observe an air bubble in the tubing; if the bubble moves through the tubing and into the Analyzer, the inlet tubing is not obstructed.

No sample will flow through the Analyzer under the following conditions: the sample pump is not operating; the 60-µm stainless steel in-line filter (for on-line sampling) is clogged; or the 1/16"-OD Teflon inlet or outlet lines (for grab sampling) are over-tightened and have collapsed.

If air is still not drawn into the Analyzer or water is not flowing out of the Analyzer, replace the pump tubing.

Backflushing the Analyzer

When there is a lack of flow through the Analyzer, a flush of the sample side or DI side fluidics can clear clogs in the tubing. To flush the Analyzer, you will need the water bottle from the Analyzer's accessories kit, a small length of tubing (similar to the sample pump tubing), and paper towels. Make sure that the inlet and waste lines are still connected to the Analyzer; the sample pump will run during this procedure.

1. Power on the Analyzer and start analysis (if you prefer not to start analysis, you can turn the sample pump on by selecting **Maintenance** tab → **Advanced** → **Diagnostics** → **Test Pumps** → **Sample Pump** → **On**).
2. Open the Analyzer front panel by turning the two latches and swinging the panel door to the left.
3. The first task is to test the sample side for an obstruction. Disconnect the two pieces of sample pump tubing from the Y-fitting (see Figure 43).

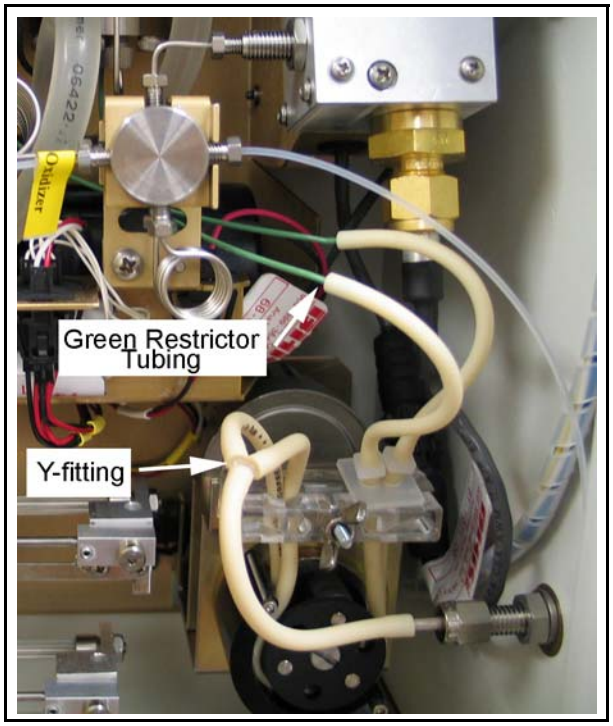

Figure 43: Preparing to Back Flush the Sample Side Fluidics

4. Water will be flowing through the two pieces of disconnected tubing. Compare the rate at which water drops from each piece of tubing.

   If the water drops at the same rate, there is no sample-side obstruction and you can proceed to Step 11 after replacing the pump tubing on the Y-fitting.

   If the water drops more slowly through one of the pieces of tubing than the other, proceed to the next step.

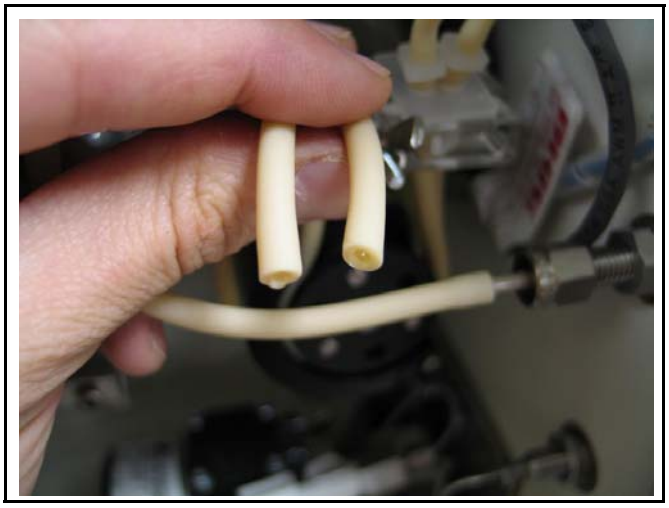

Figure 44: Comparing the Flow Rate Through the Sample Pump Tubing

5. Reconnect the pump tubing to the Y-fitting.
6. Follow the piece of tubing with the obstruction (the one with the slower flow) around the pump and up to the green restrictor tubing. Disconnect the pump tubing from the barb on the sample pump.
7. Attach the water bottle to the sample pump tubing.

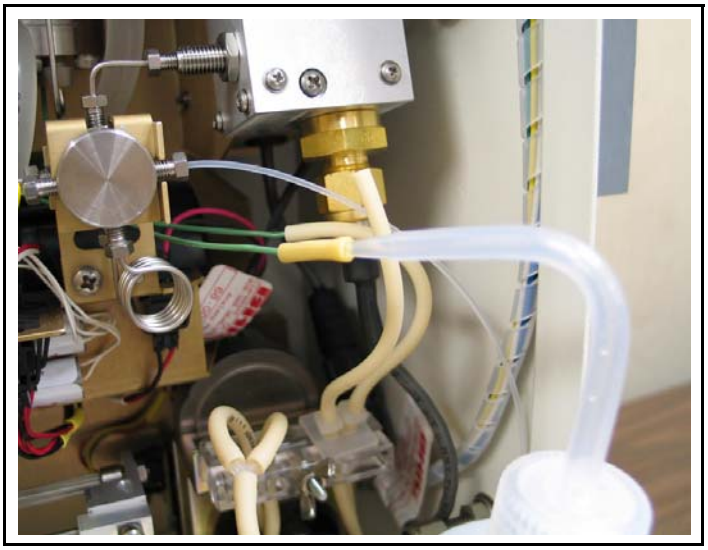

Figure 45: Flushing the Sample Side

8. Gently squeeze the water bottle to flush water into the restrictor tubing. Note that water will come out the Analyzer's sample inlet line or the IOS System; when the water flows out, the obstruction has been cleared.
9. Remove the water bottle and connector tubing from the restrictor tubing, and reconnect the sample pump tubing to the restrictor tubing.
10. Disconnect the two pieces of sample pump tubing from the Y-fitting and confirm that both sides are now flowing at the same rate. If they are not, you may need to repeat Steps 6 and 7. If the problem persists, contact Technical Support.
11. The second task is to test the DI fluidics side for an obstruction. If you placed the Analyzer into analysis while testing the sample side, press the **Stop Analysis** button now; if you used the **Diagnostics** menu to turn on the sample pump, turn it off now.
12. Disconnect the tan tubing from the connector tubing that connects to the DI water reservoir (see Figure 46).

    If the water drops at the same rate, there is no DI-side obstruction and you can replace the tubing on the DI water reservoir.

    If the water drops more slowly through one of the pieces of tubing than the other, proceed to the next step.

Figure 46: Disconnect the Tan Tubing that Connects to the DI Water Reservoir

13. Reconnect the tubing to the DI water reservoir.
14. Follow the piece of tubing with the obstruction down to the solenoid valve (see Figure 47).

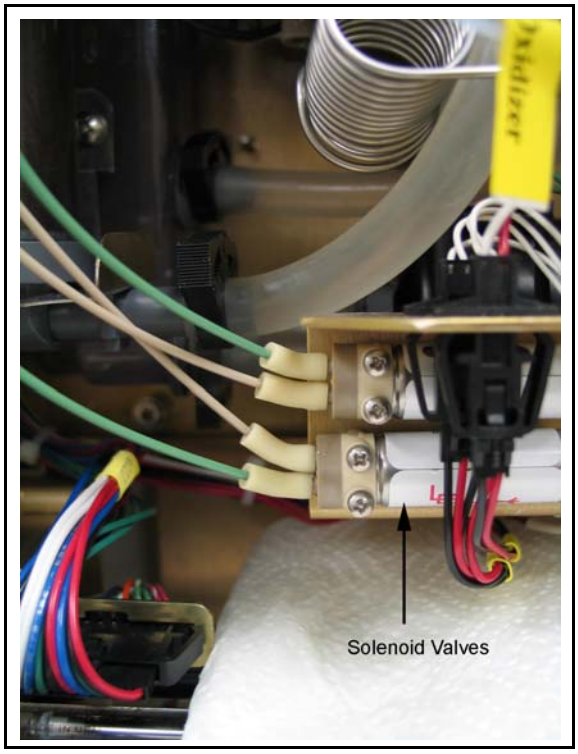

Figure 47: Preparing to Disconnect the Tubing from the Solenoid Valves

15. Place a paper towel under the solenoid valves, as water is likely to leak from the valve. Remove the obstructed tan tubing and the connector tubing from the solenoid valve.
    - If water leaks out the solenoid valve, remove the inlet cover from the DI water reservoir, attach the water bottle to the tan tubing and gently flush water through the tubing. Be sure to carefully monitor the water level in the DI water reservoir as you squeeze the water bottle, as you should avoid over-filling the reservoir. Reconnect the tan tubing to the solenoid valve and resume normal operation.
    - If water does not leak out of the solenoid valve, proceed to the next step.
16. Reconnect the tan tubing to the solenoid valve and disconnect the green restrictor tubing from the same solenoid valve.
    - If water leaks out the green restrictor tubing, the obstruction is in the solenoid valve. Connect the water bottle to the solenoid valve and gently flush water through the valve.
    - If water does not leak out the green restrictor tubing, the obstruction is in the tubing. Connect the water bottle to the green restrictor tubing, remove the inlet cover from the DI water reservoir, and gently flush water through the tubing. Again, carefully monitor the water level in the DI water reservoir as you squeeze the water bottle. Reconnect the restrictor tubing to the solenoid valve and resume normal operation.
17. If symptoms recur, contact GE Analytical Instruments Technical Support for assistance.

Gas Bubbles Are Present in Reagent Lines or Syringes

The presence of gas bubbles in the lines from the reagent containers to the syringe pumps and from the syringe pumps to the stainless steel cross can cause erratic TOC readings. Turn off the Analyzer and disconnect the power. Open the Analyzer case and inspect the 1/16" Teflon tubing from the syringes. If you detect gas bubbles in the lines or a large (greater than 30 µL) gas bubble in the syringe, reconnect the power cord, turn on the Analyzer, and perform a syringe flush. For further information, see “Flushing the Reagent Syringes” on page 177.

pH of Sample Stream is Too High

If the pH of the sample stream is too basic (e.g., pH > 8), erratic readings and low TOC recovery may be observed. Increase the acid flow rate by 1-2 µL/min and determine if this eliminates the problem.

With the sample stream flowing and analysis taking place, tear off a strip of pH paper and hold the paper in the waste stream, if accessible.

Compare the color of the paper with the pH color scale on the side of the pH paper container. If the pH is not less than 2, not enough acid is being added to the sample stream. Possible reasons for high pH include:

- The valve on the acid reservoir is closed.
- Acid flow rate is too low (see “Setting Reagent Flow Rates” on page 89 and increase flow rate if necessary).
- Acid reservoir is empty or low (perform a visual check of the reservoir).
- Acid syringe is defective or not working (contact GE Analytical Instruments for instructions).

Erratic Readings Due to High IC

The Analyzer calculates TOC from the difference between TC and IC, and erratic readings of TOC can be observed in water samples containing high levels of IC, where the IC is greater than 10 times the TOC value. This is often the case for ground water samples, some municipal water supplies, and permeate from reverse osmosis systems.

To eliminate the problems encountered in TOC measurements of water samples containing high levels of IC, GE Analytical Instruments offers an inline ICR accessory. The module is installed on the Analyzer and uses a membrane-based system and vacuum to remove approximately 99% of the IC is at concentrations up to 25 ppm. For more information on the ICR, contact GE Analytical Instruments.

If sampling from a container, you can manually remove the IC from the sample as follows:

1. Add a few drops of acid (6 M H_3PO_4) to the sample.
2. Use an N_2 or He purge gas to remove CO_2 from the sample.

3. After purging for 5-10 minutes, analyze the sample.

Acidifying the sample and purging may introduce organic impurities into the sample, so treat a sample of low-TOC DI water in the same manner as a blank.

If the response of the IC CO_2 sensor is greater than the response of the TC CO_2 sensor, the Analyzer will report a negative TOC value.

If the reading appears to have drifted by 5 ppb (or 10 ppb at the most), perform the TOC Autozero. If the drift is greater than 10 ppb, check the TC and IC calibration before performing the TOC Autozero. Follow the procedures in the section called “Perform a TOC Autozero” on page 131.

Negative Measurements

Many of the previous steps in this chapter will help troubleshoot negative measurements. If the previous steps did not remedy the situation, you may need to perform a Conductivity Autozero; if IC values continue to be high, you may need an ICR for your system.

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.

   The Conductivity Autozero can take between 1-6 hours, but generally does not take longer than 2 hours.

To manually set the 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.

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

2. Press the **Menu** button, select the **Maintenance** tab and press the **Calibrate** button.
3. Press the **Program Autozero** button.
4. Press the **Offset** button.
5. Use the number keypad to enter a negative number for the offset. The maximum allowable offset is ±5.00 ppb.

NOTE: Entering a negative number will increase the TOC value. A positive offset will decrease the TOC value.

6. Press the **Enter** button.

Problems Changing the Program Language

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, 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 second button in the right 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.

Disabling the UV Lamp

While troubleshooting, there may be times when you need to have the Analyzer powered on without turning on the UV lamp. To turn off the UV lamp, follow these steps:

1. Press the **Menu** button and select the **Maintenance** tab.
2. Press the **Advanced** button.
3. Press the **Advance Setup** button.
4. Press the **UV Lamp** button.
5. Press the **UV Lamp** button.
6. Press the **Off** button.

Step 4: Contact Technical Support

After pursuing Steps 1 through 3, in the USA contact GE Analytical Instruments Technical Support at 303.444-2009 or 888.245.2595. Installation and training by a qualified service technician can also be provided. Technical Support in the United Kingdom is available at 44 (0) 161 864 6800. In other countries, visit www.geinstruments.co to locate your 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 GEAI at 888.245.2595 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 the Analyzer, prepare it for shipping as follows:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. Press the **Menu** button and select the **Maintenance** tab.
3. Press the **Advanced** button and then press the **Empty Syringes** button. Press the **Yes** button. Wait for the reagent syringes to empty (approximately 3 minutes).
4. Press the **Advanced Setup** button and then the **Flow Sensor** button.
5. Press the **Flow Sensor** button and select **Off** to turn off the flow sensor.
6. Press the **Back** button and then press the **Menu** button.
7. Select the **Setup** tab. Press the **On-Line** button to make sure that On-Line mode is selected.
8. Press the **Configure** button.
9. Press the **Reagent** button and press the **Manual** button.
10. Press the **Acid** button and use the numeric pad to set the acid flow rate to **0**.
11. Press the **Oxid** button and use the numeric pad to set the oxidizer flow rate to **0**.
12. Press the **Menu** button.

The first task is to drain the DI side of the fluidics.

13. Open the Analyzer case. Open the reagent enclosure cover by loosening the set screw.
14. Remove the acid and oxidizer reagent cartridges. For each cartridge, push the red button to close the valve and then loosen the PEEK nut and disconnect the cartridge from the reagent syringe tubing. (Store your reagents; you may reinstall the reagents when your Analyzer is returned.)
15. Replace the reagent enclosure cover.
16. Disconnect the Analyzer from the sample source, so air will be introduced into the Analyzer sample stream. Press the **Start Analysis** button. Let the Analyzer run for approximately 10 minutes, so no significant water remains in the waste line.
17. Press the **Stop Analysis** button.
18. Turn the Analyzer off with the main power switch.
19. Open the Analyzer case.
20. Locate the water bottle from the Analyzer's accessories kit. Remove the top of the water bottle and empty out any water in the bottle. Keep the water bottle available.
21. Locate the red resin bed plug from the Analyzer's accessories kit.
22. Have a paper towel available to absorb water that may leak from the resin bed. Immediately after performing the next step, you will need to insert the red plug into the bottom port on the resin bed to prevent additional water from leaking out.
23. Locate the resin bed (see Figure on page 201).
24. Remove the DI water connector from the bottom of the resin bed as follows: rotate the connector tubing until the small tab is no longer extending through the slot on the set plate; then, pull the tubing out of the resin bed. After you remove the tubing from the resin bed, hold the tubing so that the nozzle faces up, to prevent water from leaking.
25. Insert the red plug into the port at the bottom of the old resin bed.
26. Place the water connector tubing into the water bottle (a beaker or flask also can be used).
27. Remove the rubber vent cover from the DI water reservoir. Let the water from the DI water reservoir completely drain into the bottle. When water stops flowing, remove the tubing from the water bottle and set it aside, with the connector pointing upward if possible. Use the paper towels to dry any water that leaks out of the water connector tubing.
28. Remove the resin bed by pressing down on the metal set plate and then pulling the resin bed downward and away from the DI water reservoir. Hold the resin bed over a flask, remove the red plug, and drain water from the resin bed. You may need to gently shake the resin bed to help the draining process.
29. Return the resin bed to the Analyzer. Depress the metal set plate and insert the post at the top of the resin bed up into the DI water reservoir. When the resin bed is securely in place, release the set plate.
30. Reattach the DI water connector tubing to the bottom of the resin bed, making sure that the tab extends through the slot on the set plate by rotating the tubing.
31. Empty the water in the water bottle and replace the water bottle cap.

32. Locate the green restrictor tubing that connects to each solenoid valve (see Figure).
33. Disconnect the restrictor tubing and pump tubing from each solenoid valve. To remove water from the measurement module, follow this step for both pieces of tubing: squeeze the water bottle; attach the nozzle of the water bottle to the tubing, gently release the pressure on the water bottle to suck the water into the water bottle; disconnect the water bottle from the pump tubing (see Figure).
34. Reattach each piece of green restrictor tubing and norprene tubing to the solenoid valves.
35. Close the Analyzer case.

    The second task is to drain the sample side of the fluidics.

36. Turn the Analyzer on with the main power switch.
37. Disconnect the **Sample Inlet** from the Analyzer, so that there is no sample source.
38. Press the **Start Analysis** button. Let the Analyzer run until sample stops flowing out of the waste tubing. As soon as sample stops flowing, press the **Stop Analysis** button.
39. Turn the Analyzer off with the main power switch.
40. Disconnect the waste tubing from the Analyzer.
41. Remove any printer, alarm, analog output, or computer cables and the power cord connected to the Analyzer. Note that you may need an electrician to help you disconnect the Analyzer from the power supply.

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

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

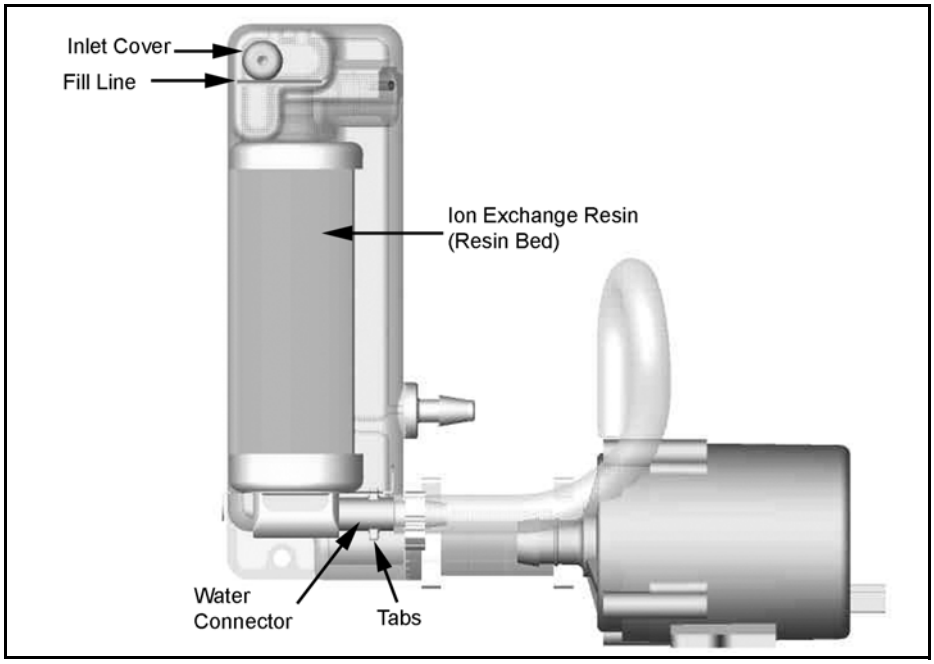

Figure 48: The DI Water Reservoir and Resin Bed

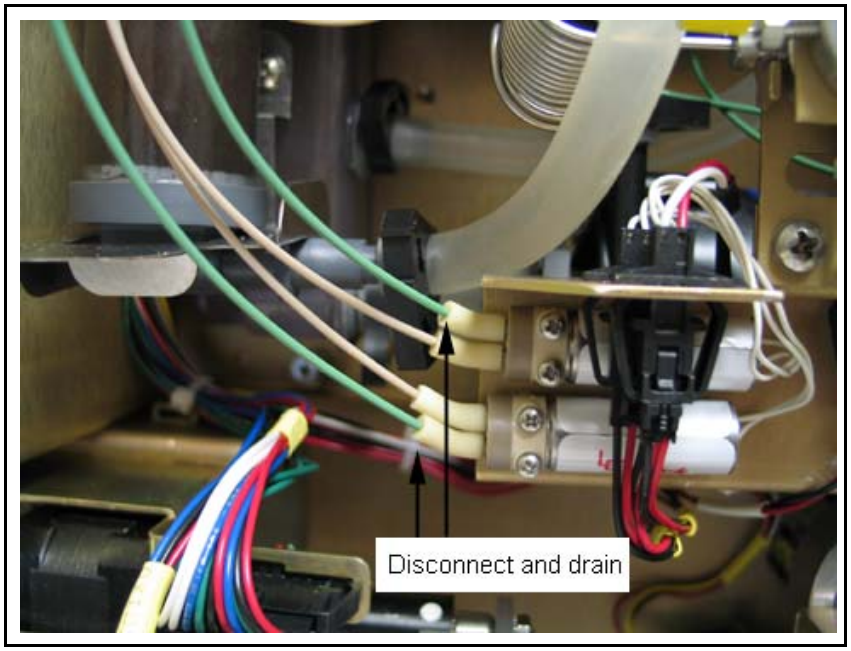

Figure 49: Disconnect the Green Restrictor Tubing

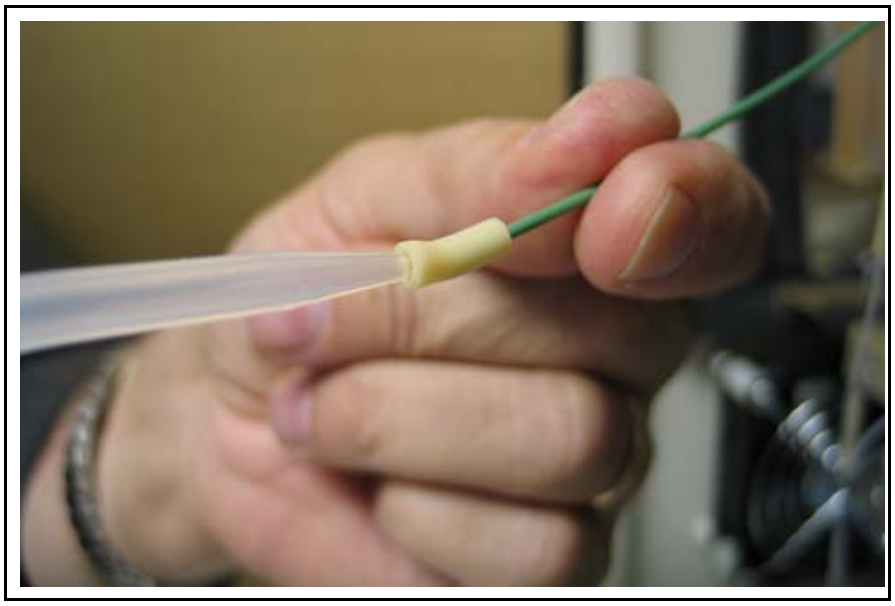

Figure 50: Draining the Measurement Module

Chapter 9. Turbo Operation

Sievers 900 On-Line and Portable TOC Analyzers only

Introduction

Turbo sampling mode is an option on a Sievers Online TOC Analyzer that is achieved by purchasing an activation code from GE Analytical Instruments. Turbo mode is useful for monitoring recycle or reclaim water in semiconductor facilities where rapid response is of primary concern. When operated in the Turbo mode, results are reported every 4 seconds.

Note: During a reagent syringe refill, there is a three to four minute delay, during which no new data are available. Refills will occur approximately every four hours.
The Autoreagent function cannot be used in Turbo mode.

Turbo Mode Specifications

When operated in Turbo mode, the Analyzer has the following specifications:

Linear range	0.20 ppb – 10 ppm TOC
Precision	2% RSD
Accuracy	±3%*
Analysis Time:	4 seconds

*Stated accuracy is achievable under controlled laboratory conditions that minimize operator and standards errors, as well as the impact of time on calibration drift.

Sample Flow Rate:	1.1 mL/min; 0.5 mL/min when TOC > 5 ppm
Instrument Delay (90% recovery)	3.5 minutes

Enabling Turbo Mode

Activation of Turbo sampling mode may be purchased directly from GE Analytical Instruments.

1. Select the **Setup** tab.
2. Press the **Enable Turbo** button.
3. Enter the Activation Code. If necessary, press the **Number** button to toggle the keypad from letters to numbers.
4. Press the **Enter** button.
5. After Turbo mode has been enabled, you must turn Turbo mode on by following the instructions in the next section.

Turning Turbo Mode On and Off

To turn Turbo mode on or off, follow these steps:

1. Press the **Menu** button and select the **Setup** tab.
2. Press the **Configure** button.
3. Press the **Turbo** button and then press **On** to enable Turbo sampling mode. If you have previously set **Turbo** to **On**, you can press the **Off** button to return the Analyzer to normal sampling mode.

Note: Turbo sampling is available only in On-Line Mode. See “Setting the Analyzer Mode” on page 88 for related information.

Instruments that have been calibrated for Turbo operation also can be used in normal, non-Turbo mode without affecting measurements. However, instruments that only have been calibrated for normal operation will not make accurate Turbo measurements until they are calibrated for Turbo mode, as described below.

Reagent Flow Rates

Operating in Turbo mode requires a change to the reagent flow rates. The Autoreagent function cannot be used in Turbo mode.

The reagent flow rates for Turbo mode should be set as follows:

Acid = 2.0 µL/min

Oxidizer = 2.0 µL/min

Performing a Turbo Calibration

Calibration for Analyzers running in Turbo mode is different from basic calibration. Because of the increased volume of standards required for Turbo calibration, the IOS System is not used, and instead standards are sampled directly from the 250 mL containers provided by GE Analytical Instruments. In addition, only a single-point calibration is performed. The Analyzer must be in Turbo mode to perform the calibration.

To calibrate an Analyzer in Turbo mode, follow these steps:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, place the lever into the **Bypass** position.
3. Press the **Menu** button and then press the **Consumables** button.
4. Press the **Flush** button and then **Flush Both** button.
5. When the flush is complete after about 10 minutes, select the **Maintenance** tab and press the **Calibrate** button.
6. Press the **Turbo Cal** button.

   At this point, the prompts on the Analyzer's display screen will help guide you through the calibration process.
7. For the Turbo calibration, you will need to sample from the standards containers and must use the sipper tube (1/16"-OD tubing with a Valco fitting provided in the Analyzer's accessories kit). First, use the 1/4" open-end wrench from the accessories kit to loosen the Valco nut that connects the stainless steel tubing from the IOS System to the **Sample Inlet** port; carefully pull the stainless steel tubing out of the way.
8. Insert the Valco fitting into the **Sample Inlet** port and tighten with the 1/4" wrench by turning the nut 1/8 turn past finger-tight.
9. Place the open end of the sipper tube into the bottle containing the TOC calibration standard (4 ppm KHP) that was purchased from GE Analytical Instruments, and press **Next**.
10. To enter the lot number of the standard vial, press the **Lot** button. The alpha or numeric keyboard appears. Press the **Number** or **Alpha** button to toggle to the other keyboard, as needed.
11. When prompted, remove the sipper tube from the TOC calibration standard bottle, place it into the bottle containing the IC calibration standard (as Na_2CO_3), and press **Next**.
12. After the IC calibration standard has been analyzed, the calibration summary screen appears. You should **Apply** the calibration if the Analyzer indicates that calibration **Passed**.

If calibration **Failed**, press the **Cancel** button to reject the calibration. Before performing the calibration procedure again, consult the chapter called "Troubleshooting" on page 181 to determine if there is a problem with the Analyzer.

13. You must verify the Turbo calibration when you are finished. Proceed to "Performing a Turbo Calibration Verification" on page 206 for instructions.

Performing a Turbo Calibration Verification

Use the verification procedure to confirm that the Analyzer's current calibration is accurate. Plan on performing a verification after replacement of consumables, such as the UV lamp, pump tubing, resin bed, or reagents.

Follow these steps to perform a calibration verification:

1. If the Analyzer is taking measurements, press the **Stop Analysis** button.
2. If you have an ICR unit, make sure the lever is in the **Bypass** position.
3. Select the **Maintenance** tab and press the **Calibrate** button.
4. Press the **Turbo Ver** button.

   At this point, the prompts on the Analyzer's display screen will help guide you through the calibration verification process.
5. Place the sipper tube into the bottle containing the verification blank and press **Next**.

   For the Turbo verification, you will need to sample from the standards containers and must use the sipper tube (1/16"-OD tubing with a Valco fitting provided in the Analyzer's accessories kit). If you just performed the Turbo calibration, no hardware change is required and you can proceed to the next step.

   If you did not perform the Turbo calibration, you must change the sample inlet now to use the sipper tube. Use the 1/4" open-end wrench from the accessories kit to loosen the Valco nut that connects the stainless steel tubing from the IOS System to the **Sample Inlet** port; carefully pull the stainless steel tubing out of the way. Then, attach the sipper tube to the **Sample Inlet** port and tighten the Valco nut with the 1/4" wrench by turning the nut 1/8 turn past finger-tight.
6. To enter the lot number of the standard vial, press the **Lot** button. The alpha or numeric keyboard appears. Press the **Number** or **Alpha** button to toggle to the other keyboard, as needed.
7. Place the open end of the sipper tube into the bottle containing the TOC verification standard (as sucrose), and press **Next**.
8. When prompted, remove the sipper tube from the bottle containing the TOC verification standard and place the sipper tube into the bottle containing the IC verification standard (as Na_2CO_3), and press **Next**.
9. After the IC verification standard has been analyzed, the verification summary screen appears. The calibration verification passes if the following conditions are satisfied:
   - RSD for the TOC standard is ≤3%.

- Blank has no criteria.
- RSD for the IC standard IC is ≤3% and TC ≤3%.
- TOC % Diff is ± 15% or less for the TOC standard.
- IC % Diff is ± 15% or less for the IC standard.

The % Difference value is calculated as follows:

$$\%\ \text{Diff} = \frac{\text{Measured Concentration - Expected Standard Concentration}}{\text{Expected Standard Concentration}} \times 100\%$$

If these conditions are not satisfied and verification fails, you may need to perform the calibration procedure again. However, first consult the chapter called "Troubleshooting" on page 181 to determine if there is a problem with the Analyzer.

10. Press the **OK** button to continue.
11. If you have an ICR unit, return the lever to the **Inline** position.

Turbo Mode Maintenance Considerations

All regular maintenance functions described in Chapter 7, "Maintenance," apply to Analyzers working in Turbo mode. In addition, if the Analyzer operates continuously in Turbo mode, the operating life of the sample pump is reduced by half, to 2.5 years.

Table 19: Replacement Schedule for Consumables in Turbo Analyzers

Description	Typical Operating Life
DI Water Reservoir	Refill as needed (check when replacing reagents or UV lamp)
Oxidizer	3 calendar months maximum (depends on flow rate)
Acid	12 calendar months maximum (depends on flow rate)
UV Lamp	6 months
Sample Pump Tubing	12 months
Resin Bed	Typically 12 Months (depends on water quality)
Sample Pump	2.5 years

Appendix A: Transferring Data to a PC

Importing Data into a Spreadsheet Program

The Analyzer exports data in comma-delimited text format to create a .csv file that can be imported into may spreadsheet or database programs. A common application involves exporting data from the Analyzer and importing the data into Microsoft Excel. This section describes how to accomplish this task.

1. Export data from the Analyzer via one of two methods.
   - Export to the Analyzer's USB port and capture the data on a USB flash memory drive. After exporting the data, remove the USB drive from the Analyzer and attach it to your computer's USB port. It should appear in your available drive list as a "removable media drive."
   - Export to the Analyzer's serial port and capture the data using a program like HyperTerminal (for more information on HyperTerminal, see "Using HyperTerminal" on page 212).
2. On your computer, launch MS Excel.
3. Select **File → Open**.
4. Set the **Files of type** drop-down menu to **All Files (*.*)**. Browse to the file containing the data exported from the Analyzer and press **Open**. The USB flash drive displays as a "Removable Disk" in the list of available drives.
5. If Excel opens the data in a spreadsheet, you do not need to continue with the next steps. You can work with the file as you would any other Excel file.
6. Depending on the version of Excel you have, Excel may automatically start the "Text Import Wizard" to help you create a spreadsheet from the data in the file. If the "Text Import Wizard" dialog box appears (Figure 51), make sure **Delimited** is selected and press the **Next** button.

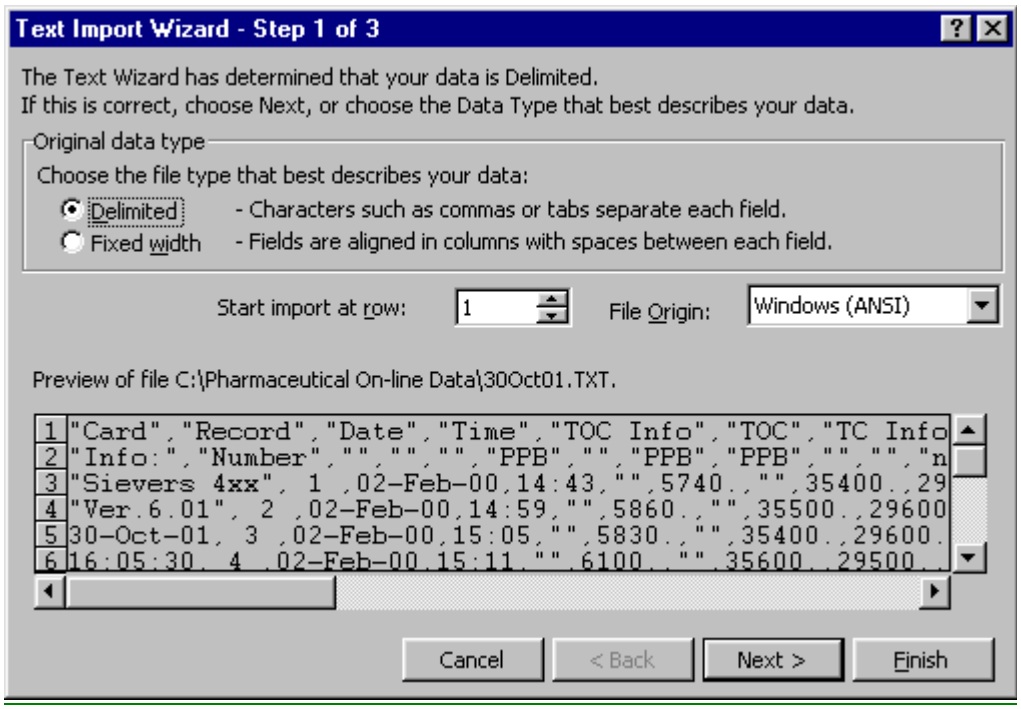

Figure 51: Step 1 of the MS Excel Text Import Wizard

7. Make sure the **Comma** check box is selected, to identify the file as being comma-delimited (Figure 52).

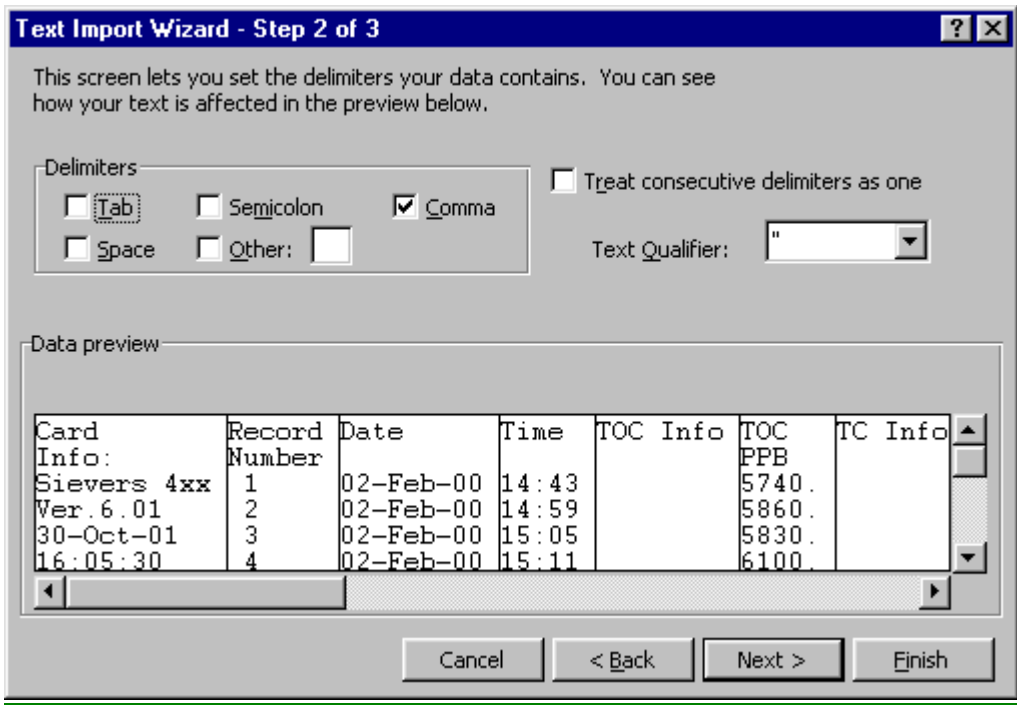

Figure 52: Step 2 of the MS Excel Text Import Wizard

8. Excel shows a preview of the data that will be imported. If desired, you can highlight a column and assign a **Column data format** (Figure 53). Press **Finish** to continue.

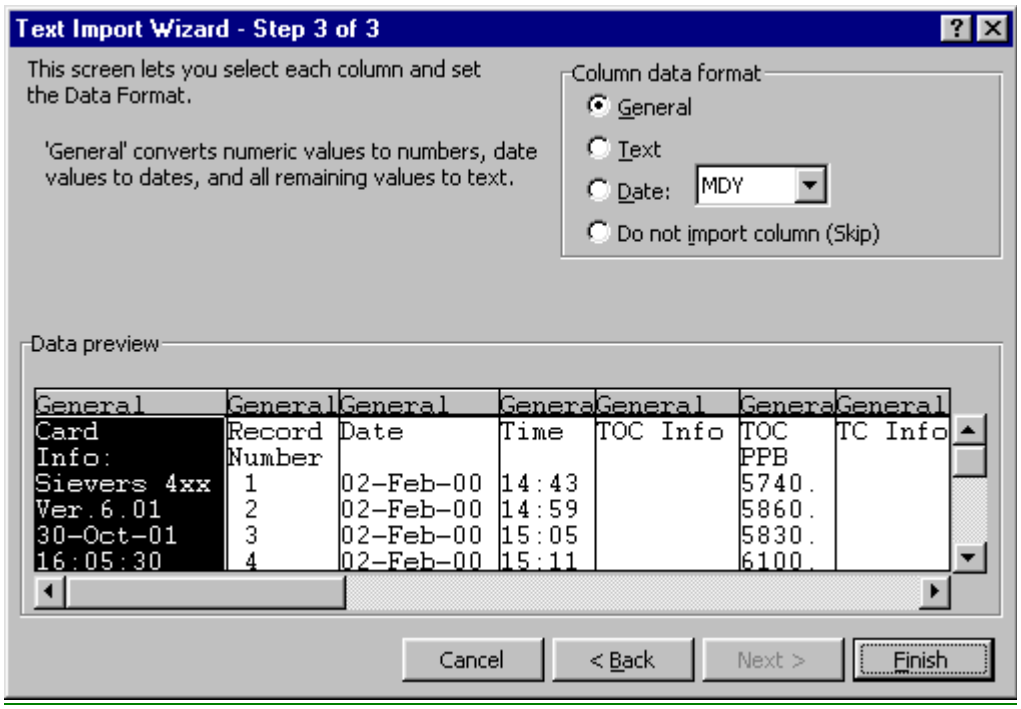

Figure 53: Step 3 of the MS Excel Text Import Wizard

9. A new spreadsheet containing your exported data opens. You can now modify the document as you would modify any other Excel file.

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 press **OK**.

3. When HyperTerminal launches, the **Connection Description** window appears. Enter a name in the Name field, such as `Sievers 900 TOC Analyzer`, and press **OK**.
4. When the **Connect To** window appears, select **Communications Port** from the **Connect Using** drop-down menu. Press **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 213.
5. In the **Com Settings** window, specify the following settings:

   Bits Per Second:9600

   Data Bits:8

   ParityNone

   Stop Bits:1

   Flow Control:Hardware

   After selecting these values, press **OK**.
6. The main HyperTerminal window appears. Select **Transfer → Capture Text**. Specify a location and name for the file and press **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. Press the **Device Manager** button.
4. Scroll down to **Ports (Com and LPT)** and expand the menu by pressing the plus sign (+).
5. The communication ports in use should be listed, along with device names.

Appendix B: Modbus Map

Register Type	Description	Function	Address	Notes
Discrete Inputs (read)	Status	2	1000	
	New Data			Bit 0
	Error			Bit 1
	Standby			Bit 2
	Alarm 1			Bit 3
	Alarm 2			Bit 4
	Activations	2	1002	
	DataGuard			Bit 0
	Turbo2			Bit 1
	DataPro			Bit 2
	DataPro with DataGuard			Bit 3
Coils (read)	State	1	2000	
	Run			Bit 0 set
	Stop			Bit 1 set
Coils (write)	Run	5	2000	*See Footnote 1*
	Stop	5	2001	
Input Registers (read)	Instrument Family	4	3010	57 = 900
	Instrument Model Lab=10, Online=20, Portable=50		3011	16 bit unsigned
	Serial Number		3012	16 bit unsigned
	Firmware Version (Major)		3015	16 bit unsigned
	Firmware Version (Minor)		3016	16 bit unsigned
	Firmware Version (Engineering)		3017	16 bit unsigned
	Current Mode		3099	*See Footnote 2*

	Measurement Time - Year		3100	16 bit unsigned
	Measurement Time - Month		3101	16 bit unsigned
	Measurement Time - Day		3102	16 bit unsigned
	Measurement Time - Hour		3103	16 bit unsigned
	Measurement Time - Minute		3104	16 bit unsigned
	Measurement Time - Second		3105	16 bit unsigned
	Error Number		3200	*See Footnote 3*
	Error Time - Year		3201	16 bit unsigned
	Error Time - Month		3202	16 bit unsigned
	Error Time - Day		3203	16 bit unsigned
	Error Time - Hour		3204	16 bit unsigned
	Error Time - Minute		3205	16 bit unsigned
	Error Time - Second		3206	16 bit unsigned
	TOC Value Low Word		3300	16 bit unsigned *See Footnote 4*
	TOC Value High Word		3301	16 bit unsigned
	TOC Units 1=ppt, 2=ppb, 3=ppm		3302	16 bit unsigned
	TC Value Low Word		3310	16 bit unsigned
	TC Value High Word		3311	16 bit unsigned
	TC Units 1=ppt, 2=ppb, 3=ppm		3312	16 bit unsigned
	TC Stream		3313	16 bit unsigned
	IC Value Low Word		3320	16 bit unsigned
	IC Value High Word		3321	16 bit unsigned
	IC Units 1=ppt, 2=ppb, 3=ppm		3322	16 bit unsigned

Note: The Analyzer does not spontaneously send data. A Modbus host system must interrogate the Analyzer.

Footnotes:

1.) Write 1 to address 2000 to start analysis or write 1 to address 2001 to stop analysis.

2.)

Mode	Value
ON_LINE_MODE	0
GRAB_MODE	1
CELL_CALIBRATION_MODE	2
CONDUCTIVITY_AUTOZERO_MODE	3
TOC_AUTOZERO_MODE	4
TC_CALIBRATION_MODE	5
IC_CALIBRATION_MODE	6
TC_VERIFICATION_MODE	7
IC_VERIFICATION_MODE	8
TURBO_CONDUCTIVITY_ZERO_MODE	9
TURBO_TOC_AUTOZERO_MODE	10
TURBO_TC_CALIBRATION_MODE	11
TURBO_IC_CALIBRATION_MODE	12
TURBO_TC_VERIFICATION_MODE	13
TURBO_IC_VERIFICATION_MODE	14
SYSTEM_SUITABILITY_MODE	15
TURBO_MODE	16
FLOW_RATE_CALIBRATION_MODE	17
AUTOREAGENT_CALIBRATION_MODE	18
AUTOREAGENT_VERIFICATION_MODE	19
ROBUSTNESS_MODE	20
SPECIFICITY_MODE	21
JP_PROTOCOL_MODE	22

3.) Returns the most recent error number. If there is no error, it returns 0. Refer to the Troubleshooting chapter and look at specific error number in the Warnings and Error Messages section.

4.) Low Word and High Word combine to make an IEEE 32-bit floating point number.

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