

ChemScan[®]
UV-4100
Process Analyzer System

**Installation, Operation
and Maintenance Manual**

Oxley Creek WWTP QLD AU ASA# 5507
Royce Water Technologies

Made in USA by ASA, Inc.
Applied Spectrometry Associates, Inc.
2325 Parklawn Drive, Suite I
Waukesha, WI 53186
Phone: 262-717-9500 Fax: 262-717-9530

ChemScan.com

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Installation and Startup

Analyzer Submittal Drawings

The following is the analyzer portion of the submittal package as approved by your representative. These drawings are to be used as installation directions.

ChemScan[®] Process Analyzers by ASA, Inc.

Applied Spectrometry Associates, Inc.

Phone (262) 717-9500 Fax (262) 717-9530

SUBMITTAL PACKAGE APPROVAL FORM

CUSTOMER: Royce Water Technologies, QLD Australia

PROJECT: Oxley Creek WWTP QLD United Utilities, Australia
One Multi-Parameter, Wastewater Monitoring System consisting of
One ChemScan UV-4100 Analyzer with Two Sample Lines,
Four Parameters, Eight 4-20 mA Outputs, 240 VAC

PURCHASE ORDER: AS100130RW

ASA, Inc. PROJECT # : 5507

SUBMITTAL PACKAGE: Sent on 2/2/10

Applied Spectrometry Associates submittal package for the referenced order has been reviewed and approved. Applied Spectrometry Associates is authorized to begin fabrication of the analyzer.

Signature: _____ Date: _____

COMMENTS:

PLEASE RETURN THIS APPROVAL FORM TO:

Applied Spectrometry Associates, Inc.

2325 Parklawn Drive Suite I

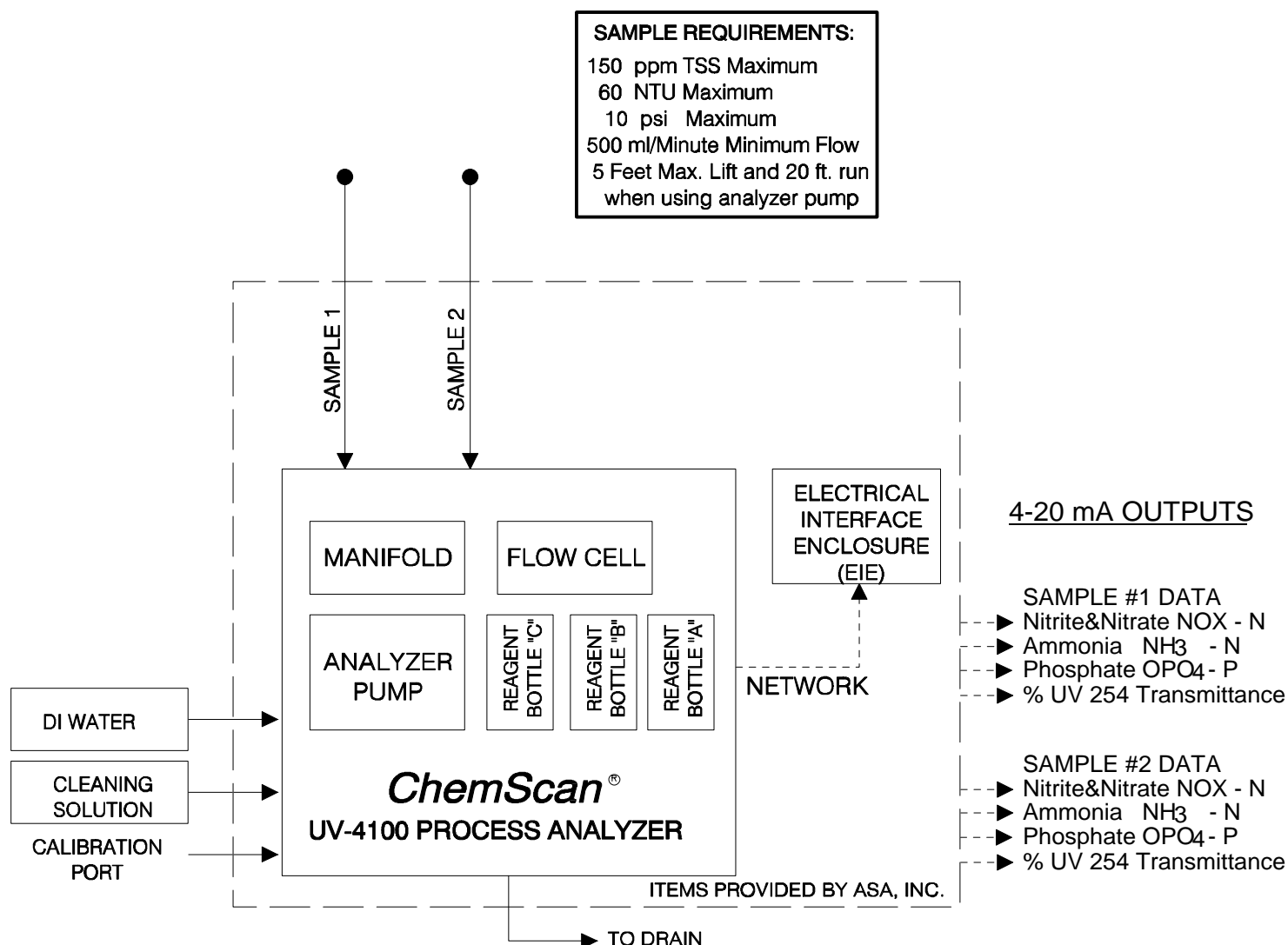
Waukesha, WI 53186

ChemScan System Description

- Item 1** One (1) Wall Mounted ChemScan Model UV-4100 Process Analyzer, including NEMA-4 electronics module enclosure, main power connection, control circuit board, network communications board and associated software for instrument control, internal memory with lithium battery backup, light source module, spectrograph module with 256 element array detector, external keypad and cabinet mounted display. Flow cell module consisting of injection type flow cell, reagent injectors, internal manifold including auto zero and clean functions, calibration sample port and 2 sample lines, peristaltic analyzer pump for zero and clean solutions, RS-232 serial port and NEMA-3R enclosure.
- Item 2** One (1) Wall Mounted ChemScan Electrical Interface Enclosure including NEMA-4 enclosure, system communication module and 8 analog 4-20 mA outputs.
- Item 3** Applied Spectrometry Associates, Inc. single instrument software license for chemometric algorithm suitable for on-line analysis of the following parameters:

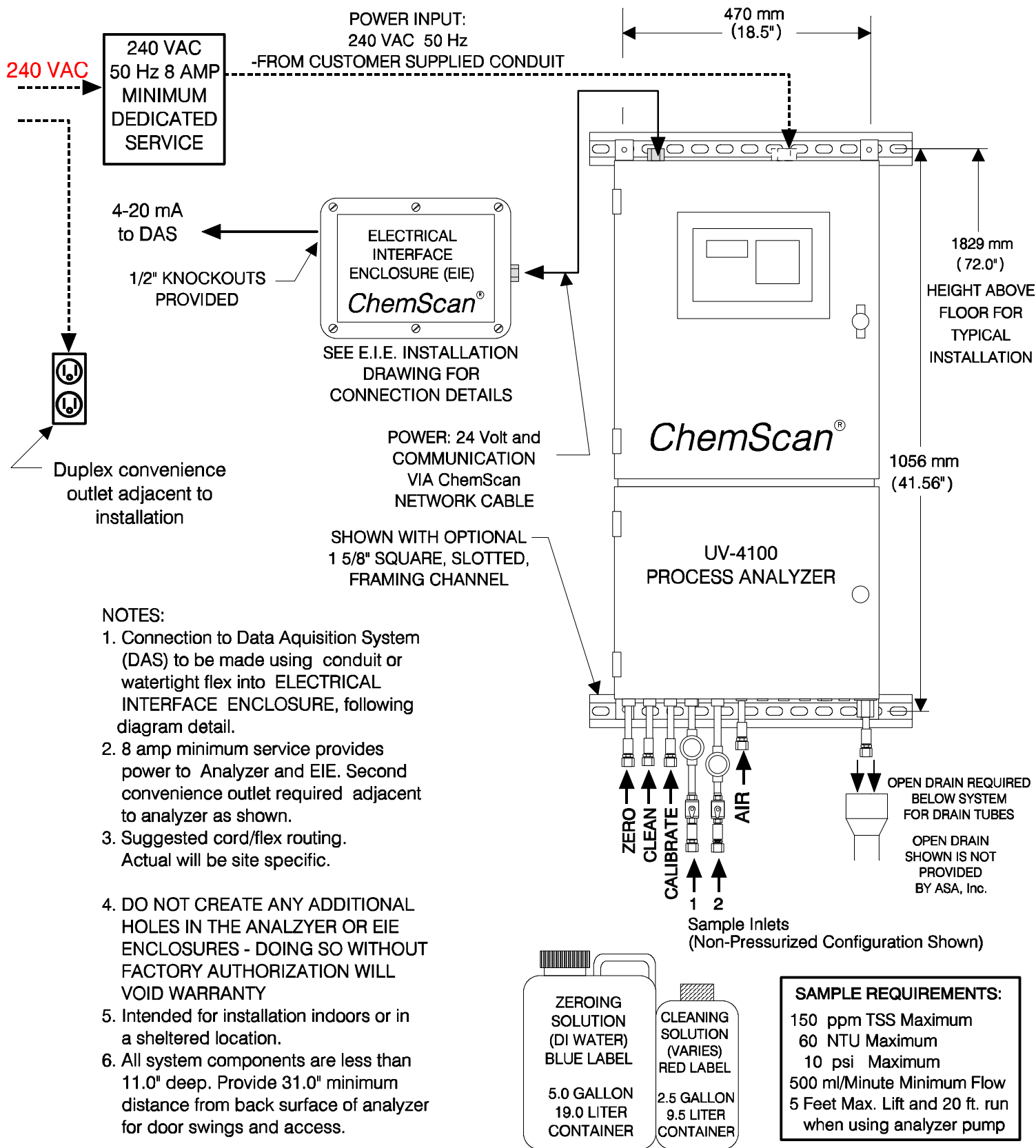
Nitrate & Nitrite NOX-N	0.10 – 20.0 mg/l as N
Ammonia NH3 - N	0.20 – 20.0 mg/l as N
Ortho-phosphate OPO4-P	0.10 – 5.0 mg/l as P
UV 254 Transmittance	0 - 100 % T

KEY	
—▶	FLUID
---▶	ELEC. SIGNALS
— -	ASA, INC. ITEMS



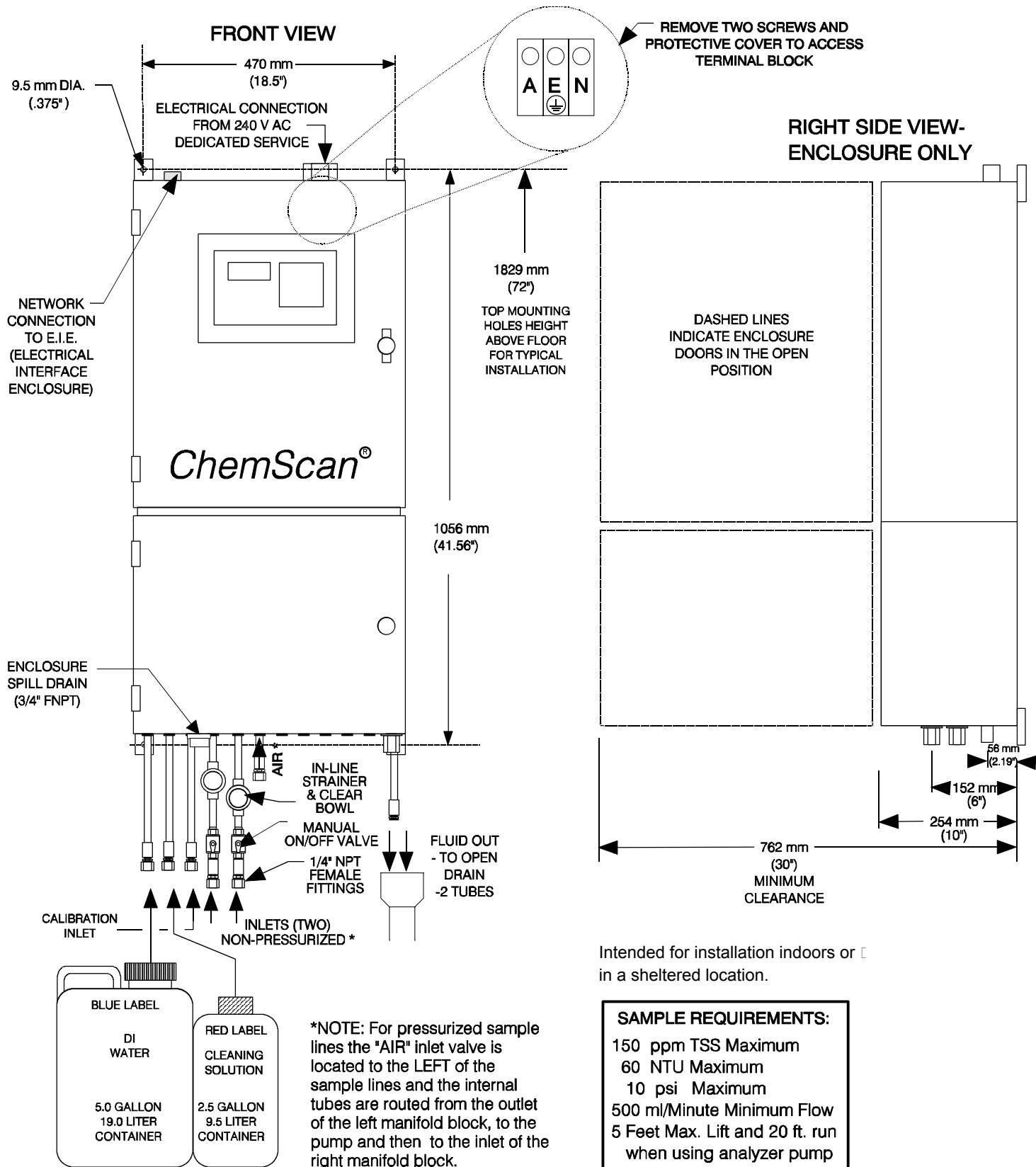
ChemScan®
Functional Block Diagram of
Multiple Sample Line, Multiple Parameter,
Water Monitoring System

ASA, Inc.	PHONE: 262-717-9500
	FAX: 262-717-9530
Applied Spectrometry Associates, Inc.©'10	
DATE: 2/2/10 BY: LJB	
Functional Block Diagram of Wastewater Monitoring System	
FILE # 48NAPTBD	



***ChemScan*[®]**
UV-4100 Analyzer System Installation Diagram
- Front View, Wall Mount -
240 V AC Version

ASA, Inc.		PHONE: 262-717-9500
		FAX: 262-717-9530
Applied Spectrometry Associates, Inc. ©'10		
DATE: 9/1/00 REV: 2/2/10		
ChemScan UV-4100 Analyzer System Installation Diagram - Wall		
FILE # 4240CWUF		



Intended for installation indoors or in a sheltered location.

SAMPLE REQUIREMENTS:

150 ppm TSS Maximum
60 NTU Maximum
10 psi Maximum
500 ml/Minute Minimum Flow
5 Feet Max. Lift and 20 ft. run when using analyzer pump

- **UV-4100 Series Process Analyzer**
WEIGHT: 125 lbs (56.7 kg)
DIMENSIONS: 20 x 40 x 10" DEEP, (51 x 102 x 26 cm)
POWER: 240V AC 2 AMP
NEMA 4 and 3R

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UV-4100 Series Analyzer Installation Diagram/
System Plumbing Details with Dual Sample Inlets,
Auto Zero and Cleaning

ASA, Inc.

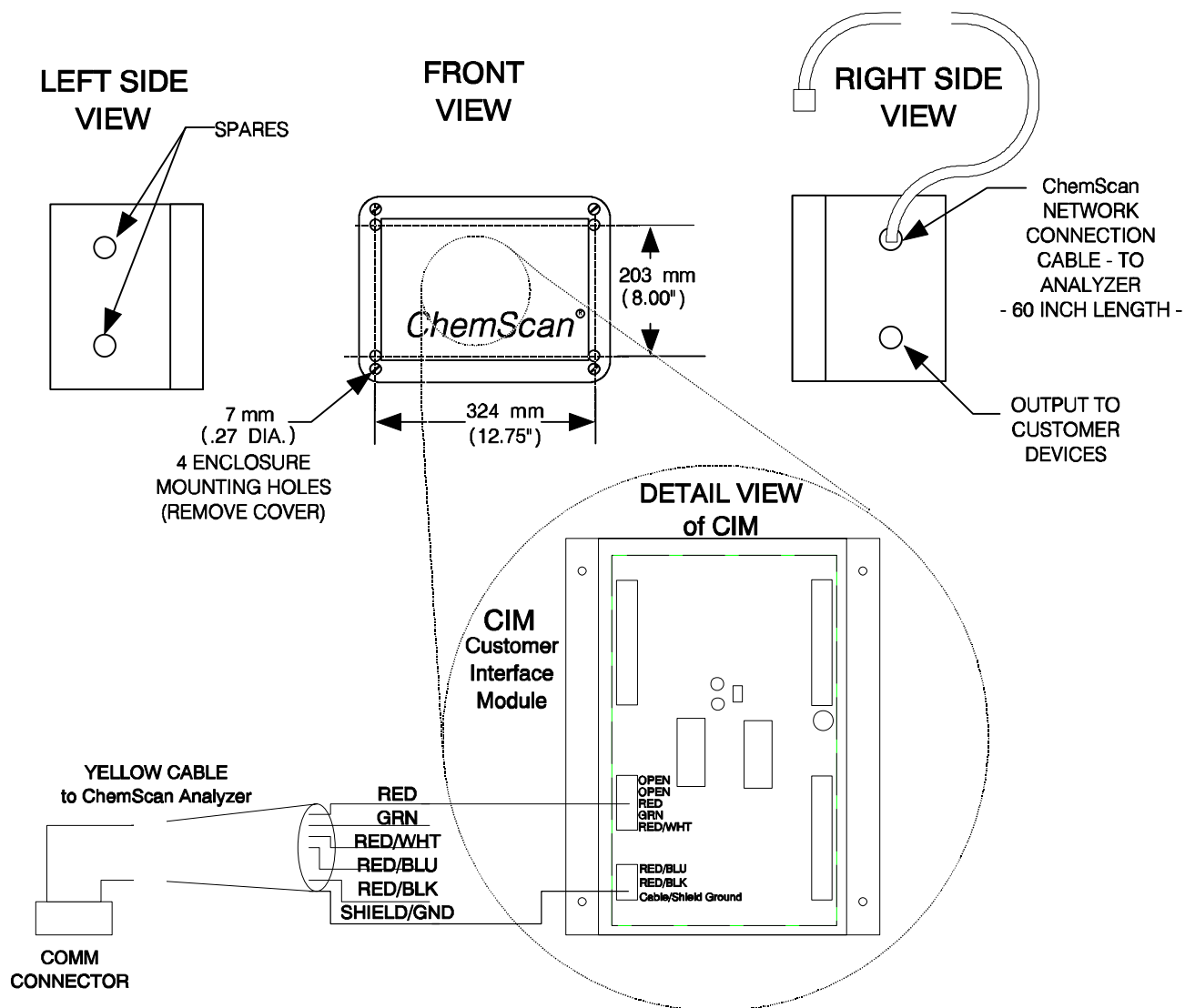
PHONE: 262-717-9500
FAX: 262-717-9530

Applied Spectrometry Associates, Inc. ©'97

DATE: 11/17/06 REV: 2/2/10 BY: LJB

ChemScan UV-4100 Series Process
Analyzer Installation Diagram

FILE # 41NTUMM



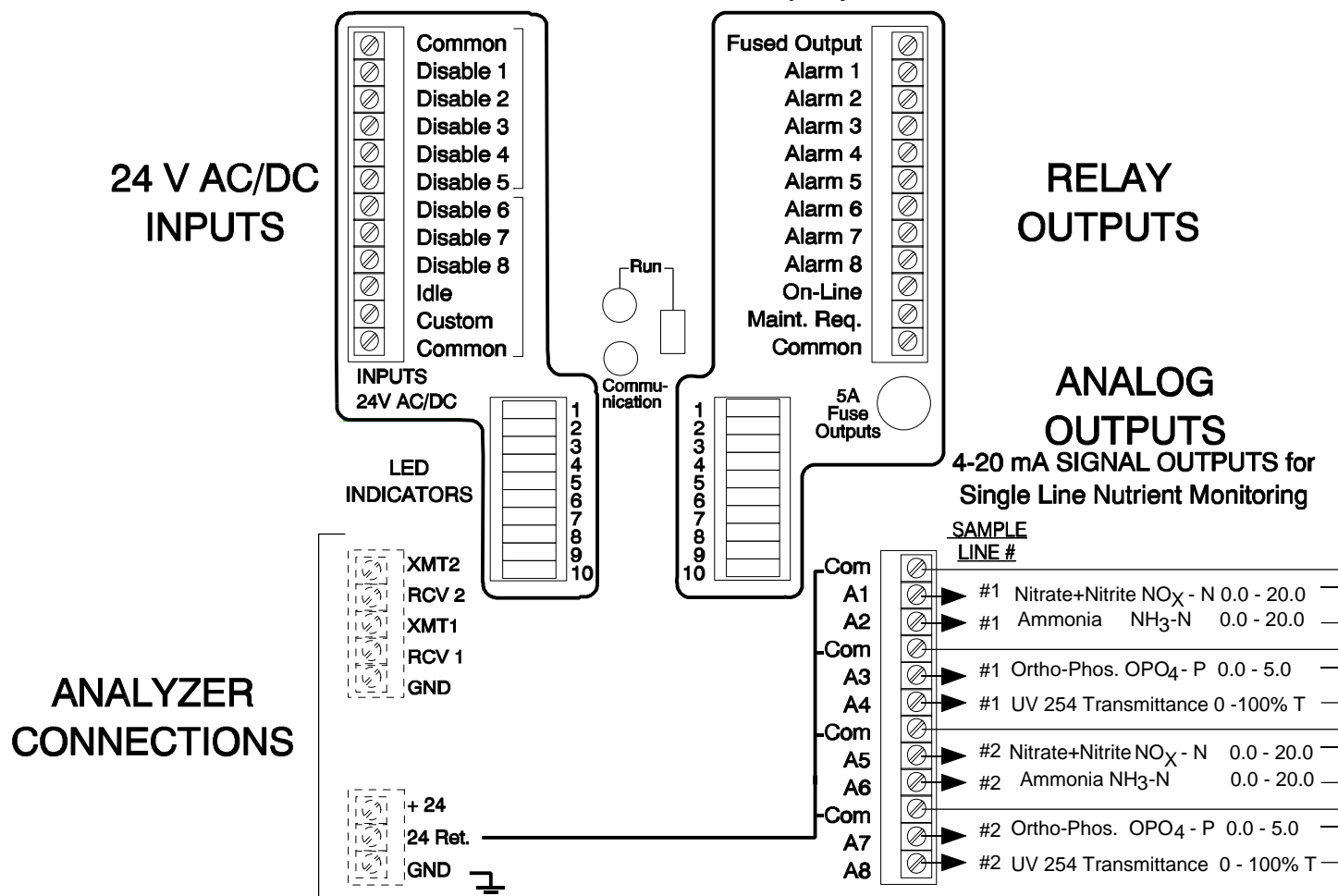
- **ELECTRICAL INTERFACE ENCLOSURE (EIE)**
 - WEIGHT: 9.1 kg (20 lbs)
 - DIMENSIONS: 36 X 27 X 20 cm DEEP (14 X 10.5 X 8")
 - POWER: Provided by ChemScan Network Cable
 - ENCL. RATING: NEMA 4X (GRAY FIBERGLASS)
- **ACCESS HOLES PROVIDED, FOR 1/2" SEALTITE HUBS TO BE FIELD INSTALLED FOR 4-20 SIGNALS**

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UV-Series System Electrical Interface Enclosure Installation Diagram

ASA, Inc.	PHONE: 262-717-9500 FAX: 262-717-9530
Applied Spectrometry Associates, Inc. © '10	
DATE: 9/13/04 REV: 6/6/09 BY: LJB	
UV-Series System Electrical Interface Enclosure - Installation Diagram w/ CIM	
FILE # ELECIMJ	

**ASA Inc./ ChemScan Analyzer
Customer Interface Module (CIM)**



**UV-Series Electrical Interface Enclosure -
CIM IN/OUT Module Connection Details**

ASA, Inc.	PHONE: 262-717-9500
	FAX: 262-717-9530
Applied Spectrometry Associates, Inc. © '10	
DATE: 2/2/10 BY: LJB	
UV-Series Electrical Interface Enclosure - Schematic - Output Module	
FILE # EICNAPT8	

ChemScan Analyzer Calibration Plan

Introduction

The ChemScan Process Analyzer is an on-line multiple wavelength transmissive spectrometry system. A site-specific detection algorithm, which relies on light absorbance measurements at multiple wavelengths, is used to calculate the concentration of a specific chemical of interest (analyte) in each process sample analyzed by the system. The development of information for this detection algorithm is what is referred to as the “calibration” of the ChemScan Process Analyzer. This process is substantially different from the response adjustment typically referred to as “calibration” by other types of instruments.

ChemScan Calibration Process

1. The analyzer will be factory calibrated for detection of each parameter identified below.
2. Factory calibration will be based on absorbance values from a minimum of 30 files obtained by ASA (ASA - Applied Spectrometry Associates Inc. technician or ASA Inc. trained representative) using laboratory standards of known concentration in pure water.
3. Initial operation at the site will be based on the factory calibration. The factory calibration is not expected to provide results that meet the accuracy goal shown below without the use of additional site-specific samples.
4. An initial site-specific learning set of process samples will be obtained by ASA following the availability of a stable process and sample flow to the ChemScan system. Each sample will be split for laboratory analysis of each analyte of interest by site personnel, using the standard method of analysis employed at the site. Each sample will be used by ASA to make several spiked samples. The set of samples and spikes produce a learning set of information for algorithm development. Quick turn around of lab results is essential to provide timely calibration and avoid duplicate trips to the site by ASA.
5. ASA will install an initial site-specific calibration for each analyte using information from the initial learning set. This calibration will be operated at the site for several weeks while calibration adjustment information is being gathered. ASA expects that the initial site-specific calibration will provide results that are closer to the accuracy results shown below, but that at least one calibration adjustment will be required to meet the accuracy goal.
6. Site personnel will be instructed to obtain a minimum of 10 and a maximum of 24 calibration adjustment samples for laboratory analysis following the recording of a data file for a split of the sample by the ChemScan analyzer. These data will be used as a calibration adjustment learning set by ASA. Laboratory analysis should be performed using the same facilities and procedures that were used for the initial site-specific learning set.

7. Following the availability of lab results for the calibration adjustment samples, ASA will use extracted data files from the ChemScan analyzer to produce an adjusted calibration for each analyte. The adjusted calibration is expected to meet the accuracy goal shown below. Performance testing should not commence until after the adjusted calibration has been installed.
8. Site personnel may, at their option, continue to obtain grab samples to verify the accuracy of results from the ChemScan system. A minimum of 10 samples should be obtained. All samples should be within the range shown below. Laboratory analysis should be performed using the same facilities and procedures that were used for the initial, site specific, learning set.

Parameter	Range	Accuracy Goal (5%)
Nitrite and Nitrate - Nitrogen NO _x - N	0.10 - 20.0 mg/L as N	1.00 mg/L
Ammonia-Nitrogen NH ₃ -N	0.20 - 20.0 mg/L as N	1.00 mg/L
Ortho-Phosphorus OPO ₄ -P	0.10 - 5.0 mg/L as P	0.25 mg/L
UV 254 Transmittance	0 – 100 % T	5.0 % T
Factory Learning Set Reference Method	30 files (minimum) Lab Standards	
Initial Site Learning Set Reference Method	10 Samples Any Approved Method	
Adjustment Learning Set Reference Method	10-24 Samples Same as Learning Set	
Test Set* Reference Method	10 Samples (minimum) Same as Learning Set	

*Test set is optional, at the operator's discretion.

Calibration Adjustments

An ASA, Inc. technical representative will arrive on-site following notification that the analyzer has been installed. The preceding document “Calibration Plan” gives guidelines for the initial calibration for your installation.

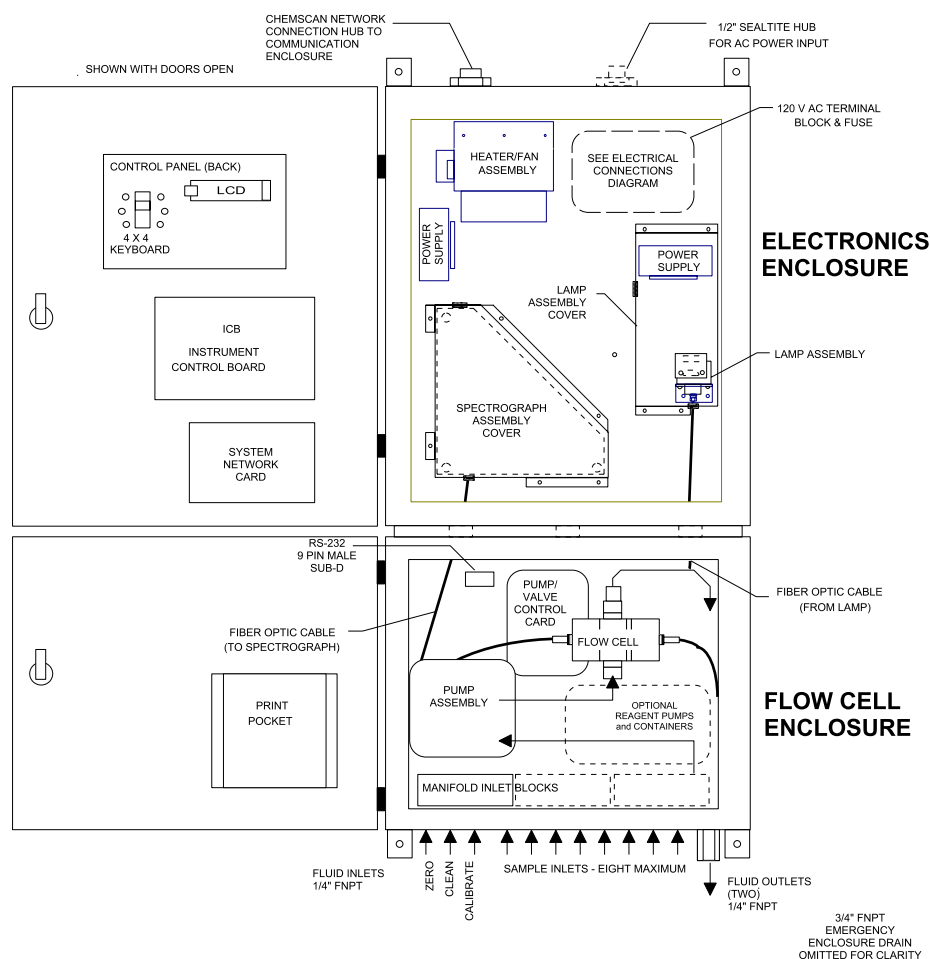
UV-4100 Series Analyzer

Analyzer Description

The ChemScan UV-4100 Analyzer is an on-line process-monitoring instrument. It has the capability of measuring multiple parameters including free nitrate, nitrite, ammonia, phosphate and percent transmittance of any wavelength between 230 nm and 450 nm. The precise measurement of these parameters is critical for optimizing today's advanced wastewater treatment processes. The analyzer can perform a complete sample profile faster than any other single analyzer. It has been designed to minimize maintenance time and reagent costs.

The analyzer has a built-in manifold to accept sample from two locations. External manifolding through the use of the ChemScan Sample Sequencer can increase the number of samples to eight and incorporate the ChemScan Cross Flow Filter System to analyze process samples prior to the secondary clarifier.

The analyzer is equipped with automatic zeroing and cleaning capability. Periodically the analyzer will pump zeroing solution into the flow cell. The analyzer tests for the need for cleaning the flowcell and zero stability. Once the diagnostic parameter is satisfied, the analyzer will return to the on-line sequence. If any abnormal operation is detected, the analyzer will alert the operator by displaying a "Maintenance Required" message.



Typical ChemScan Instrument Layout
- Size of the Lower Enclosure, Number of Sample Lines
and Quantity of Reagent Containers Varies with Model and
Site Specific Configuration

TYPLYT08

Menu Structure

The analyzer is equipped with an operator interface consisting of a display and keypad. The operational parameters can be adjusted through the operator interface. NOTE: Whenever a "+" is displayed in the lower right of the display, use the + key to display more menu choices. A complete menu structure table can be found at the end of this section.

The keypad is used to enter numerical values and to select menu choices for the analyzer. There are three main menu paths:

- 1) RUN
- 2) SETUP
- 3) CAL

RUN Menu

The RUN menu is generally used to initiate a sample analysis. Where multiple analytes are measured, the menu will request an analyte line number for read once and read cal sample options.

- 1) READ-ONCE
- 2) ON-LINE
- 3) SAMPLE
- 4) READ CAL SAMPLE

The READ ONCE choice under the RUN menu will instruct the instrument to initiate a reading for a specific analyte (or parameter) chosen and display the results on the LCD display. The analyzer will perform the complete analysis sequence required to measure the selected parameter. The analyte numbering has been configured for your site. The CLEAR key followed by the MAIN MENU key will return the analyzer to the MAIN menu.

The ON-LINE choice will place the system in the automatic mode of operation. Each sample line will be flushed and read in accordance with the intervals entered under the SETUP menu options. To interrupt the on-line mode, press the CLEAR key followed by the security code.

The SAMPLE choice will allow a selected sample line to be flushed for an indefinite interval, controlled by the operator using the + (start flushing) and - (stop flushing) keys. To return to the RUN menu press the CLEAR key.

The READ CAL SAMPLE choice allows the chosen analyte (or parameter) to be analyzed in a sample drawn in through the calibration inlet port. Once the analyte has been chosen the + and - keys are used to draw the sample into the flowcell for analysis. A minimum of 500 ml should be used to insure a complete flush of the cell. Press the ENTER key to initiate the sample analysis. Upon completion of the sample analysis the complete spectral signature is logged in the data log and the concentration is displayed. To return to the RUN menu, press the CLEAR key. If repeat analysis will be performed, be sure to flush the cell for each analysis. A physical sample is typically obtained for laboratory analysis. Once the laboratory sample has been analyzed, the values can be compared and used to make calibration adjustments.

SETUP Menu

The SETUP menu is used to configure the operational parameters used during the operation of the analyzer.

- 1) FLUSH TIME
- 2) TIME 'TWEEN READS
- 3) SECURITY CODE
- 4) AUTO ZERO INTRVL
- 5) ANALYTE INTER
- 6) SET TIME/DATE
- 7) ACCUM TIME
- 8) ALARM SETPOINTS
- 9) PRIME INJECTORS

The FLUSH TIME choice sets the amount of time the sample will be flushed through the flowcell before analysis. The FLUSH TIME of each sample line can be adjusted. FLUSH TIME should be sufficient to insure complete removal of the previous sample. The typical minimum flush time is 60 seconds.

The TIME 'TWEEN READS choice sets the time, in minutes, between each On-Line read event, starting with the first sample line to be read. Sufficient time to read all parameters in all sample lines should be allowed before a new On-Line read event is initiated.

The SECURITY CODE choice allows the operator to select a unique four-digit code. (Default code is 0000.) This code will be the only code, which will permit On-Line operation to be interrupted and provide access to the main menu.

The AUTO ZERO INTRVL option permits the operator to select the number of On-Line read events between each automatic zero event. Frequency of zeroing is site specific and is set to the frequency necessary for stable operations. Typically the interval is set to perform a zero once each day.

The ANALYTE INTER option allows a different sample frequency for each analyte. If all analytes are to be read during each On-Line read event, each analyte interval should have a setting of "01". A setting of "00" will deactivate an analyte. A setting of "02" will cause the analyte to be read during every other On-Line read event.

The SET TIME/DATE choice allows the current time and date to be entered. NOTE: The analyzer may not adjust the time and date at day light savings time or leap year.

The ACCUM TIME choice is used when a filtering system is used with the analyzer. It allows a sample to be accumulated for a period of time before the read sequence begins. If a ChemScan Sample Line Sequencer is installed, the sequencer will control the accumulator and the analyzer's ACCUM TIME must be set to 0.

The ALARM SETPOINTS choice sets a concentration for each analyte where if exceeded, the alarm relay contact will close. Alarm contacts must be specified prior to purchase of the analyzer.

The PRIME INJECTORS option is used to control the operation of the injector pump(s). Select the injector pump to prime and use the + key to start the injector and the - key to stop the injector. NOTE: The injectors are numbered from right to left.

CAL Menu

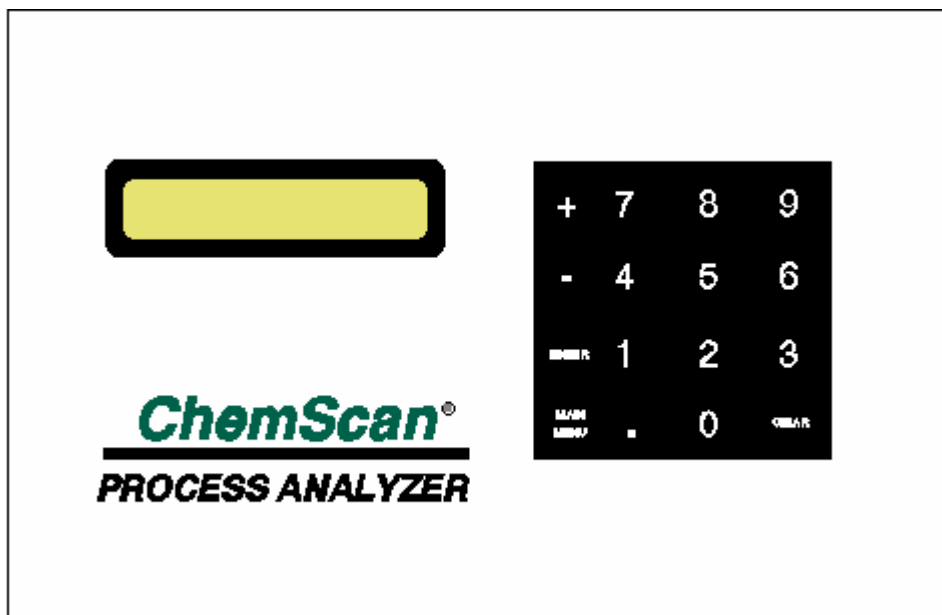
The CAL Menu is used to perform and test manual zeroing, to pass control of the analyzer to a PC or laptop connected to the serial port or to enter calibration values.

The ZERO menu allows an operator to instruct the instrument to READ ZERO solution (DI water) and automatically make appropriate mathematical adjustments for any film build up on optical surfaces within the system. The operator may initiate an AUTO ZERO cycle or may perform a MANUAL ZERO. The operator may also TEST ZERO using a choice under this Menu option. A full description of zeroing the analyzer can be found in the maintenance section of this manual.

The PC CNTRL choice passes command control from the keypad to a PC or laptop computer connected to the serial port. This is used most often to download the internal data logs from the system.

The ADJ choice allows a calibration adjustment to be entered for each analyte (or parameter). An adjustment can be made to the SLOPE and/or OFFSET of the calibration. When a parameter is measuring consistently high or low as compared to the lab, a simple offset adjustment can often correct the predictions. The calibration adjustment will be applied to all readings from that point on. A complete description of calibration adjustment can be found in the maintenance section of this manual.

The operator interface for the ChemScan Analyzer consists of a sixteen key keypad in a 4 x 4 matrix layout and a 2 x 20 character LCD as shown below.



MENU STRUCTURE

MAIN

ACTION

-1) RUN

- 1) READ-ONCE
ENTER ANALYTE #
- 2) ON-LINE
- 3) SAMPLE
ENTER SAMPLE LINE#
+ TO FLUSH - TO STOP
CLEAR TO RETURN
- 4) READ CAL SAMPLE
ENTER ANALYTE #

- READ AN ANALYTE
- PUT SYSTEM ON-LINE
- FLUSH A SAMPLE LINE

-2) SETUP

- 1) FLUSH TIME
ENTER SAMPLE LINE #
SAMPLE FLUSH TIME
LINE X XX.X SEC
- 2) TIME 'TWEEN READS
TIME BETWEEN RUNS
XXX.X MIN
- 3) SECURITY CODE
ENTER SECURITY CODE
SET SECURITY CODE
- 4) AUTOZERO INTRVL
AUTO ZERO/CLEAN
EVERY XX READ(S)
- 5) ANALYTE INTRV
ENTER ANALYTE #
ANALYTE X INTRVL
EVERY XX READ(S)
- 6) SET TIME/DATE
- 7) ACCUM TIME
- 8) ALARM SETPOINT
- 9) PRIME INJECTOR

- SET SAMPLE LINE FLUSH TIME
- SET TIME BETWEEN READINGS
- MODIFY THE SECURITY CODE
- SET NUMBER OF READINGS BETWEEN AUTO ZERO AND CLEAN
- SET NUMBER OF READINGS BETWEEN AN ANALYTE UPDATE
- SET THE CURRENT AND DATE
- SET SAMPLE ACCUMULATION TIME (FILTER SYSTEMS ONLY)
- SET THE ALARM CONCENTRATION
- OPERATION INJECTOR PUMPS

-3) CAL

- 1) ZERO
 - 1) READ ZERO
 - 1) AUTO ZERO
 - 2) MANUAL ZERO
ZERO: + FLUSH-STOP
ENTER TO READ
 - 2) TEST ZERO
TEST: + FLUSH-STOP
ENTER TO READ
 - 3) CLEAN
+ FLUSH - STOP
CLEAR TO RETURN
- 2) PC CNTRL -PASS CONTROL TO THE PC
PRESS ENTER TO GIVE
CONTROL TO PC
- 3) ADJ
ENTER ANALYTE #
1) SLOPE 2) OFFSET

- INVOKE AUTO ZERO
- INVOKE MANUAL ZERO
- TEST ZERO BY READING ZEROING SOLUTION AGAIN
- CLEAN FLOW CELL WITH THE CLEANING SOLUTION
- FOR DATA ACCESS
- ADJUST THE SLOPE AND INTERCEPT FOR FUTURE READINGS

Analyzer Maintenance

The analyzer has been design to minimize the total amount of maintenance time. Typically the analyzer requires less than 2 hours of maintenance per month.

Maintenance Schedule

Routine maintenance of the UV-4100 series analyzer is limited to a few periodic procedures as follows:

Daily

- Observe operation looking for abnormal operation

Weekly

- Fill Zeroing and Cleaning solution containers.
- Inspect and clean Inlet Strainers

Monthly

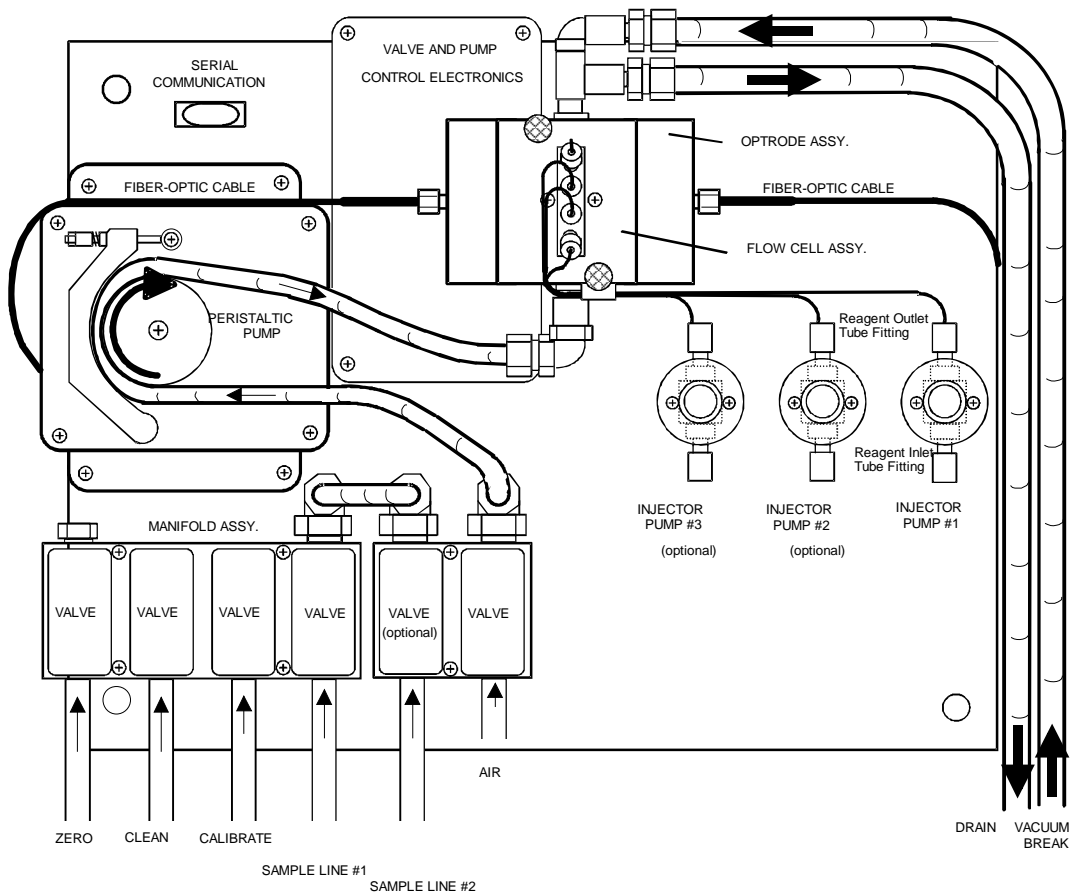
- Replace the Reagent Chemicals
- Perform a Manual Zero Operation and Log Indicator Numbers

Every 2 Years

- Replace Battery

Every 4 Years

- Replace Flash Lamp Module



ChemScan[®]
 UV-4100 Lower Enclosure Layout
 - Unpressurized Sample Lines -
 Two Shown - Actual May Differ

ASA, Inc.		PHONE: 262-717-9500
Applied Spectrometry Assoc. Inc. © '04		FAX: 262-717-9530
DATE: 4/28/04 BY: SJK		
UV-4100 Lower Enclosure Layout		
FILE # 412LWRU		

Maintenance Procedures

The following pages are procedures describing the routine maintenance operations.

Interrupting On-Line Operation

To interrupt on-line operation the "Clear" key is pressed. The following message will appear:

ENTER SECURITY CODE
—

Enter the 4-digit security code followed by the ENTER key. Press the MAIN MENU key to return the Main Menu. If an invalid security code is entered or if the entry of the code takes longer than 30 seconds, the following message will be displayed for 5 seconds:

INVALID SECURITY CODE

The instrument will then return to the on-line mode.

Sample Line Screens

The sample lines connected to the manifold are equipped with small mesh screens to prevent the entry of large particles and debris into the system. These screens must be periodically cleaned or replaced.

To clean the strainers, INTERRUPT on-line mode and close the sample line valve. Unscrew the strainer bowl and remove the screen. If algae is growing on the screen clean it with a bleach solution. Rinse the screen and bowl thoroughly with tap water. Install the screen into the strainer bowl. Be sure the o-ring is installed and screw the bowl onto the housing. Open the sample line valve and look for leaks.

If the analyzer is equipped with a sample circulation chamber, remove and clean the inlet strainer with a mild bleach solution. Rinse the strainer thoroughly and return it to the circulation chamber.

After all strainers have been cleaned, return the analyzer to the on-line mode.

Reagent Mixing Procedures

The ChemScan analyzer can be configured to measure a number of chemicals over a variety of ranges. Therefore, the chemical mixtures will be prescribed for the specific site conditions.

CAUTION: Always use appropriate chemistry laboratory precautions when mixing and handling these solutions. ALWAYS WEAR EYE PROTECTION.

Zeroing Solution

The analyzer will automatically perform a zero operation at a preset interval. The zeroing solution is typically deionized or distilled water. The zeroing solution must contain no nitrate, nitrite, iron or organics. A 20-liter / 5 gallon zeroing solution container is provided with the analyzer.

Cleaning Solution

While the analyzer is performing an autozero, it will test the need for cleaning the flow cell. The typical cleaning solution is 1 liter of Muriatic acid (HCl) into 9 liters of DI water. A 10-liter / 2.5 gallon cleaning solution container is provided with the analyzer.

NOTE: Variations to these reagents mixing procedures may be prescribed at the time of analyzer startup and calibration to match the operating range and water at your site. Follow the procedures printed on the reagent containers at your site and in the hard copy of your site manual.

Ammonia Reagents

The ChemScan UV-4100 series analyzer uses a bleach and a sodium hydroxide reagent when measuring ammonia. The following ingredients and procedures will make 1 liter of each reagent. The quantities may be modified at startup to match the operating range and type of water the analyzer is measuring.

CAUTION: Always use appropriate chemistry laboratory precautions when mixing and handling these solutions. ALWAYS WEAR EYE PROTECTION.

Items Required:

- 1 - 1 liter bleach reagent bottle (green stripe)
- 1 - 1 liter sodium hydroxide bottle (yellow stripe)
- ~2 liters of deionized or distilled water
- 170 ml of ~ 5.25% Sodium Hypochlorite NaOCl (Blue Label Clorox Bleach)
- OR 150 ml of ~ 6.00% Sodium Hypochlorite NaOCl (Ultra No Scent Clorox)

50 grams of EDTA tetrasodium salt, 96% or greater

50 grams Sodium Hydroxide NaOH, ACS reagent grade or equivalent

Recommended mixing procedure:

- 1) Using the reagent container with the **yellow stripe**, dissolve **45 g** of NaOH in 1 liter of deionized or distilled water. **Add the EDTA** and mix thoroughly and be sure the solids are completely dissolved before installing reagent.
- 2) Add the NaOCl solution (bleach) to a volumetric container, add **5 g** of NaOH and dilute with deionized or distilled water to 1 liter. Mix thoroughly and be sure the solids are completely dissolved. Pour the contents into the reagent container with the **green stripe**. Mix thoroughly.

Reagent Mixing Procedures Continued

Phosphate Reagent

The ChemScan UV-4100 analyzer uses the Vanadate – Molybdate Reagent when measuring orthophosphate. You may wish to purchase pre-mixed solution from a supplier or mix it yourself using one of the two the following procedures:

Pre-Mixed Reagent Procedure:

- 1.) Purchase pre-mixed 1 Liter bottles of Vanadate – Molybdate Reagent
- 2.) Pour the contents into the marked container (purple stripe) found in the lower enclosure of the ChemScan Analyzer.

On-Site Reagent Mixing Procedure:

The following ingredients and procedure will make 1 liter of the reagent solution.

CAUTION: Always use appropriate chemistry laboratory precautions when mixing and handling these solutions. ALWAYS WEAR EYE PROTECTION.

Items Required:

- 1 - 1 liter container suitable for heating
- 1 - 1 liter reagent container (purple stripe)
- ~700 ml of deionized or distilled water
- 3.0 g Ammonium Metavanadate, NH_4VO_3 99+%
[7803-55-6] CAS Reg. No.
ACS reagent or equivalent
- 50.0 g Ammonium Heptamolybdate tetrahydrate, $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24}\cdot\text{H}_2\text{O}$ 81-83% MoO_3
[12054-85-2] CAS Reg. No.
ACS reagent or equivalent
- 300 ml Sulfuric Acid, H_2SO_4 95-98%
{7664-93-9} CAS Reg. No.
ACS reagent or equivalent

Recommended mixing procedure:

- 1) Dissolve Ammonium Heptamolybdate in ~300 ml distilled water.
- 2) Mix Ammonium Metavanadate with ~300 ml distilled water and heat to dissolve. Cool to warm temperature once the solid has completely dissolved.
- 3) Mix the Ammonium Heptamolybdate solution and Ammonium Metavanadate solution. Add the Sulfuric Acid and dilute to 1 liter.

CAUTION: When adding the Sulfuric Acid, always add it to the aqueous solution with stirring. This process generates large quantities of heat. Always use appropriate laboratory procedures when handling these solutions. ALWAYS WEAR EYE PROTECTION

Reagent Replacement

Periodically the reagents must be replenished. This time period depends on the number of sample lines and time between reading cycles. Whenever possible the replenishment period has been setup to correspond to an even week interval. Always replace the chemicals do not simply add reagent to the existing container. This will assure the analyzer is operating using a fresh reagent all the time.

- 1) Interrupt the On-Line mode as described above.
- 2) Without lifting the reagent container, unscrew the reagent cap. The reagent tube connector has been designed to allow the cap to spin without the tubing rotating.
- 3) Carefully lift and slide the used reagent container out of the analyzer enclosure.
- 4) Cap the used reagent container.
- 5) Unscrew the replacement reagent container cap and carefully raise the reagent container onto the tube.
- 6) While holding the reagent bottle screw the on the cap.
- 7) Slide the reagent bottle into the analyzer enclosure and tighten the cap.
- 8) If the previous reagent container has been emptied or the previous reagent is in question prime the injectors using the following steps.

From the MAIN MENU, press 2 for SETUP. The SETUP MENU will be displayed:

SETUP: _ 1) FLUSH
2) TIME "TWEEN RUNS +

Press the "+" key to display more options. Keep press the "+" key until the 9th option is displayed.

8) SET ALARM LEVELS
9) PRIME INJECTORS

Press 9 for PRIME INJECTORS.

PRIME INJECTOR #: _

Enter the injector number to be tested.

PRIME _ : +starts
-stops, C QUITs

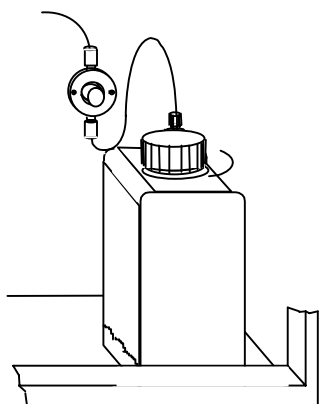
Press the "+" key to begin the injector operation. The injector will continue to operate until the "-" key or "CLEAR" key is pressed.

- 9) Return the unused portion of the reagent to the lab for proper disposal.

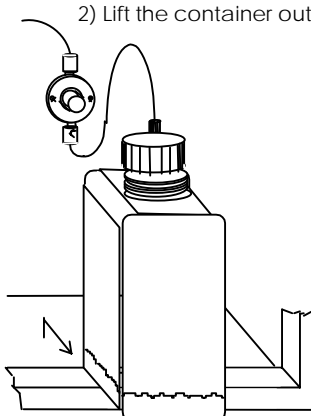
Reagent Replacement

Removing the Container

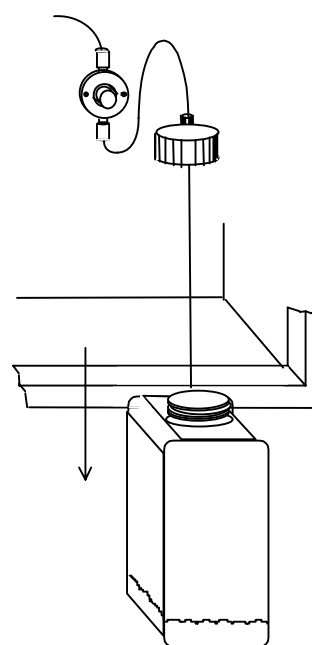
1) Loosen the cap



2) Lift the container out

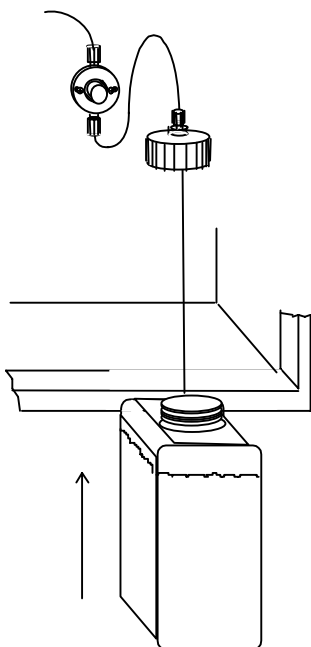


3) Lower the container off the Tubing

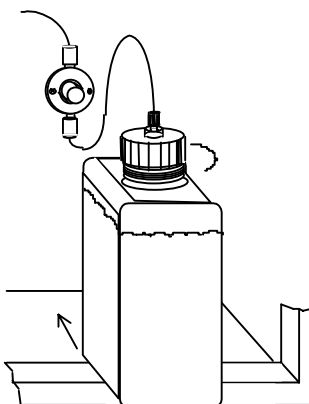


Installing the Container

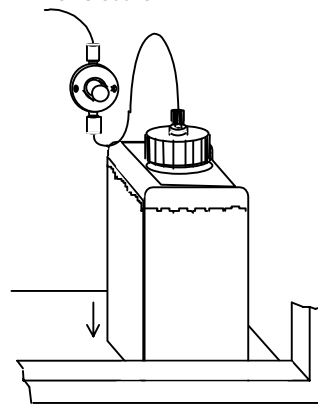
1) Raise the container onto the Tube



2) Screw the cap onto the container



3) Tilt the container slightly and lower into the enclosure



4) Check reagent tube connector tightness on pump

5) Prime the injector (if necessary)

4100TST4

Pump Tube Replacement

Other than periodic tubing replacement this peristaltic pump does not require any regular service or lubrication. It is absolutely necessary that the pump tubing be changed periodically to prevent excessive tube wear, which may lead to eventual tube rupture and leakage.

Always use tubing of the exact same type, size and length as originally supplied with the pump to ensure proper operation. Replacement pump tubes of the correct type with connection fittings attached are available from ASA, Inc. Three replacement tubes are provided with the ChemScan system.

Follow the procedure below when replacing the pump tubing:

- 1.) Place the instrument in the “OFF LINE” mode.

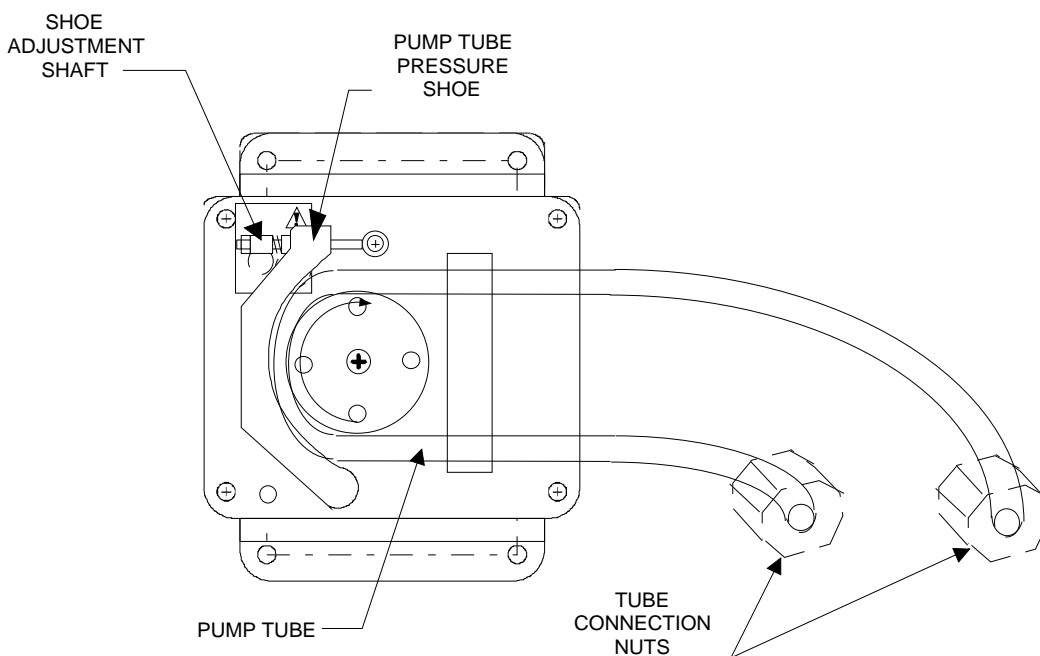
CAUTION ! Failure to place the instrument in the “OFF LINE” mode will result in the pump starting without warning. This could cause injury to the person changing the pump tubing.

- 2.) Release the pump tube pressure shoe by pivoting the shoe adjustment shaft out of the slot in the shoe.
NOTE: Adjustment of the shaft knurled nut and lock nut should not be necessary in normal operation. These are adjusted and locked in place at the factory to reduce field maintenance time.

- 3.) Loosen the two black hex tube connection nuts at the ends of the pump tube located at the gray valve block and remove the old tube.

- 4.) Install the new tube by connecting the upper connection and route the tube around the center of the pump rollers. Avoiding excessive twisting or stretching of the tubing attach the lower end of the tube to the other fitting and tighten both fittings securely.

- 5.) Reposition the pressure shoe, latch it and return instrument to “ON LINE” mode.



Manual Instrument Zeroing Procedure

The ChemScan UV-4100 Series Analyzer must be zeroed occasionally to correct for drift and flow cell fouling. The analyzer will automatically perform a zero on a regular basis (typically daily). However it is important to periodically perform a Manual Zero Operation to track the indicator numbers. This procedure simply involves rinsing the flow cell with deionized water, initiating a zero reading and testing the zero.

Items Required:

1 gallon of deionized water

Interrupt on-line mode:

Press the CLEAR key on the keypad. The following message will appear:

ENTER SECURITY CODE
—

Enter 0000 or the current security code followed by the MAIN MENU key and the Main Menu will be displayed:

MAIN: _ 1) RUN
2) SETUP 3) CAL

Instrument Zeroing:

On the instrument keypad, press 3 for CAL. The CAL MENU will be displayed:

CAL: _ 1) ZERO
2) PC CNTRL 3) OFFSET

Press 1 for ZERO. The following will be displayed:

ZERO: 1) READ ZERO
2) TEST ZERO 3) CLEAN

Press 1 for READ ZERO. The following message will be displayed:

READ ZERO: 1) AUTO
2) MANUAL ZERO

Selection of 1) AUTO will cause the system to immediately initiate an auto zero cycle. The instrument will automatically flush with DI water, take a reading, compare the values to certain set points, determine if cleaning is necessary, auto clean, re-zero and re-test.

Selection of 2) MANUAL ZERO will require the operator to manage the zeroing procedure and to interpret the indicator results.

Press 2 for MANUAL ZERO. The following message will be displayed:

ZERO: + FLUSH - STOP
ENTER TO READ

Using the + key to begin flushing the deionized water. Allow the water to flush for 2 minutes and press the - key to stop flushing. Press ENTER to take the reading. The instrument will read the deionized water and store the reading as a zero.

Checking the zero:

Following the reading of the zero, the ZERO MENU will be displayed.

ZERO: 1) READ ZERO
2) TEST ZERO

Press 2 for TEST ZERO. The following will be displayed:

TEST: + FLUSH - STOP
ENTER TO READ

Using the + and - keys to control the pump, allow deionized water to flush for 8-10 seconds. Press the ENTER key to initiate the reading. Following the reading the READ ONCE RESULTS will be displayed. Record the concentration values in the log. Press the 2 key on the keypad. Record the values for:

MX	AV
MN	TL

Press the 3 key on the keypad. Record the values for:

230	424
248	448

Press CLEAR and MAIN MENU to return to the MAIN MENU.

If the MX value is greater than 0.005 or if the MN value is less than -0.005 repeat the Zeroing procedure.
If the 230 or 248 values are less than 2500, the flow cell should be chemically cleaned.

Returning to on-line mode:

From the MAIN MENU, press 1 for RUN. The RUN MENU will be displayed:

RUN_: 1) READ-ONCE
2) ON-LINE 3) SAMPLE +

Press 2 for ON-LINE. The instrument is now in the ON-LINE MODE.

Manual Chemical Cleaning Procedure

The ChemScan UV-4100 series analyzer uses ultraviolet light to measure chemicals. Over time the windows in the flow cell will foul. The flow cell windows must be cleaned occasionally to insure strong light signal through the sample. This can be accomplished by simply flushing the flow cell and tubes with a mild acid rinsing the cleaning solution out and zeroing the instrument.

Items Needed:

250 ml of 20 percent HCl acid solution
1 gallon of deionized water for zeroing.

Interrupt On-Line Mode:

If the instrument is in the ON-LINE mode, press the CLEAR key on the keypad. The following message will appear:

ENTER SECURITY CODE

—

Enter 0000 or the current security code and the instrument will display the MAIN MENU.

MAIN: _ 1) RUN
2) SETUP 3) CAL

Acid Flush:

Note: Cleaning solution can cause permanent damage to eyes, skin and clothing. Take proper precautions while handling. If solution comes in contact, rinse heavily with water.

On the instrument keypad, press 3 for CAL. The CAL MENU will be displayed:

CAL: _ 1) ZERO
2) PC CNTRL 3) OFFSET

Press 1 for ZERO. The following will be displayed:

ZERO: 1) READ ZERO
2) TEST ZERO 3) CLEAN

Press 3 for CLEAN. The following will be displayed:

+ FLUSH - STOP
CLEAR TO EXIT

Press the + key to begin pumping the cleaning solution. Allow the pump to run for 15 seconds. Press the - key to stop the pump. Allow the cleaning solution to stay in the flow cell and tubes for 2 minutes.

Instrument Zeroing:

Zero the instrument using the MANUAL INSTRUMENT ZEROING PROCEDURE.

Following the zeroing procedure, note the 230 and 248 values. If they are less than 2500, the FLOW CELL must be disassembled and cleaned.

Returning to On-Line Mode:

From the MAIN MENU, press 1 for RUN. The RUN MENU will be displayed:

RUN_: 1) READ-ONCE
2) ON-LINE 3) SAMPLE +

Press 2 for ON-LINE. The instrument is now in the ON-LINE MODE.

Mechanical Cleaning Procedure

Occasionally the automatic cleaning of the flow cell will not remove enough of the fouling on the flow cell windows. If the analyzer readings are erratic or the chemical cleaning solution is being consumed more rapidly than normal, perform the MANUAL ZEROING PROCEDURE. If the 230 and 248 values are below the specified range, perform a mechanical cleaning.

Items needed

One #2 Phillips screw driver.
One wide mouth liquid container 50 - 100 ml.
One box of laboratory lens wipes.
One gallon of deionized water for zeroing.

Flushing the Flow Cell

From the MAIN MENU, press 3 for CAL. The CAL MENU will be displayed:

CAL: _ 1) ZERO
2) PC CNTRL 3)OFFSET

Press 1 for ZERO. The following will be displayed:

ZERO: 1) READ ZERO
2) TEST ZERO 3) CLEAN

Press 2 for TEST ZERO. The following will be displayed:

TEST: + FLUSH - STOP
ENTER TO READ

Using the + and - keys to control the pump, allow deionized water to flush for 60 seconds. Press the - key to stop the flow. Press the CLEAR key followed by the MAIN MENU key to return to the Main Menu.

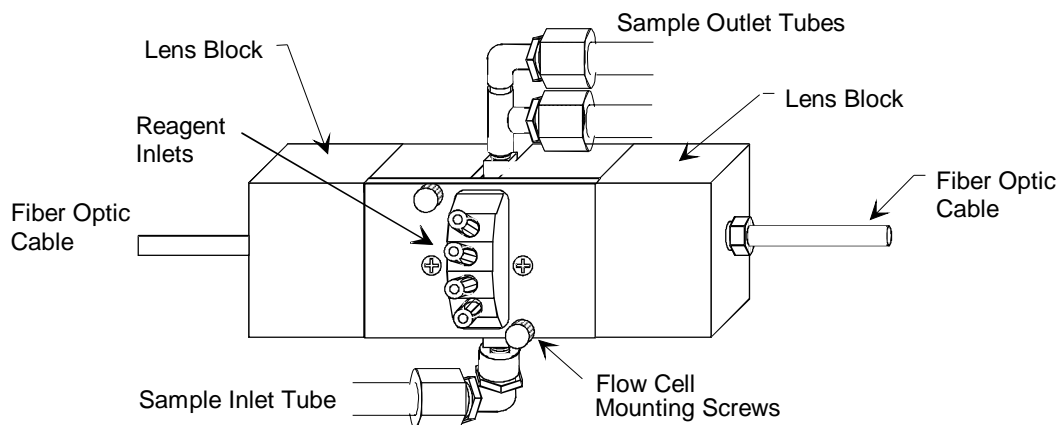
Removing the Flow Cell Assembly

- 1) Hold a small container under the flow cell sample inlet fitting. Loosen the fitting and capture the deionized water into the container. Remove the tubing from the fitting.
- 2) Remove the tubing from the top of the flow cell.
- 3) Remove the thumb screw securing the injector tubing harness.
- 4) Remove the injector fittings in the front of the flow cell by unscrewing the brown colored fittings.
Note: Take care not to drip the reagents on your skin. They are acid or caustic solutions.
- 5) Remove the remaining thumb screw securing the flow cell.
- 6) Carefully remove the flow cell assembly by sliding it out the front of the flow cell mount.

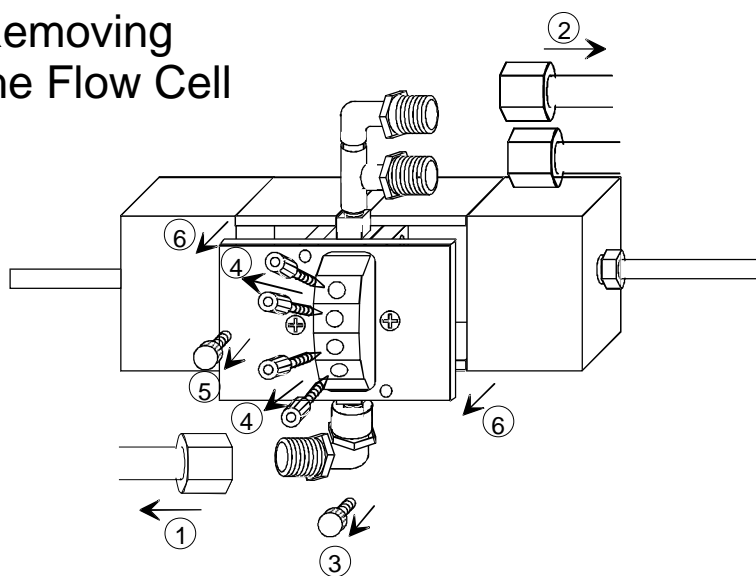
Disassembling and Cleaning the Flow Cell Assembly

- 1) Remove the two screws mounting the flow cell to the cover plate.
- 2) Remove the four window plate mounting screws.
- 3) Clean the windows using laboratory lens wipes dipped in water or cleaning solution.
- 4) Wipe the windows and flow cell completely dry.

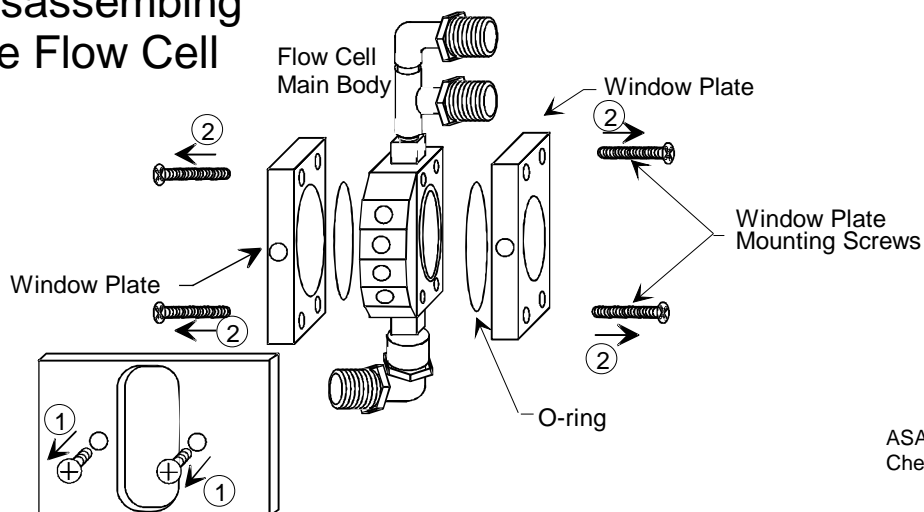
Optrode Assembly



Removing the Flow Cell



Disassembling the Flow Cell



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F#FCINJ42V

Assembling and Mounting the Flow Cell Assembly

- 1) Mount the window plates to the flow cell body with the larger window against the o-rings and the cover plate mounting holes facing the same direction as the injector ports. Be sure the o-ring is installed and fully compressed.
- 2) Wipe the outside of the flow cell.
- 3) Mount the cover plate to the window plates.
- 4) Carefully slide the flow cell into the flow cell mount and secure using the upper thumb screw.
- 5) Screw the injector tubes into the injector ports.
- 6) Screw in the thumb screw securing the injector tube harness.
- 7) Attach the fluid tubing and tighten the fittings.

Testing the Flow Cell Assembly

- 1) Perform the MANUAL ZEROING PROCEDURE.

Following the zeroing procedure, note the 230 and 248 values. If they are less than 2500, call ChemScan Service for further instructions.

Battery Replacement

The Lithium Battery on the ICB is used to hold the nonvolatile memory when the power is removed from the analyzer. It is very critical that the battery not get too low, as the analyzer configuration will be lost upon power down. Therefore the battery should be checked / replaced every two years.

Test:

- 1) Open the Electronics Enclosure door. LEAVE THE POWER ON THE ANALYZER.
- 2) Measure the voltage across the battery located on the circuit board on the door of the upper enclosure.
- 3) If the battery voltage is less than 3.3 VDC, replace it.

Replacement:

- 1) LEAVE THE POWER ON THE ANALYZER.
- 2) Note the polarity of the installed battery and remove it by pulling it straight out.
- 3) Find the polarity markings on the replacement battery, with the + on the top, insert the replacement battery. Be sure it is completely seated in the battery holder.
- 4) Verify the voltage of the new battery (3.3 VDC Minimum) by measuring on the contacts of the battery holder. Double-check the polarity

NOTE: If the battery is not installed properly or fails and the A. C. power to the analyzer is disconnected or interrupted, the following will occur:

When the A. C. power is restored to the analyzer, the display will read: "RAM DATA RESET" or something other than "MAIN MENU" when the "MAIN MENU" key is pressed.

Properly install a new battery and reinstall the analyzer configuration software. (Refer to prior instructions provided by ASA personnel or call ASA, Inc. for the details on this procedure.)

Flash Lamp Replacement

NOTE: Flash Lamp Module replacement or adjustment should only be performed if all other methods of improving light throughput have failed. Be absolutely sure the optrode assembly is completely functional.

The flash lamp should be replaced on a four-year interval. Even though lamp intensity does not decrease much in this time period, there have been cases where the lamp becomes less stable with time.

Lamp Removal and Installation

Warning: The lamp emits UV light when operating. Wear suitable eye protection.

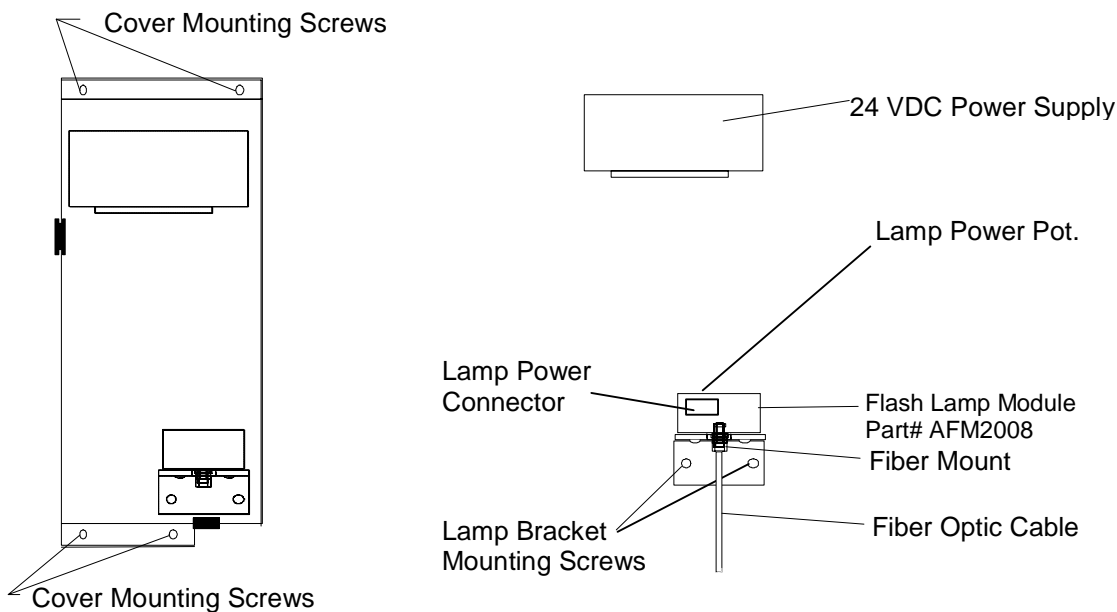
Caution: Handle the Fiber Optic Cable gently to prevent damage.

- 1) Remove power from the analyzer.
- 2) Remove the Flash Lamp Assembly Cover by removing the four mounting screws (figure 5.1).
- 3) Remove the Fiber Optic Cable by carefully loosening the nut using a 5/16" open-end wrench. Place the Fiber Optic Cable out of the way but take care not to bend it too tightly.
- 4) Remove the Lamp Mount Power Connector by removing the two mounting screws on the connector and pulling it forward.
- 5) Remove the old Lamp Mount Assembly by removing the two Phillips head mounting screws on the lamp mounting bracket.
- 6) Install the new Lamp Mount Assembly using the two mounting screws. Verify that the small switch on the lamp module is in the "INT" position.
- 7) Reconnect the Lamp Mount Power Connector and secure with the screws.
- 7) Install the Fiber Optic Cable finger tight. Tighten the nut using a 5/16" wrench just tight enough so fingers cannot loosen it.

Lamp Adjustment Procedure

The lamp must be occasionally adjusted due to system throughput changes or following lamp replacement. The adjustability in the Flash Lamp Assembly is the only way to provide system-level light intensity adjustments. For this reason, the other optical components must be operating optimally before adjusting the lamp.

- 1) Before adjusting the lamp, physically clean the windows on the lens blocks and flow cell assemblies and visually inspect the flow cell for any obvious transmittance problems. Check all fiber connections to be certain that they are greater than finger tight by attempting to loosen them without tools.



Flash Lamp Assembly

2) **Warning: The 24 VDC supply is powered by 120 VAC. Also wear suitable eye protection while working with the flash lamp and potential exposure to UV light from the lamp or fiber optic cables.**

3) Fill the flow cell with DI water. Be sure the flow cell is completely flushed and there is no air bubbles in the flow cell.

3) Perform a Test Zero Operation.

4) Display the intensity values.

Intensity Value Specifications:

Indicator Wavelength	A/D Range
230 nm	2800 to 3600 A/Ds
248 nm	2800 to 3600 A/Ds
424 nm	1500 to 3600 A/Ds
448 nm	1500 to 3600 A/Ds

5) If the intensity values do not fall within the above ranges yet they all remain approximately equal the lamp requires adjustment using the following procedure: **REMOVE THE POWER FROM THE ANALYZER.** Remove the Flash Lamp Assembly Cover. **RETURN POWER TO THE ANALYZER.**

6) Using a small flat blade screwdriver, adjust the potentiometer on the top of the flash lamp module. Clockwise to increase light, counterclockwise to decrease. **Turn no more than about five degrees.**

7) Perform a "Test Zero".

8) Repeat steps 6 through 7 until the intensity values fall into the specified ranges shown in step 4. Perform a final Test Zero to verify the intensity values.

9) **REMOVE THE A.C. POWER FROM THE ANALYZER.**

10) Replace the flash lamp cover. Return power to the analyzer.

Reagent Injector Pump Test and Replacement

The reagent injector pump provides a small volume of reagent to the flowcell to aid the analyzer in measurement of certain parameters. The injector pump is a piston style pump, which delivers 0.1 ml per stroke. On each analysis the analyzer performs a verification of the reagent volume. If the analyzer detects an incorrect volume of reagent in the cell, it will display a message "SCU READ ERROR" following the reading. If the analyzer detects an incorrect volume of reagent in the cell for three consecutive readings, it will disable the parameter, set the parameter's output to maximum of range and display the message "MAINTENANCE REQUIRED". The parameter is enabled any time the on-line mode is interrupted.

Items needed:

One #2 Phillips screw driver.
One small flat bladed screwdriver.
One wide mouth liquid container 50 - 100 ml.
One 5 - 10 ml graduated cylinder (if needed)
One injector pump (if needed)

Testing an Injector Pump

Injector Back Flow Test

The injector pumps are design to prevent ANY back flow through the pump. Back flow is when solution from the flowcell flows back through the pump and into the reagent container. This is a rare but possible failure to the pump due to wear or if particulate has gotten into the reagent. To test for injector back-flow perform the following procedure.

- 1) Remove the reagent container from the analyzer lower enclosure.
- 2) Rest the reagent tube on the lip of the lower enclosure where the end of the tube is resting so that if a drop would form it would be suspended at the end of the tube.
- 3) Allow the tube to rest for at 20 - 30 minutes. Watch for drops forming at the end of the tube.
- 4) If drops are forming and dripping off the end of the tube in the 30 minute time period, double check the tightness of the reagent tube at the injector. If the reagent continues to drip, replace the injector pump and reagent. If no drops are formed or the droplet does not grow over the 30 minute time period, the injector does not have a back flow problem.

Injection Volume Test

The injector pumps have been calibrated at the factory to provide approximately 0.05 ml per injection stroke. The injection volume can be verified using the following steps:

- 1) Flushing the Flow Cell

From the MAIN MENU, press 3 for CAL. The CAL MENU will be displayed:

CAL: _ 1) ZERO
2) PC CNTRL 3) OFFSET

Press 1 for ZERO. The following will be displayed:

ZERO: 1) READ ZERO
2) TEST ZERO 3) CLEAN

Press 2 for TEST ZERO. The following will be displayed:

TEST: + FLUSH - STOP
ENTER TO READ

Using the + and - keys to control the pump, allow deionized water to flush for 60 seconds. Press the - key to stop the flow. Press the CLEAR key followed by the MAIN MENU key to return to the Main Menu.

2) Hold a small container under the flow cell sample inlet fitting. Loosen the fitting and capture the deionized water into the container. Remove the tubing from the fitting.

NOTE: The reagent may be an acid or base. Use normal precautions while handling reagents.

3) Trace the injector tube from the injector to be tested to the flow cell. Remove the injector tube fitting from the flow cell.

NOTE: Typically the injectors do not lose calibration. It is more likely the injector is not injecting at all. Therefore it may not be critical to measure the injection volume but to verify the reagent is being injected.

4) Place the injector tube into a 5 - 10 ml graduated cylinder.

5) Initiate the injector:

From the MAIN MENU, press 2 for SETUP. The SETUP MENU will be displayed:

SETUP: _ 1) FLUSH
2) TIME "TWEEN RUNS +

Press the "+" key to display more options. Keep press the "+" key until the 9th option is displayed.

8) SET ALARM LEVELS
9) PRIME INJECTORS

Press 9 for PRIME INJECTORS.

PRIME INJECTOR #:_

Enter the injector number to be tested.

PRIME _ : +starts
-stops, C QUITs

Press the "+" key to begin the injector operation. The injector will continue to operate until the "-" key or "CLEAR" key is pressed.

6) If the volume is being tested, count the injections. Since the injector will deliver 0.05 ml per injection, 50 injections will provide approximately 2.5 ml.

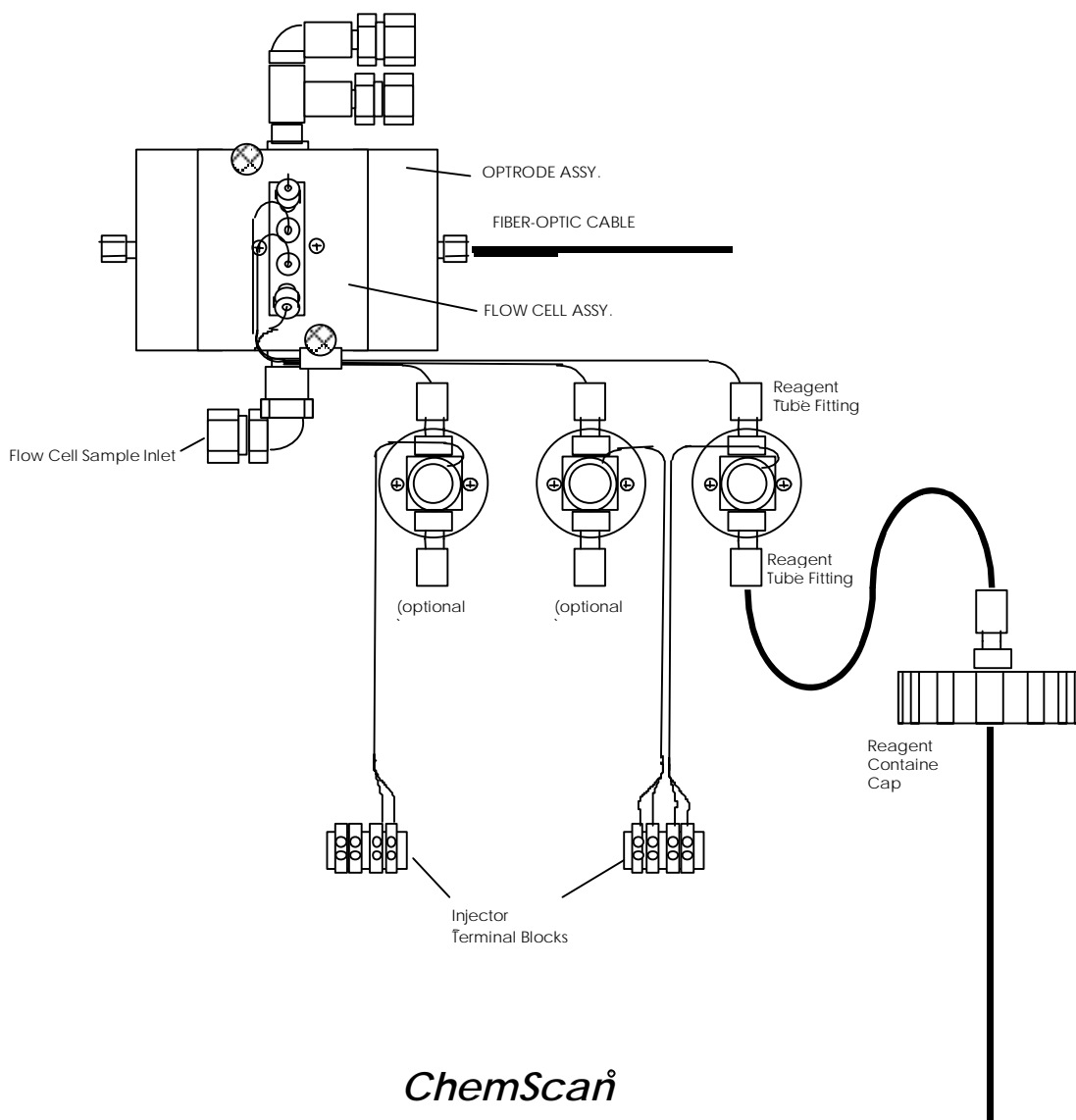
7) If the injector pump is not clicking every 1-2 seconds, check the voltage at the injector terminal strip. The voltage should be 20 - 24 VAC each time the injector is energized. If the voltage is not present, the valve and pump control board may be faulty. Disconnect the pump wires and test again. If the voltage returns, the pump is faulty and must be replaced.

If the injector is not providing adequate volume, replace the injector pump. If the injector is providing the appropriate volume, install the injector pump tube into the flow cell.

Replacing an Injector Pump

If an injector pump has failed the back flow test, the volume test or has malfunctioned in some other way, it is faster and more efficient to replace the injector rather than attempting to repair it. It is a good idea to have one spare injector pump for each analyzer installed. The follow procedure describes the steps to replace an injector pump. **NOTE: Always wear suitable eye protection when maintaining this analyzer, especially when handling reagents, tubing or pumps.**

- 1) Flush the flow cell with DI water as describe in step 1) of the above *Injection Volume Test* procedure. Then empty the flow cell as described in step 2) of the above *Injection Volume Test* procedure.
- 2) Turn the power to the analyzer off.
- 3) Remove the reagent tubing from the top and bottom of the injector. Allow the reagent to flow back into the reagent container.
- 4) Remove all of the reagent containers from the analyzer lower enclosure. **NOTE: The reagents may contain acidic or caustic solutions. Take appropriate chemistry lab precautions while handling the open reagent containers and tubing/fittings. Always cap the open reagent containers before removing them from the enclosure. Always wear eye protection.**
- 5) Remove the injector wires by using a small flat bladed screwdriver to loosen the terminal screws.
- 6) Remove the two mounting screws and remove the injector. **NOTE: Take precautions to prevent contact with the reagent contained in the injection pump or tubing. Rinse with water and place in Ziplock type bag before shipping or discarding.**
- 7) Install the replacement injector by reversing the above steps. Be sure the reagent tubes are finger-tight. Loose fittings will cause a reagent leak or an air leak causing insufficient reagent to be delivered to the flow cell. Tightening with a tool may damage the fittings on the pump. **FINGER-TIGHT ONLY PLEASE.**
- 8) Prime the injector as described in step 5 of the above *Injector Volume Test* procedure. Allow the injector to prime for at least 50 injections (about 2 minutes 15 seconds).
- 9) Flush the flow cell with DI water as describe in step 1 of the above *Injection Volume Test* procedure.
- 10) Return power to the analyzer and return to the On-Line Mode.



ChemScan Injector Pump Components

410NINJ2

Replacing a Manifold Valve

The manifold valves are 24VAC solenoid operated valves. These valves are controlled by the Valve and Pump Control Board. When energized, the red indicator in the valve connector is lit and the valve opens.

Testing Valve Operation

Each of the valves can be operated manually through menu choices except the air valve. To test the operation of the a valve in question, see the *MENU STRUCTURE* section

Valve	Procedure
Zero Valve	TEST ZERO
Clean Valve	MANUAL CHEMICAL CLEAN
Cal. Valve	READ CAL SAMPLE
Line 1	RUN - SAMPLE (LINE 1)
Line 2	RUN - SAMPLE (LINE 2)
Air Valve	Observe during READ ONCE

If the red indicator light comes on but the valve does not “click”, the valve is faulty and must be replaced. If the red indicator light does not come on when energized, check the voltage at the valve and pump control board.

Testing Flow Through the Valve

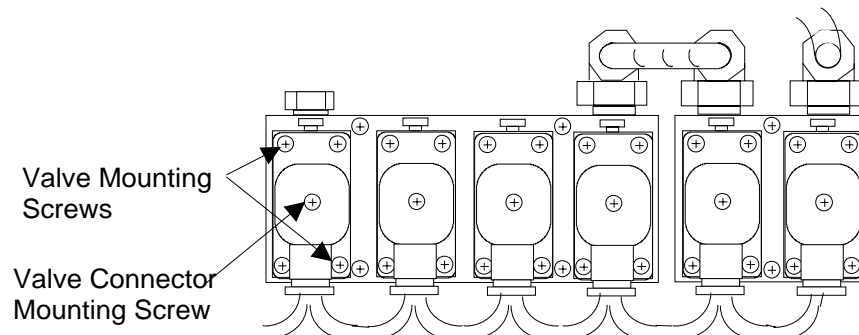
To test the flow through the valve manually, press the manual bypass button on the top of the valve. This button can be locked in the pressed position by turning the button 90 degrees while pressing it down.

NOTE: Do not leave the button in the locked position for normal operation. This will greatly affect the analyzer results.

Valve Replacement

To remove a valve, the flow off to the sample line, loosen the valve connector mounting screw and slide the connector off. NOTE: DO NOT REMOVE THE RED MARKED VALVE ALIGNMENT SCREWS. Remove the two valve mounting screws and remove the valve.

To install the replacement valve mount the valve using the same mounting screws. NOTE: Be sure the three o-rings are in place before mounting the valve. Tighten the valve mounting screws so that the o-rings are fully compressed and the valve is bottomed out on the manifold block. Slide the valve connector and gasket on. Tighten the connector screw.



Replacing the Analyzer Pump

The analyzer pump is 24VDC peristaltic style pump. It has been designed using a spring-loaded shoe to minimize tube wear and stress on the pump components.

Testing Pump Operation

The pump can be operated by using the TEST ZERO procedure. From the TEST ZERO menu, the pump can be operated using the +/- keys.

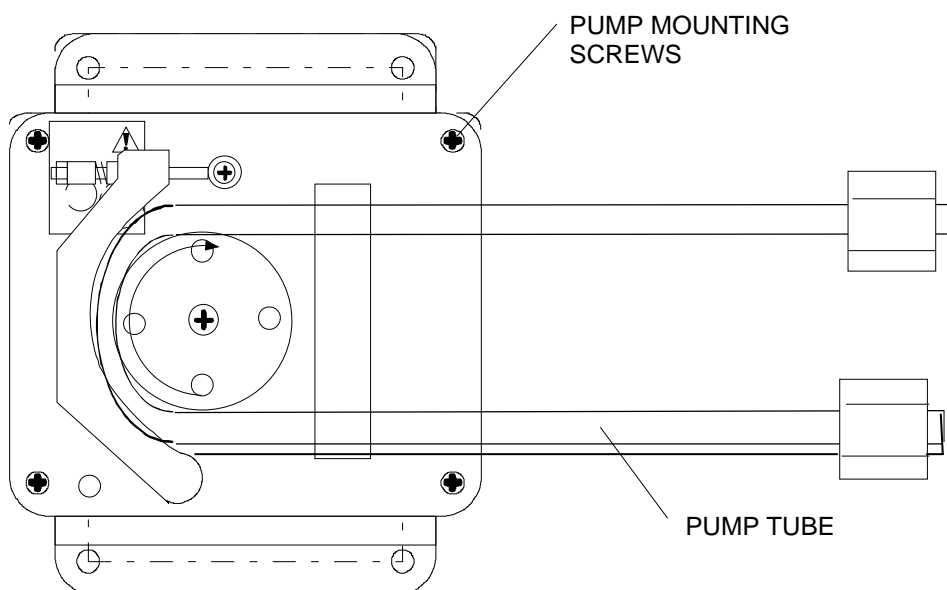
The pump flow can be tested by timing the filling of a 500 ml sample bottle. This test should be performed with a new pump tube installed. Follow the procedure previously noted in this document for replacing the pump tube. If the 500 ml bottle is filled within 70 seconds the pump is providing adequate flow to the cell.

If the sample is not pumped at an adequate rate or the pump does not turn at all, test the voltage at the valve and pump control board. The voltage should be 20-25 VDC.

Pump Replacement

Remove power from the analyzer. The pump can be replaced by removing the pump tube and the four pump mounting screws. Note the wire polarity, disconnect the wires and remove the pump.

Connect the wires with the correct polarity, mount the pump using the 4 screws and install a new pump tube. Return power to the analyzer.



Long Term Shut-Down Procedure

Occasionally the analyzer may need to be taken out of service for an extended period of time. If the analyzer will be out of operation for a period greater than 2-3 days, perform the following procedure to insure a more trouble free startup.

- 1) Interrupt the On-line Mode as by pressing the CLEAR key followed by the security code, then the ENTER key.
- 2) If your analyzer uses reagents, remove and cover the reagents from the lower enclosure and cover
- 3) Flush the injector pumps
 - a) Place the injector inlet tubes into a small container of distilled or deionized water.
 - b) From the Main Menu, select 2 for Setup.
 - c) From the Setup Menu, select 9 for Prime Injectors.
 - d) Select 1 for the first injector and press the + key to begin flushing the tubing and pump. Allow the pump to operate for 2 minutes then press the – key to stop the injector.
 - e) Repeat steps “a” through “d” for the remaining injector pumps.
 - f) Return to the Main Menu.
 - g) To flush the Flow-Cell with Zeroing Solution, select 3 for Cal, 1 for Zero then 2 for Test Zero. Press the + key to begin flushing. Allow the cell to flush for 2 minutes then press the – key to stop the pump. Press the CLEAR key followed by the MAIN MENU key.

At this time the ChemScan unit can rest idle in the MAIN MENU. If power will be removed from the analyzer for an extend period of time, verify the battery voltage before removing power. If the analyzer will be moved please call ChemScan Service for further instructions.

Storage of ChemScan System

ChemScan Analyzers and related equipment is typically shipped in wooden crates with polyfoam packing suitable to protect the equipment during transportation to the installation site. Store the crate(s) in an area protected from precipitation if it will be needed to store or transport the equipment in the future.

The equipment should remain crated until the time of installation to protect the equipment from damage and reduce the chance of misplacing components. Store the crated equipment in a sheltered location protected from precipitation and within a temperature range of 35 F and 110 F. (2 - 43 C)

Analyzer Self-Diagnostics and Error Messages

MAINTENANCE REQUIRED message:

The UV-4100 series analyzer performs an autozero each day. As the deionized water is measured, the light intensity values are monitored. If the light intensity values fall below the preset value, the system will attempt to chemically clean the flow cell. This process will be repeated up to 3 times. If the intensity values are still too low, the MAINTENANCE REQUIRED message will be flashed on the display along with the analyte concentrations. The flow cell will need to be mechanically cleaned to rectify the problem.

The analyzer also monitors the UV absorbance spectrum on each reading. If the spectrum is abnormal for three readings in a row, the analyte will be disabled the concentration value will be set to the maximum and the message MAINTENANCE REQUIRED will be displayed. A typical cause for abnormal spectrum is a plugged sample line, empty reagent container or a malfunctioning injector pump.

Whenever the message MAINTENANCE REQUIRED is displayed or an analyte has been disabled, first perform a MANUAL ZERO PROCEDURE. If required, manually clean the flowcell. If the of the flow cell passes the test zero specifications, verify sample flow through each sample line and verify injector pump operation.

The analyzer is continually monitoring the internal network status. If a network problem is detected, the message NETWORK ERROR will be displayed. The system has been programmed to reinitialize the network if an error is detected. If the message continues to be displayed and operation appears abnormal, call ASA, Inc. to report the operational conditions when the problem occurred.

The analyzer monitors the memory configuration each time the system is powered. If it detects a problem in the memory, the message "RAM DATA RESET" will be display and all the configuration data will be set to the factory defaults. If this occurs, reload the analyzer using the supplied configuration diskette.

Analyzer Troubleshooting Guide

Symptom	Cause	Action
No Flow / Inadequate Flow	Plugged Strainer Plugged Line or Valve	Replace Strainer Blow Out or Replace Plugged Items
Unstable Test Zero Readings	Fouled Flow Cell Reading Too Fast Bubbles/Air in Flow Cell	Chemically Clean Flow-Cell * Allow 1 Minute Between Readings Check Plumbing Parts/Tighten/Replace
Light Levels Too Low After Zeroing	Fouled Flow Cell	Chemically Clean Flow-Cell*
Light Levels Too Low After Chemically Cleaning Cell	Fouled Flow Cell	Mechanically Clean Flow Cell*
Light Levels Too Low after Mechanical Cleaning of Cell	Lens Block Windows Fouled Bad Flow Cell Lamp Requires Adjustment Lamp Excessively Aged Fiber Cable Damaged	Clean Lens Block Windows* Test Zero without Flow-Cell Adjust Lamp Power* Replace Lamp Module* Replace Fiber Optic Cable*
“MAINTENANCE REQUIRED” Flashing On Display	Low Light Level- During Auto Clean	Perform Mechanical Cleaning Procedure*
	Plugged Line or Valve	Clean Sample Line / Valve
“SCU SPECTRUM ERROR” message	Old/Bad Chemicals Flow Cell Fouled Bad Diaphragm Pump Plugged Sample Line Plugged Valve Bad Injector Pump	Replace Chemicals Clean Flow-Cell* Replace pump Clean out sample line Clean out/replace valve Replace Injector
“NETWORK ERROR” message	Network Communication- Problem	Cycle System Power – Call ASA Tech Support
“RAM DATA RESET”	UV-4100 Lost Memory	Test/Replace Battery* Reload Configuration* Replace ICB* (Instrument Control Board)
Readings Constantly at Maximum of Range	Old/Bad Chemicals Flow Cell Fouled Analyte Read Fault	Replace Chemicals Clean Flow-Cell* Check for sample line plug

* and Perform Manual Zero Procedure

Analyzer Troubleshooting Guide Continued....

Analyzer Troubleshooting Guide Continued....

Symptom	Cause	Action
Readings Inaccurate/ Unstable On-Line Readings	Needs Zeroing Fouled Flow Cell Low Sample Flow Cloudy Sample Bubbles/Air in Flow Cell Needs Calibration Faulty Analyzer	Perform Manual Zero Procedure Clean Flow-Cell* Clean Line, Check Pump / Flow Install Filters* Check Plumbing Fittings Calibrate Analyzer Call ASA Tech Support
Display Problems/ Upper Enclosure Hot or Cold/ Menu Problems/ Erratic Operation/ 4-20 mA Problems/ Chronic Instability/ Calibration Problems	Instrument/Calibration Heater Control Failure	Reload UV-4100 Configuration Replace ICB* or Heater/Fan Call ASA Tech Support

* and Perform Manual Zero

ChemScan®

Service Information and Replacement Parts List

**Analyzer Service and Parts Provided By:
Applied Spectrometry Associates, Inc.
Manufactures of ChemScan Process Analyzers**

Contact:

**ASA, Inc.
2325 Parklawn Drive, Suite i
Waukesha WI 53186**

**Phone: 262-717-9500
Fax: 262-717-9530**

ChemScan.com

ChemScan Analyzer Replacement Parts List

Applied Spectrometry Associates, Inc. - 2325 Parklawn Drive Suite i - Waukesha, WI 53186

Analyzer Upper Enclosure - * Recommended Spare Part (Prices are as of 1/9/08 - Subject to change)

NOTE: Minimum order is \$100.00. Prices do not include shipping and handling charges.

Description	Part Number	Qty	Unit Price	Rec. Spares
Power Terminal Assembly	AEP0001		125.00	
*1 Amp Fuse	AEF0001	1	10.00	10.00
*4 Amp Fuse	AEF0002	1	10.00	10.00
Heater/Fan Assembly	AEH0000		325.00	
DC Power Supply w/wiring- 5/12	EPS0001		265.00	
Spectrograph Assembly	AOS0006		5225.00	
Flash Lamp Module	AFM2008		1418.00	
Flash Lamp Assembly without lamp	AOF0000		2609.00	
Flash Lamp High Voltage P.S.	EPS0002		1260.00	
*Flash Lamp	OLX0000	1	628.00	628.00
Flash Lamp DC Power Supply-24 w/wiring	EPS0000		130.00	
Instrument Control Board (I.C.B.)	AEC0001		869.00	
*Battery	ECB0001	1	16.00	16.00
Network Interface Card	AEC0011		325.00	
24 VAC Transformer	EXF0000		35.00	
RF Line Filter	ELF0000		53.00	
Control Panel Assembly	MPC0000		228.00	

Analyzer Lower Enclosure

Description	Part Number	Qty	Unit Price	Spares
Fiber Optic Cable Assembly	OFC2000		375.00	
Valve/Pump Driver Card	AEC0012		434.00	
*Injector Pump	PFP0007	1	780.00	780.00
Flowcell- Injector Tube Assembly (Qty 3)	AIF0016	1	83.00	
Reagent Containers (Specify Color)	FSC0005		24.00	
Reagent Container Tube Assembly (Specify Color)	ARI0016		107.00	
*Manifold Valve	PVS0016	1	495.00	495.00
Manifold Block (4 station)	MAN0615		600.00	
Manifold Block (2 station)	MAN0516		300.00	
Peristaltic Pump Assembly	PSP0003		1385.00	
*Peristaltic Pump Tube (50 ft)	TGT0007	1	147.00	147.00
Peristaltic Pump Tube Assy.(set of 3)	APT0022		82.00	
Optrode Assembly (Lens Blocks-set)	AFO0099		1097.00	
Flow Cell Assembly (injectable-12.7mm)	AFC0540		878.00	
Flow Cell Body (50 mm, injectable)			520.00	
Flow Cell Assembly (non-injectable)	AFC0535		550.00	
O-rings	POX0001		8.00	
Inlet Pipe Assembly	BFA0001		37.00	
*Inlet Strainer Screen Assembly	PFS0054	2	18.00	36.00
Flow Cell Windows (set)	AWP1175		384.00	
Diaphragm Pump (Cyclic)	PFP0014		442.00	
Diaphragm Pump (UV-2150S)	PFP0015		545.00	
Cyclic Valve on pump plate	PVS0018		526.00	

Electronic Interface Enclosure

Description	Part Number	Qty	Unit Price
CIM module	AEC2005	1	1022.00
Fuse (2 A)	EFF0001	1	10.00
Backplane (4 slot) D2-04B-1	UPM0001		323.00
Backplane (6 slot) D2-06B-1	UPM0002		398.00
4-20 mA Output Module F2-02DA-1(2 channel)	UPM0003	1	390.00
Input Module D2-08NA-1 (120 vac)	UPM0005		173.00
Output Module D2-08TR	UPM0006		155.00
Pre-loaded CPU Module D2-240	UPM0008	1	698.00
4-20ma Output Module (8 channel)	UPM0019		748.00

Filter Elements

Cyclic Elements	PFM1004	12/pkg	710.00
Ultra Element	UFM0003	1	440.00

Appendix A – Ancillary and Site Specific Information

The following pages (if any) are provided for supplemental information, site-specific information and additions to this manual that may become available in the future.