ATOM Instrument
APPLIED TECHNOLOGY of OPTICAL METHODS

ATOM TraceS-1000

Trace Total Sulfur in Gas Analyzer

User's Manual

ATOM Instrument
APPLIED TECHNOLOGY of OPTICAL METHODS
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Contents

Introduction

Letter from the President

Dear Valued Customer,

During the past several years, we have experienced extraordinary growth and change at ATOM Instrument, due to our continued commitment to teamwork, technology-focused product strategies and to our policy of placing the trust of our customers above all else. We have successfully reached key milestones, expanded research and development initiatives, achieved significant technological advancements and initiated our position as a premier manufacturer and developer of analytical instrumentation. In the face of challenging economic conditions, we are finding new ways to provide solutions to an evolving industry landscape to ensure ATOM remains the brightest light on the marketplace.

The upcoming years will be exciting as we continue to broaden our business efforts and move from promise to product. We have set increasingly ambitious goals, but possess the passionate vision and resources to achieve them. We have the knowledge, experience and expertise to bring specialty products to this niche market, and we know the steps we need to take are simply an extension of what we have been doing successfully since our inception. Simultaneously, we plan to continue responding to market challenges and expand our line of analyzers with products incorporating enhanced features in order to engage a wider customer base. Consequently, we have set an aggressive timeline for the development of new products to fulfill our commitment to a "total sulfur and nitrogen analysis solution."

One of our customers has described our success story as "more a marathon than a sprint." We take pride in this characterization and embrace it as the philosophy for our operations as a successful business is built on sustainable and reliable growth. In recent years, we've grown our business substantially, yet managed to never waver from our promise to deliver the very best products and service to our valued customers. ATOM is building the analyzer tools of tomorrow, hearing the markets' demands and we are ready to meet the challenges. Watch us closely; the next five years will be a defining notch in ATOM's timeline.

I credit each of our devoted employees for making these past years such a success in turbulent times. I would also like to extend my thanks to our customers and our suppliers for their unfailing sense of devotion, responsibility, guidance and support, without which our Excimer light would have surely extinguished long ago.

Thank you for the purchase of this ATOM Instrument product and please trust in our commitment to your complete satisfaction. Should you have any concerns, please do not hesitate contacting us for support.

Sincerely,

Franek Olstowski, President/Founder

Mission Statement

ATOM Instrument is founded on fundamental principles and timeless values that perpetually lie at the heart of our business and represent the structural foundation on which it is built. These principles have helped ATOM Instrument set a higher standard for its products and services, making it a recognized leader for innovative solutions. Our mission is to become a market leader in the development and manufacturing of analytical instrumentation with unsurpassed performance that will fulfill a strategic role in industry to control processes, verify product conformance and help solve a variety of problems for the benefit of society.

Creativity

– To establish and maintain an environment that encourages creativity and promotes innovation in order to capitalize on collective talents and intellectual resources, to maintain a technologically advanced position and competitive edge within the market.

Quality

– To provide superior quality products in both form and function while continually striving to improve what may already be the best in its class.

Integrity

– Above all, to conduct all aspects of business operations while adhering to the highest level of business ethics and standards.

Dependability

– To proactively address and reliably respond to our customer's needs in a timely fashion.

About This Manual

This manual is a multipart user's manual that provides information regarding the proper installation, operation and service of ATOM Instrument's TraceS-1000 Sulfur Process Analyzer. The manual is divided into the following six sections.

- **Section 1** Principle of Operation, Specifications, and Drawings
- **Section 2** Software Operation
- **Section 3** Basic Maintenance Guide
- **Section 4** TraceS-1000 MODBUS Digital Communications
- **Section 5** Purge System
- **Section 6** Parker Valve System

Warranty, compliance, and safety information concerning the TraceS-1000 Sulfur Process Analyzer is provided immediately following this page.

The benefits, features and configurations of the TraceS-1000 are described in Section 1 along with basic theory and operations.

Installation and operation of the TraceS-1000 and most optional equipment are illustrated in Sections 2 and 3 of this manual. Future Information may be supplied in other manuals (i.e., options manuals) or addenda to this manual.

Maintenance information includes step-by-step procedures along with a complete set of drawings and schematics.

The information contained herein is furnished without warranty of any kind. Users should consider the data in this manual only as a supplement to other information gathered by them and must make independent determinations of the suitability and completeness of the information.

Some of the terms and labels used in the manual are abbreviated intuitively due to space constraints in tables, photos and illustrations. For further explanation, contact ATOM Instrument service.

Conditions for Proper Use

The TraceS-1000 analyzer is designed to be installed, operated and maintained as specified in this manual. Failure to operate the analyzer as specified may produce erroneous data and possible equipment failure which may void the warranty. Some of the conditions for proper and improper use of the TraceS-1000 analyzer are provided as follows:

- The TraceS-1000 analyzer is designed to continuously analyze gaseous samples from a sample handling system and display the amount of sulfur contained in the sample. Operation for any use other than specified may damage the analyzer and/or cause personal injury to the operator. The results obtained from any other use cannot be guaranteed.
- The standard configuration of the TraceS-1000 analyzer is not intended for extended use in corrosive environments.
- The TraceS-1000 analyzer can be operated in open, outdoor environments but should not be exposed to direct sunlight or precipitation.
- The best accuracy and precision is obtained when the analyzer is located in a temperature controlled environment.
- To ensure safe operation, the purge system should always be engaged during operation of the analyzer except after the area has been determined to be non-hazardous and repairs or tests must be performed that require the purge system to be bypassed. Refer to the manufacturer documentation included in the appendix sections of this manual regarding the purge system operation.
- The electrical power source for the analyzer must be capable of delivering 2400 Watts of power. Note that if the sample heat tracing is powered by the analyzer, up to an additional 600 Watts may be required
- The sample to the analyzer must be filtered through a 2-micron (min) filter and delivered to the analyzer by an approved, leak-free sample handling system to ensure the sample being analyzed is representative of the current process status.
- The sample handling system should eliminate or minimize "dead volumes" and areas in the flow path where new sample can be mixed with old sample.
- Air and other gas supplied to the analyzer must be filtered and meet specified requirements.
- **All cautions and warnings in this manual, on tags and in other publications pertaining to the installation, operation and maintenance of the analyzer must be read and observed. Failure to consider the warning and caution messages can lead to severe personal injury, equipment damage and/or void of the warranty.**
- Instrument should be sheltered from direct sun or rain. If the instrument is to be used for very low ppm concentrations, it should be located in a climate controlled area. Ambient temperature should be between -20°C to +40°C (-4°F to +104°F).

Warnings and Cautions

This manual provides caution and warning messages as listed below. Failure to consider these messages can lead to severe personal injury, instrument damage and/or void of warranty.

WARNING:	**POWER MUST NOT BE RESTORED UNTIL ENCLOSURE HAS BEEN PURGED FOR 10 MINUTES WITH AN INPUT PRESSURE OF 30 PSIG.**
WARNING:	**A SEVERE ELECTRIC SHOCK HAZARD MAY EXIST WHEN POWER IS APPLIED WHILE SERVICING INTERNAL COMPONENTS.** Ensure that power lines are removed from the power source before continuing.
WARNING:	**A POTENTIONALLY LETHAL ELECTRICAL SHOCK HAZARD EXISTS WHEN CONTACT IS MADE WITH THE 120VAC LINE COMPONENTS.** Do not attempt to repair or test the 120VAC section without using the appropriate test meter with insulated probes.
WARNING:	**AN EXPLOSION DANGER EXISTS WHEN THE DOOR TO A POWERED ENCLOSURE IS OPENED WITHOUT FIRST DETERMINING THE SAFETY CLASSIFICATION OF THE OVEN AND THE TYPE OF GASES IN THE AREA.** The area must be known to be non-hazardous before a powered enclosure is opened. Follow the procedures for opening and closing a powered enclosure.
WARNING:	**A POOR GROUND CONNECTION MAY PRESENT A SEVERE SHOCK HAZARD.**
WARNING:	**HIGH-PRESSURE GASES SHOULD BE HANDLED WITH EXTREME CARE.** Ensure that all relevant safety precautions are carefully followed and all gas lines, regulators, gas purifiers, etc. are specified for the intended use.
WARNING:	**A PUNCTURE INJURY MAY RESULT IF THE WAGO CONNECTOR INSERTION TOOL IS ALLOWED TO SLIP DURING THE INSERTION PROCESS.** Some force is required to insert the WAGO tool completely into the connector. When possible, use a vice to hold the connector during insertion.

WARNING:	**IF THE SPECIFIED OPERATING PRESSURE CANNOT BE MAINTAINED, THE SOURCE OF THE LEAK MUST BE CORRECTED BEFORE CONTINUING WITH INSTALLATION AND OPERATION.** Ensure the sample and main gas flow is leak free by performing a leak test.
WARNING:	**EYE INJURY CAN RESULT WHEN HANDLING THE GLASS COMBUSTION TUBE.** Wear appropriate eye protection during service, removal and replacement of the combustion tube.
WARNING:	**PERMANENT EYE DAMAGE CAN OCCUR DUE TO LOOKING DIRECTLY INTO AN ILLUMINATED UV LIGHT SOURCE.** Wear appropriate eye protection when looking directly into a UV light source.
WARNING:	**SEVERE BURNS CAN RESULT WHEN WORKING AROUND A HOT COMBUSTION TUBE.** Allow the combustion tube to cool before performing maintenance.
WARNING:	**SEVERE BURNS CAN RESULT WHEN WORKING AROUND A HOT FURNACE.** Allow the furnace to cool before performing maintenance.
WARNING:	**AN ELECTRICAL SHOCK HAZARD MAY EXIST AND SEVERE COMPONENT DAMAGE MAY OCCUR WHEN USING A LIQUID LEAK DETECTOR.** Even though the solution in an approved liquid leak detector "Snoop" solution is non-conductive, care should be taken not to wet any electrical or electronic components.
CAUTION:	**Most liquid leak detectors contain sulfur compounds that can contaminate the gas supply line and instrument flow path components. Care should be taken not to wet or contaminate the analytical flow system when using a liquid leak detector.**
CAUTION:	**Become familiar with the location and use of all controls, indicators, connections and accessories and carefully read all instructions and warning labels prior to operating any portion of the system.**
CAUTION:	**The TraceS-1000 should be sheltered from direct sunlight and precipitation exposure.**
CAUTION:	**Carefully ensure the system is leak free. Failure to do so may cause severe system component damage.**
CAUTION:	**Instrument Air for the sample injection and Parker valves must be set to a pressure of 70 psi. Lower activating pressure may result in improper actuation while higher pressure may cause damage to these valves.**

CAUTION:	**Line Voltage to analyzer must be supplied from an External Power Breaker with the specified current and voltage properties.**
CAUTION:	**All seals MUST be poured before energizing the unit.**
CAUTION:	**Follow Installation Drawings and Schematics in this manual to bring the unit on line.**
CAUTION:	**Do not attempt to operate the TraceS-1000 until all installation and setup procedures outlined in the previous listed sections of this manual have been successfully completed.**
CAUTION:	**Serious instrument damage can result if the TraceS-1000 is not fully functional and/or if the operator is inexperienced with the computer control.**
CAUTION:	**The glass combustion tube is easily broken during removal of the transfer tube fittings. Care must be taken not to apply pressure to the glass tube when removing the transfer line.**
CAUTION:	**The glass combustion tube inlet and outlet connection points are easily broken during removal. Care must be taken not to allow force to be applied to the tube when removing these connections from the glass combustion tube.**
CAUTION:	**Do not over tighten fittings. Over-tightening can cause restrictions, which will affect instrument performance. If ferrules need replacement, the fittings should be tightened according to the standard industry practice.**
CAUTION:	**The Excimer UV lamp is extremely fragile. Extreme care should be taken with these lamps to avoid breakage.**
CAUTION:	**Ensure that all interconnections are properly installed. Improper connections may cause damage to system components when power is applied.**
CAUTION:	**The Photo Multiplier Tube (PMT) is extremely light sensitive. Any exposure to ambient light with PMT power applied will result in extreme damage to the PMT. As a result, power to the PMT should always be turned off before exposing the PMT window to any ambient light.**
CAUTION:	**Ensure all inlet and outlet openings are kept clean and free from contaminants. It is recommended that the inlet and outlet openings be covered with tape when not connected to lines.**

CAUTION:	**Do not exceed recommended pressures. If higher pressures are used, severe and irreparable damage may be done to fragile system components.**

Warranty

ATOM Instrument TraceS-1000 Standard Warranty

Atom Instrument warrants that all products supplied will be of merchantable quality and will comply with the specification agreed for them.

Atom Instrument guarantees for a period of twelve months from installation of the product or fifteen months from delivery to the customer, whichever is the shorter, all Products and spare parts sold hereunder.

ATOM Instrument will repair or replace defective and/or nonconforming parts without charge for material or labor service during the warranty period.

Products that have been repaired or replaced during the warranty period are themselves warranted only for the remaining portion of the original one (1) year.

Repairs, adjustments and service performed after the expiration of the one (1) year warranty period shall be charged to the owner/purchaser at the then current prices for parts, labor, and travel related expenses.

Exceptions to this warranty are:

- Defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, unauthorized modification, or the attachment of improper devices to the products.
- Installation, operation and maintenance of the products in a manner that does not meet ATOM Instrument specifications will void this warranty.
- All requests for service or repair under this warranty must be received within the warranty period by ATOM Instrument or its authorized representative.

The warranties contained in this agreement are in lieu of all other warranties, expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

Statements made by any persons, including representatives of ATOM Instrument, which are inconsistent or in conflict with the terms of this warranty shall not be binding upon ATOM Instrument unless reduced to writing and approved by an officer of the company.

Liability covered under this warranty is limited to the original cost of the ATOM Instrument supplied equipment. ATOM Instrument will not be liable for consequential damages including but not limited to loss of production, throughput or off specification product due to user or equipment error.

This warranty shall be governed by and construed in accordance with the laws of the State of Texas.

Service

Service Contact Information

Address:
1656 Townhurst Dr, Suite G
Houston, TX 77043

Phone Number:
713-461-0034

Service Rate Information

ATOM Instrument offers quality service and preventative maintenance work at reasonable rates. Our goal is to provide consistent and reliable service with an emphasis on customer satisfaction.

Hourly Field Service Rate:		
Standard Rate (Regular Business Day)	$	187.50 / Hour
Premium Rate (Weekends)	$	225.00 / Hour
Minimum Charge:		
2-Hour (Customer Location less than 100 mi. from Houston)	$	375.00
4-Hour (Customer Location greater than 100 mi. from Houston)	$	750.00
Travel Rate:		
Travel Time	$	125.00 / Hour
Travel Day (8 Hour/ day maximum)	$	1000.00 / Day
Personal Auto Mileage (Rounded IRS Mileage Rate for 2017)	$	0.535 / Mi.
Reasonable Travel Expenses: (Airfare, lodging, surface transportation, meals, etc.)		Actual Cost
Misc. Charges: (Includes license fees, customs fees, excess baggage fees, training fees, etc.)		Actual Cost
Cancellation Charges:		
Prior to departure for travel expenses incurred (i.e. fees for cancellation of airline, hotel, or rental car reservations, plus time spent)		Actual cost

Payment Methods:

- Purchase Orders from customers with approved credit, Net 30 days.
- Credit Cards Accepted (MasterCard, VISA, American Express and Discover)

Limited Warranty

Any replaced parts and service labor performed in replacing associated parts is warranted for a period of 90 days from the date of service. This warranty excludes travel time and expenses if returning to customer site to make repairs is requested. ATOM attempts to maintain stock of essential parts that may be necessary for general repairs and preventative maintenance.

Recommended Consumable Spare Parts List

Part Number	Description	Quantity
60064-00001	SGA Online Combustion Tube, 10.75 L	1
60038-00001	Combustion Furnace	1
60097-10005	Type S Thermocouple for Furnace	1
23058-00001	Valve, 6-Port External Sample Injector, High Temp-Air Actuator	1
11228-00001	Dryer, .110" ID, 72" L, Fluorocarbon Fittings	1
60008-10001	Excimer Lamp Envelope	1
10027-00001	Ferrule, Standard 1/4", Graphite, (2/Pk)	6

Recommended Replacement Spare Parts List

Part Number	Sample Enclosure Section
23058-00001	Valve, 6-Port External Sample Injector, High Temp-Air Actuator
60062-00003	Sample Shut Off Valve to ARV
11258-00001	Thermocouple, Type K, 6" Long
10027-00002	Ferrule, Standard 1/8", Vespel
60037-00001	Sample Enclosure Heater, 120V 400 W, .500" D x 5" L Assembly
	Combustion Furnace Section
60038-00001	Combustion Furnace
60097-10005	Type S Thermocouple for Furnace
	Combustion Kit - Includes:
60064-00001	Online Combustion Tube
10027-00001	Ferrule, Standard 1/4", Graphite (2/Pk)
23251-00001	Tubing, PTFE Teflon. 1/8" O.D .x 1/16" I.D. (10ft./Pk)
23252-00001	Swagelok 2-Piece Ferrule Set (10/Pk)
	Main Enclosure Section
23248-00001	Nematron 12" Touchscreen PC, Class1, Div.2
23135-00001	Cyclops Z-Purge System
60037-00002	Main Enclosure Heater, 120V 400 W, .500" D x 5" L
11572-00001	Stacklable 3-way Solenoid, Buna O-Rings
11572-00002	Stacklable 4-way Solenoid, Buna O-Rings
11478-00001	Connector, DIN, Manifold, 24VDC
23242-00001	Pressure Switch Assy, Adjustable, 4-125 PSI, 7A, 250V
23245-00001	Mass Flow Controller, Air 500 sccm

	Main Enclosure Section (contd…)
11506-00001	Temperature Controller, SSR Out, 24V
11280-00001	Solid-State Relay (SSR), 25A, 240 VAC
11233-00001	Universal Signal Conditioner, 24V, 4-20 ma Out
11224-00001	Thermocouple, 30 AWG Type K, PFA
11262-00001	Thermostat, 1/2" Dis, Auto Reset, 15A Open@ 48.9C, Close@ 32.2C
11525-00001	Solid-State Relay (SSR), 5VDC, DIN Mount
11526-00001	Relay, 24V, DIN Mount
23123-00001	Power Supply, 24V, 4.2A, 100W, DIN Rail
60078-10001	SP-2000 Signal Processor Board PCA
60059-10001	External Interface Board PCA
60079-00004	DC/DC Converter, Quad 24/5V,+15V,-15V,12V
60003-10001	Detector with PMT
60008-10001	Excimer Lamp Envelope
60001-10001	Excimer Lamp Assy
11228-00001	Dryer, .110" ID, 72" L, Fluorocarbon Fittings

Section 1 – Principle of Operation, Specifications, and Drawings

Section 1.1 Principle of Operation

The ATOM TraceS-1000 has the highest dynamic measurement range of any commercially available analyzer without the need for additional sample valves, calibration gases or system hardware. In addition, the ATOM TraceS-1000 does not require installation in a controlled environment shelter.

The ATOM TraceS-1000 is an online process analyzer utilizing patented Excimer UV Fluorescence (EUVF) technology to measure Total Sulfur in a variety of applications such as monitoring of total sulfur in process gas streams.

The UV Fluorescence method (UVF) is one of the most simple and practical low-level sulfur analytical techniques that has been widely used and proven over many years of industrial utilization. The UV Fluorescence method involves injection of a sample into a high-temperature oxidation or combustion furnace, which converts all hydrocarbons into water (H_2O) and carbon dioxide (CO_2) byproducts. Total Sulfur content contained in any molecular-bound hydrocarbon species is similarly oxidized at temperatures in excess of 1000°C into sulfur dioxide (SO_2) by the reaction:

$$R\text{-}SH + O_2 \rightarrow SO_2 + CO_2 + H_2O$$

The furnace effluent containing these combustion byproducts is directed into a detection chamber where it is excited by high-energy, short-wavelength emission from a UV excitation source. The UV photons from the excitation source or lamp, transfers energy into the SO_2 molecule and raises its energy level to create an excited singlet state. These excited molecules rapidly decay back to their lower energy ground state releasing the absorbed energy as a secondary emission known as fluorescence.

$$SO_2 + h\upsilon \rightarrow SO_2^* \rightarrow SO_2 + h\upsilon'$$

This low-level fluorescence emission is optically filtered to remove undesired wavelengths of the UV source and background scatter within the detector chamber. Detection of the filtered fluorescence emission is usually accomplished with a Photomultiplier Tube (PMT), Channel-Plate Multiplier (CPM) or other high gain, light-sensitive detector.

Section 1.2 Specifications

Analytical Performance

Measurement Method	Total Sulfur by Excimer UV Fluorescence (EUVF)
Measurement Range	0 – 10,000 ppm (higher range available on request)
Repeatability	50 ppb SD or ±2% of measured value, whichever is greater 30 ppb SD with 5-min. averaging
Linearity	±2% of full scale
Response Time	100 sec. to 99% of new value
Calibration	Automatic or manual

Analog/Discrete Data Communications

Analog Outputs	Two 4-20 mA DC (optional)
Alarm Outputs	One global dry contact triggered by one or more of the following: Power Failure, Loss of Purge, Low Oxidizer Pressure, User-configured Digital Inputs (DI4 – DI7)
Digital Data Communications	RS-232, RS-485/422 MODBUS (TCP/IP optional)
Local MMI	12" Touchscreen Computer with Embedded Windows 7 allows complete operation and control of all analyzer functions
Remote Interface	Complete control of ATOM SGA, including monitoring of analysis parameters and digital data values

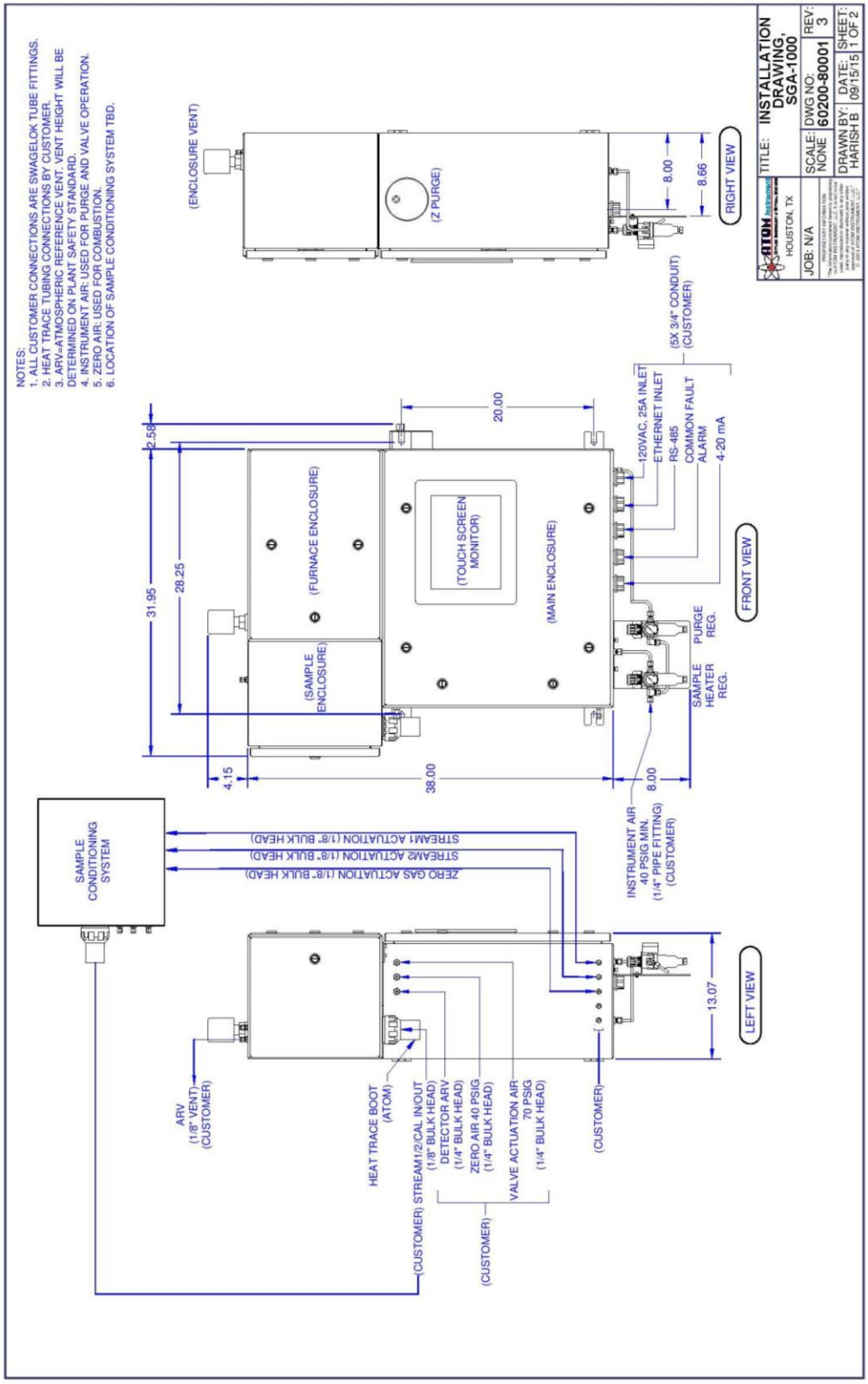
Utility Requirements

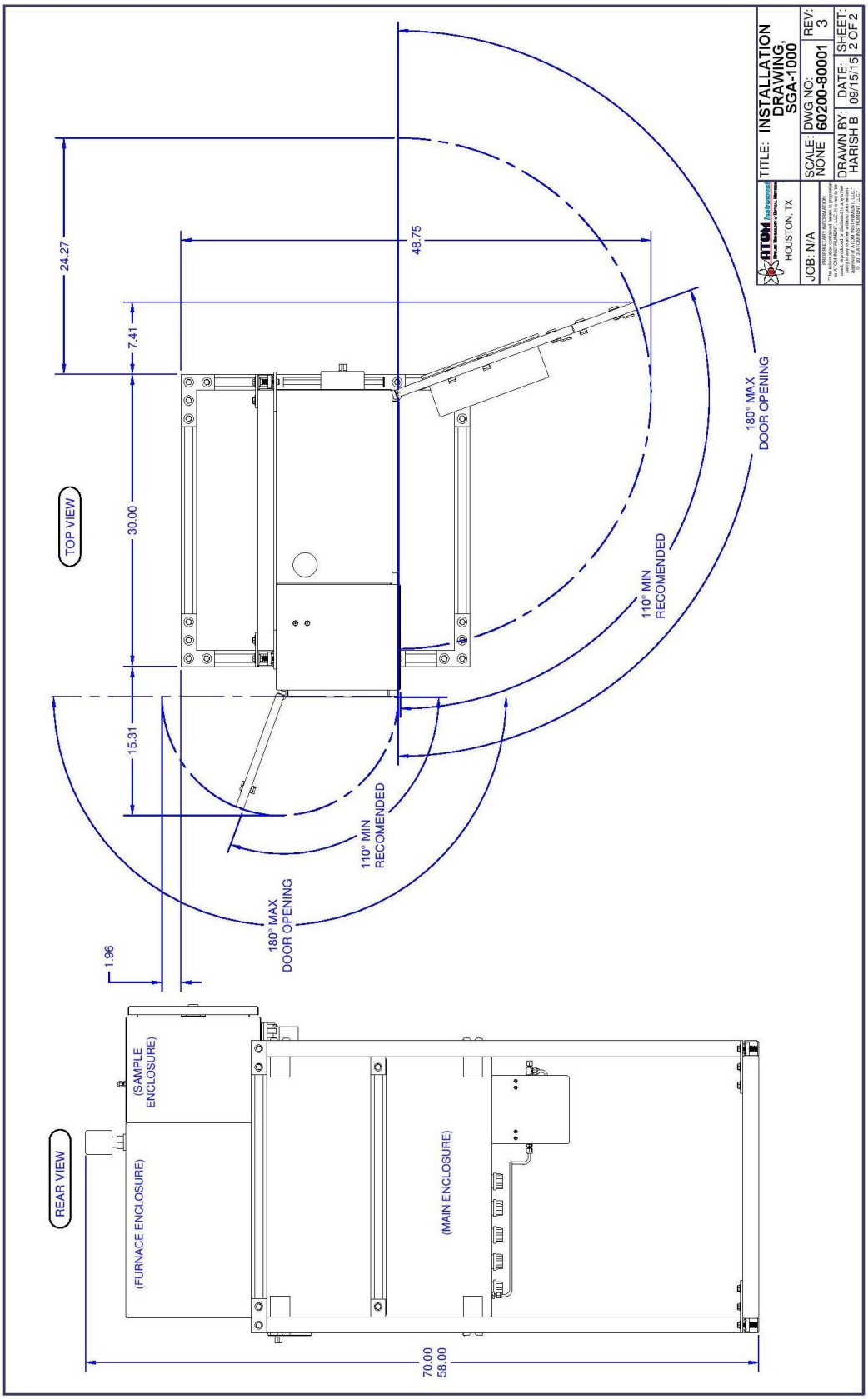
Ambient Temperature	20°C to 40°C (68°F to +104°F)
Power	120 VAC, 25 A, 50/60 Hz at 3000 watts
Instrument Air	70 psig (4.8 bar), 7 SCFM, Oil Free, -40°C (-40°F) dew point
Zero Grade Air	70 psig (4.8 bar), 200 SCCM

Physical Parameters

Dimensions	965.2 mm (38.0 in) high x 660.4mm (26.0 in) wide x 304.8 mm (12.0 in) deep
Mounting	Wall or Unistrut Stand

Section 1.3 TraceS-1000 Drawings


NOTES:
1. ALL CUSTOMER CONNECTIONS ARE SWAGELOK TUBE FITTINGS.
2. HEAT TRACE TUBING CONNECTIONS BY CUSTOMER.
3. ARV=ATMOSPHERIC REFERENCE VENT. VENT HEIGHT WILL BE DETERMINED ON PLANT SAFETY STANDARD.
4. INSTRUMENT AIR: USED FOR PURGE AND VALVE OPERATION.
5. ZERO AIR: USED FOR COMBUSTION.
6. LOCATION OF SAMPLE CONDITIONING SYSTEM TBD.
TITLE: INSTALLATION DRAWING, SGA-1000
ATOM Instrument
HOUSTON, TX
JOB: N/A
SCALE: NONE
DWG NO: 60200-80001
REV: 3
DRAWN BY: HARISH B
DATE: 09/15/15
SHEET: 1 OF 2
RIGHT VIEW
(ENCLOSURE VENT)
(Z PURGE)
8.00
8.66
(5X 3/4" CONDUIT) (CUSTOMER)
FRONT VIEW
20.00
2.58
31.95
28.25
(FURNACE ENCLOSURE)
(TOUCH SCREEN MONITOR)
(MAIN ENCLOSURE)
(SAMPLE ENCLOSURE)
120VAC, 25A INLET
ETHERNET INLET
RS-485
COMMON FAULT
ALARM
4-20 mA
PURGE REG.
SAMPLE HEATER REG.
4.15
38.00
8.00
INSTRUMENT AIR 40 PSIG MIN. (1/4" PIPE FITTING) (CUSTOMER)
SAMPLE CONDITIONING SYSTEM
ZERO GAS ACTUATION (1/8" BULK HEAD)
STREAM2 ACTUATION (1/8" BULK HEAD)
STREAM1 ACTUATION (1/8" BULK HEAD)
LEFT VIEW
13.07
ARV (1/8" VENT) (CUSTOMER)
HEAT TRACE BOOT (ATOM)
(CUSTOMER) STREAM1/2/CAL IN/OUT (1/8" BULK HEAD)
DETECTOR ARV (1/4" BULK HEAD)
ZERO AIR 40 PSIG (1/4" BULK HEAD)
VALVE ACTUATION AIR 70 PSIG (1/4" BULK HEAD)
(CUSTOMER)
(CUSTOMER)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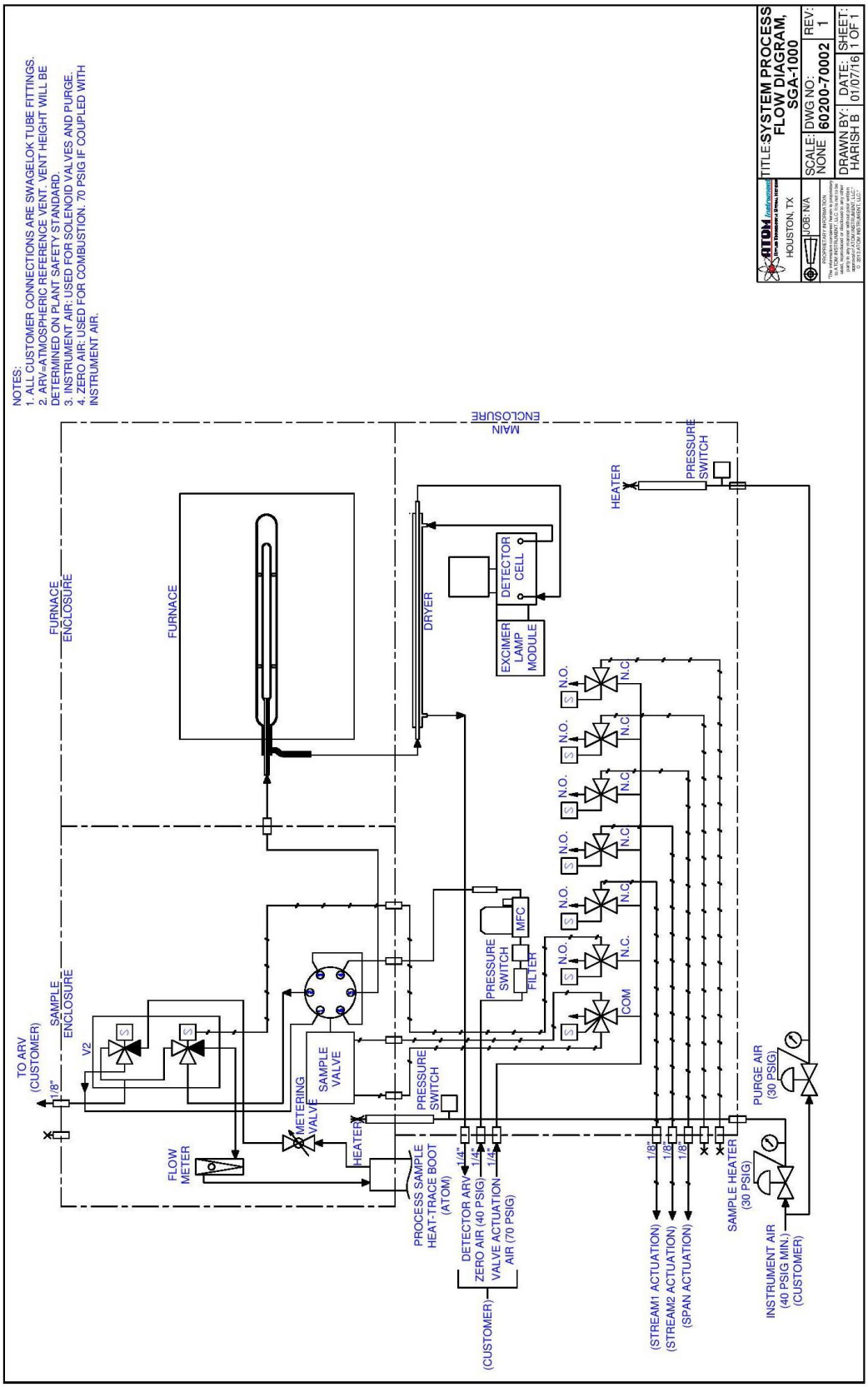
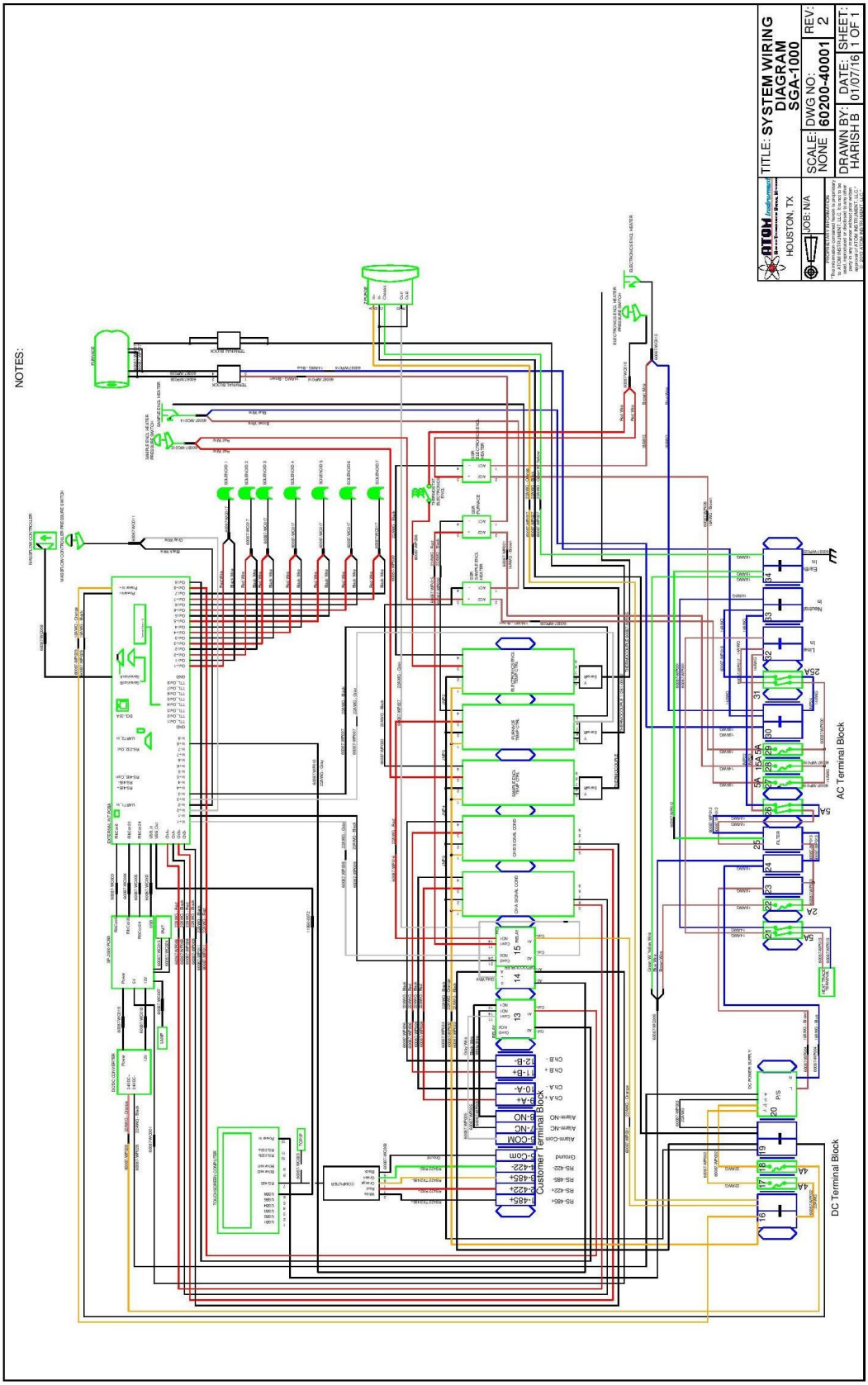
SCALE: NONE
DWG NO: 60200-80001
REV: 3
DRAWN BY: HARISH B
DATE: 09/15/15
SHEET: 2 OF 2
ATOM Instrument
HOUSTON, TX
JOB: N/A
PROPRIETARY INFORMATION
TOP VIEW
24.27
7.41
30.00
15.31
1.96
48.75
180° MAX DOOR OPENING
110° MIN RECOMENDED
180° MAX DOOR OPENING
110° MIN RECOMENDED
REAR VIEW
(SAMPLE ENCLOSURE)
(FURNACE ENCLOSURE)
(MAIN ENCLOSURE)
70.00
58.00


NOTES:
1. ALL CUSTOMER CONNECTIONS ARE SWAGELOK TUBE FITTINGS.
2. ARV=ATMOSPHERIC REFERENCE VENT. VENT HEIGHT WILL BE DETERMINED ON PLANT SAFETY STANDARD.
3. INSTRUMENT AIR: USED FOR SOLENOID VALVES AND PURGE.
4. ZERO AIR: USED FOR COMBUSTION. 70 PSIG IF COUPLED WITH INSTRUMENT AIR.
TITLE: SYSTEM PROCESS FLOW DIAGRAM, SGA-1000
HOUSTON, TX
JOB: N/A
SCALE: NONE
DWG NO: 60200-70002
REV: 1
DRAWN BY: HARISH B
DATE: 01/07/16
SHEET: 1 OF 1
MAIN ENCLOSURE
FURNACE ENCLOSURE
FURNACE
DRYER
DETECTOR CELL
EXCIMER LAMP MODULE
HEATER
PRESSURE SWITCH
N.O.
N.C.
COM
MFC
FILTER
PRESSURE SWITCH
SAMPLE ENCLOSURE
V2
TO ARV (CUSTOMER)
1/8"
METERING VALVE
SAMPLE VALVE
HEATER
FLOW METER
PROCESS SAMPLE HEAT-TRACE BOOT (ATOM)
1/4"
DETECTOR ARV ZERO AIR (40 PSIG)
VALVE ACTUATION AIR (70 PSIG)
(CUSTOMER)
1/8"
(STREAM1 ACTUATION)
(STREAM2 ACTUATION)
(SPAN ACTUATION)
SAMPLE HEATER (30 PSIG)
PURGE AIR (30 PSIG)
INSTRUMENT AIR (40 PSIG MIN.) (CUSTOMER)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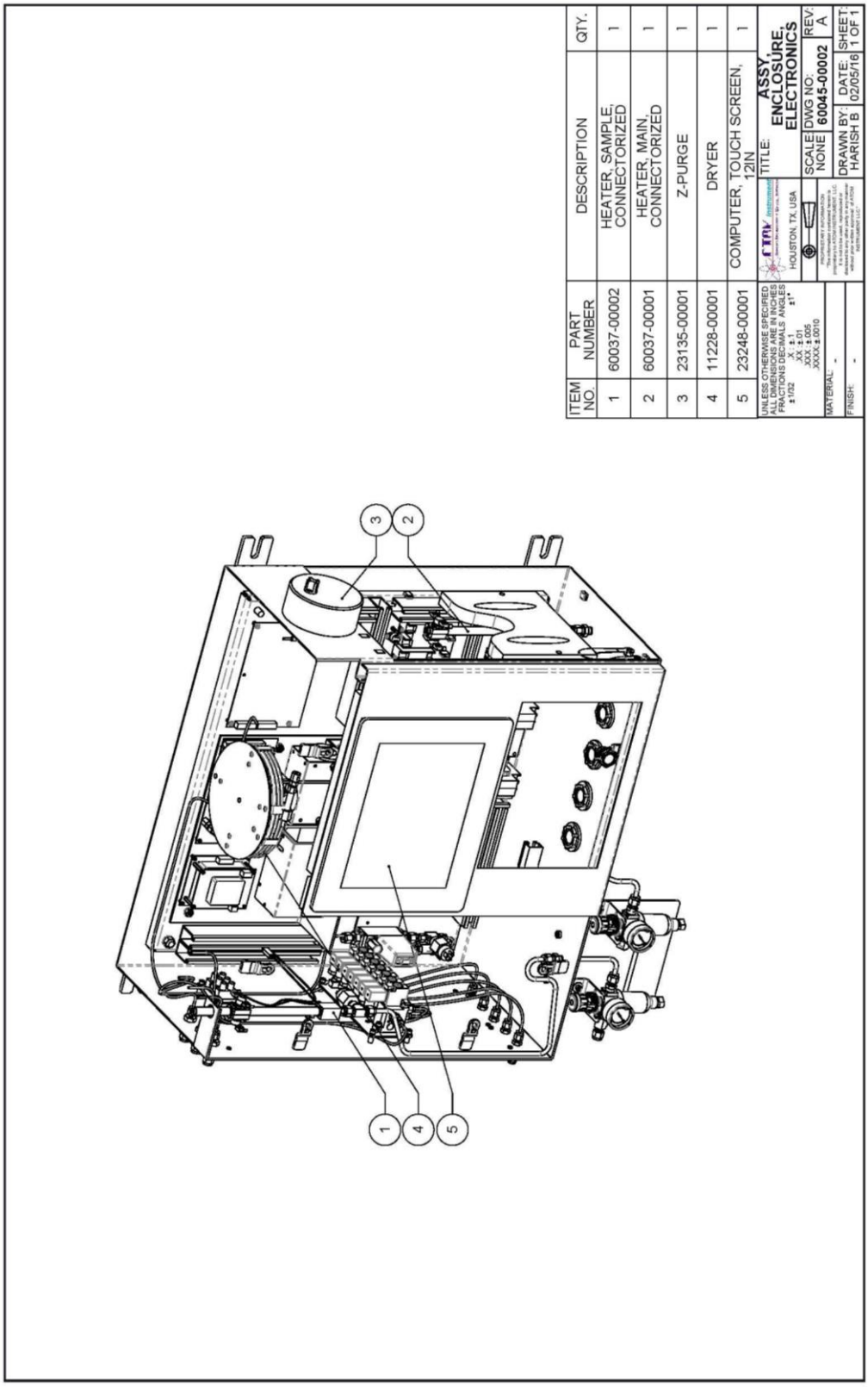
REV: 2
SCALE: NONE
DWG NO: 60200-40001
SHEET: 1 OF 1
DRAWN BY: HARISH B
DATE: 01/07/16
HOUSTON, TX
JOB: N/A
NOTES:
AC Terminal Block
DC Terminal Block
Customer Terminal Block


ITEM NO.
PART NUMBER
DESCRIPTION
QTY.
1
60037-00002
HEATER, SAMPLE, CONNECTORIZED
1
2
60037-00001
HEATER, MAIN, CONNECTORIZED
1
3
23135-00001
Z-PURGE
1
4
11228-00001
DRYER
1
5
23248-00001
COMPUTER, TOUCH SCREEN, 12IN
1
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES ±1/32 X ± .1 XX ± .01 XXX ± .005 XXXX ± .0010 ±1°
MATERIAL: -
FINISH: -
HOUSTON, TX, USA
TITLE:
ASSY, ENCLOSURE, ELECTRONICS
SCALE: NONE
DWG NO: 60045-00002
REV: A
DRAWN BY: HARISH B
DATE: 02/05/16
SHEET 1 OF 1
1
2
3
4
5

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	60078-00001	PCBA, DETECTOR, SP-2000	1
2	60001-00001	EXCIMER LAMP MODULE	1
3	60003-00001	ASSY, DETECTOR, EXCIMER	1
4	60079-00003	DC/DC-24V/12V	1
5	60079-00002	DC/DC-24V/5V,+15V,-15V	1
6	60059-00001	PCB, EXTERNAL INTERFACE	1
7	11507-00002	CIRCUIT BREAKER, 240V, 25A	1
8	23136-00001	FILTER, EMI, 250 VAC, 10A, DIN RAIL	1
9	11507-00001	CIRCUIT BREAKER, 240V, 5A	2
10	11526-00001	RELAY, DIN MOUNT	2
11	11525-00001	SSR, DIN MOUNT	1
12	11233-00001	SIGNAL CONDITIONER	2
13	11506-00001	TEMPERATURE CONTROLLER	3
14	23123-00001	POWER SUPPLY, 24V	1
15	23245-00001	CONTROLLER, MASS FLOW	1
16	23124-00002	FILTER, 1/8	1
17	23242-00001	PRESSURE SWITCH	1
18	11262-00001	THERMOSTAT, MAIN ENCLOSURE	1
19	11280-00001	SSR, HEATER	3

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES ±1/32 .XX: ± .01 .XXX: ± .005 .XXXX: ± .0010 ±1°

MATERIAL: -

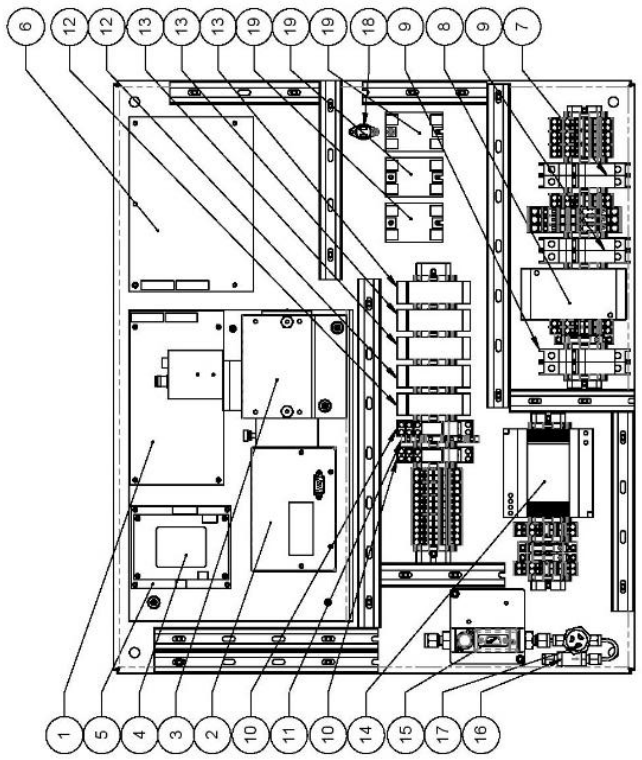
FINISH: -

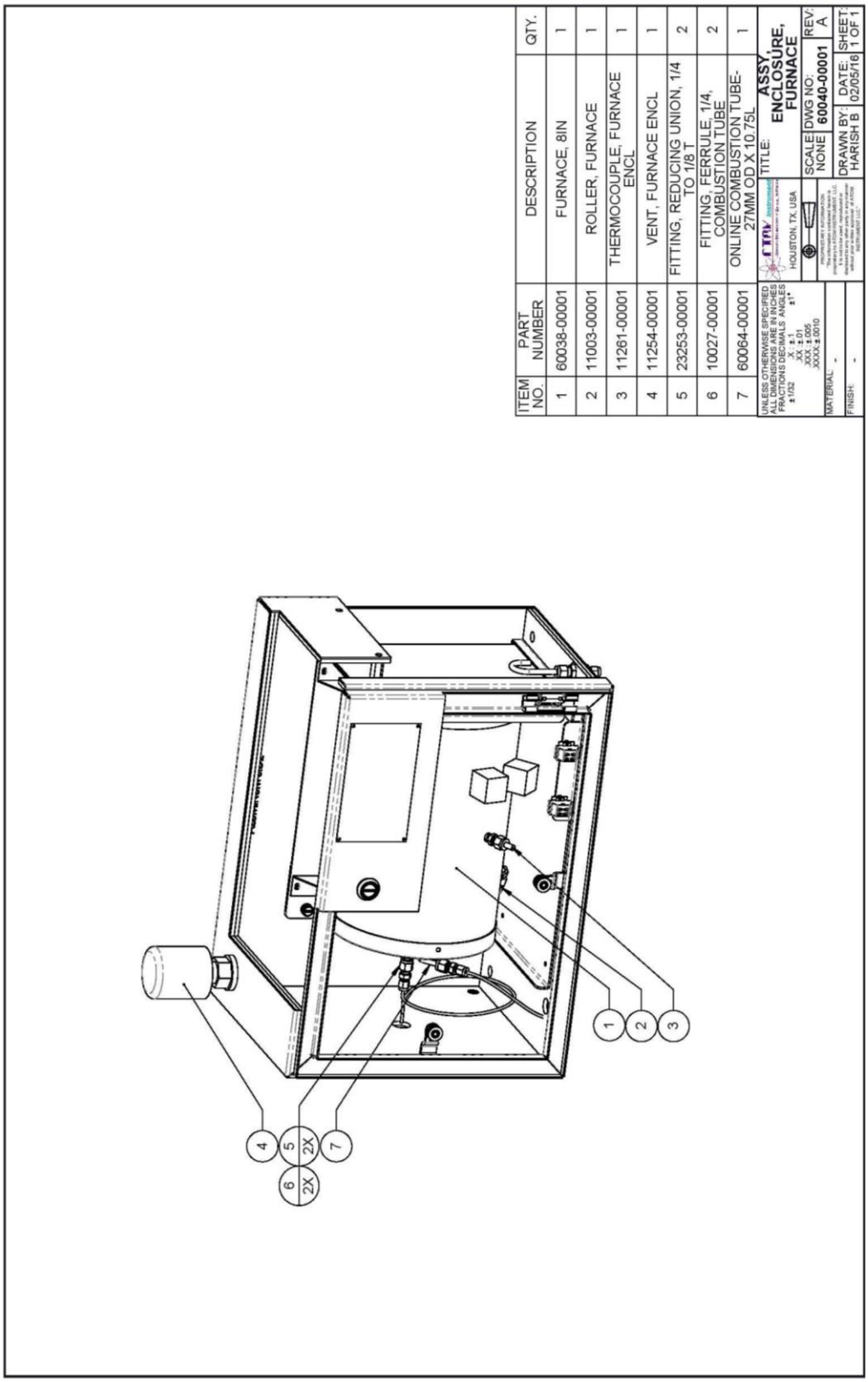
HOUSTON, TX, USA

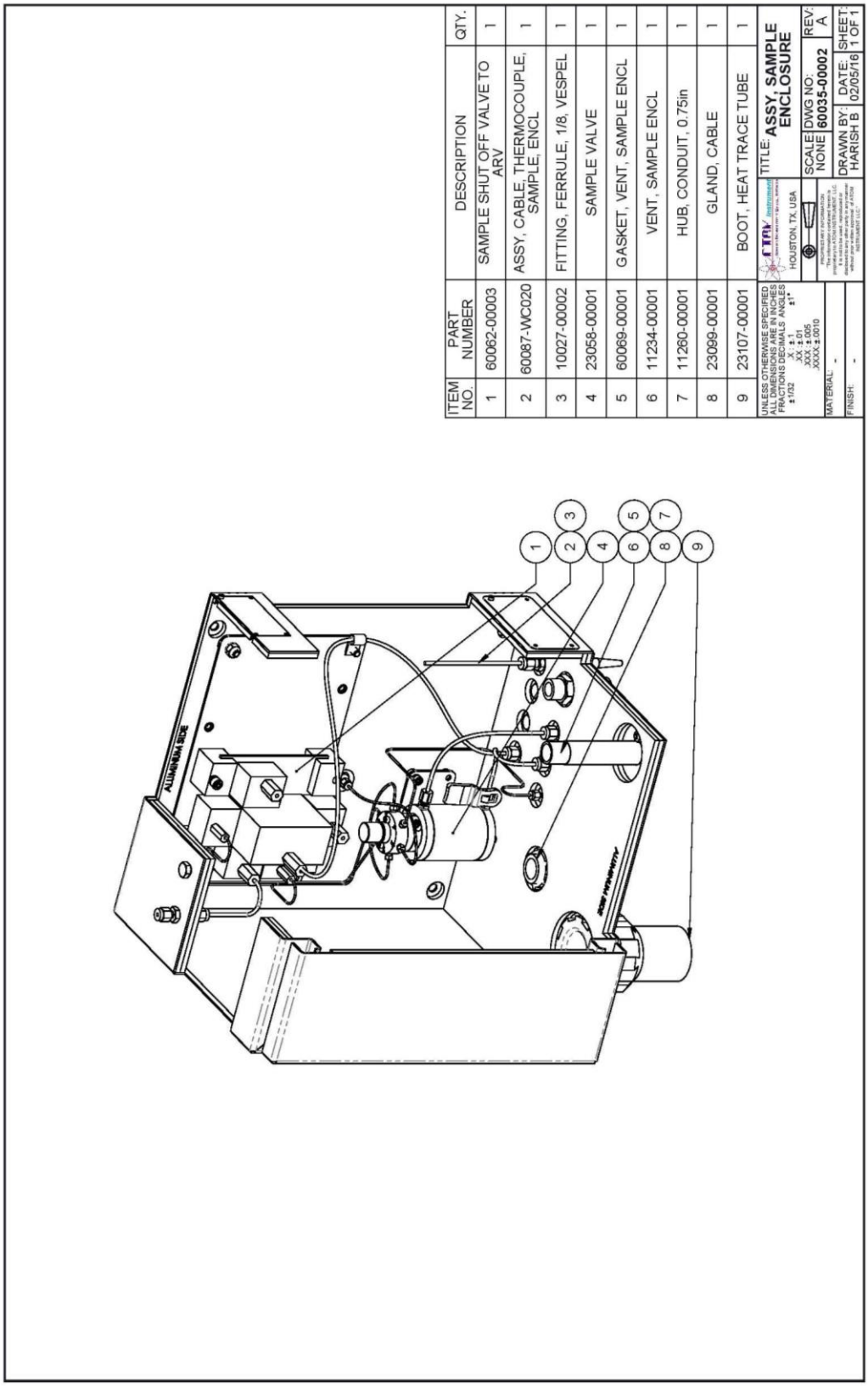
TITLE: **ASSY, BACK PANEL**

SCALE: NONE | DWG NO: - | REV: A

DRAWN BY: HARISH B | DATE: 02/05/16 | SHEET: 1 OF 1




ITEM NO. | PART NUMBER | DESCRIPTION | QTY.
1 | 60038-00001 | FURNACE, 8IN | 1
2 | 11003-00001 | ROLLER, FURNACE | 1
3 | 11261-00001 | THERMOCOUPLE, FURNACE ENCL | 1
4 | 11254-00001 | VENT, FURNACE ENCL | 1
5 | 23253-00001 | FITTING, REDUCING UNION, 1/4 TO 1/8 T | 2
6 | 10027-00001 | FITTING, FERRULE, 1/4, COMBUSTION TUBE | 2
7 | 60064-00001 | ONLINE COMBUSTION TUBE-27MM OD X 10.75L | 1
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES ±1/32 X: ± .1 XX: ± .01 XXX: ± .005 XXXX: ± .0010 ±1°
MATERIAL: -
FINISH: -
HOUSTON, TX. USA
TITLE: ASSY ENCLOSURE, FURNACE
SCALE: NONE
DWG NO: 60040-00001
REV: A
DRAWN BY: HARISH B
DATE: 02/05/16
SHEET 1 OF 1
1
2
3
4
5
2X
6
2X
7


ITEM NO. | PART NUMBER | DESCRIPTION | QTY.
1 | 60062-00003 | SAMPLE SHUT OFF VALVE TO ARV | 1
2 | 60087-WC020 | ASSY, CABLE, THERMOCOUPLE, SAMPLE, ENCL | 1
3 | 10027-00002 | FITTING, FERRULE, 1/8, VESPEL | 1
4 | 23058-00001 | SAMPLE VALVE | 1
5 | 60069-00001 | GASKET, VENT, SAMPLE ENCL | 1
6 | 11234-00001 | VENT, SAMPLE ENCL | 1
7 | 11260-00001 | HUB, CONDUIT, 0.75in | 1
8 | 23099-00001 | GLAND, CABLE | 1
9 | 23107-00001 | BOOT, HEAT TRACE TUBE | 1
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES ± 1/32 .X ± .1 .XX ± .01 .XXX ± .005 .XXXX ± .0010 ±1°
MATERIAL: -
FINISH: -
HOUSTON, TX, USA
TITLE: ASSY, SAMPLE ENCLOSURE
SCALE: NONE
DWG NO: 60035-00002
REV: A
DRAWN BY: HARISH B
DATE: 02/05/16
SHEET: 1 OF 1
ALUMINUM SIDE
ADD STAINLESS

Section 2 – Software Operation

This section of the manual is intended to provide a complete overview of the TraceS-1000 software providing the user a fundamental understanding of analyzer operation.

There are 3 programs incorporated into TraceS-1000 software that have distinct functions, but work together to provide complete control and user interface of the TraceS-1000 instrument. The main TraceS-1000 software program operates in the background and controls all aspects of analyzer operation, which includes protocols for communicating with the detector module. The detector module firmware is a distinctly separate, machine-language program embedded in the onboard microprocessor. The third program is a colorful, high-contrast Graphical User interface or GUI that provides a user-friendly interface comprised of an organized set of intuitive menu screens that are configured for ease of use.

Start Up

Upon powering up the TraceS-1000, the touchscreen will begin to turn on and Windows 7 will boot. If an administrator password has been set up for Windows 7, the password can be entered using an external keyboard plugged into a USB port to access the software. If no keyboard is connected, the touchscreen keyboard can be displayed by pressing the "Ease of access center" button at the bottom left of the screen and then selecting the "Type without the keyboard (On-Screen Keyboard)" option.

If no Windows administrator password has been implemented, the main GUI menu (*Figure 2.1)* will open automatically after the TraceS-1000 and touchscreen computer are powered on. All sub-menus may then be accessed from this bar found at the top of the desktop screen.

Figure 2.1 – Main Menu

In order to access any of the sub-menus of the GUI, the user must first log into the system. Refer to section 2.1.1 for Login information

Section 2.1 File Menu

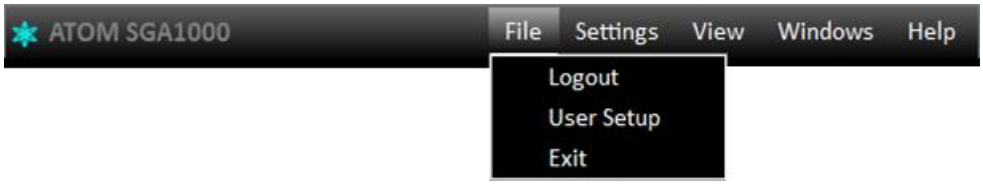


Figure 2.2 – File Dropdown Menu

Section 2.1.1 Login

The **Login** feature allows users to interface with the software on two separate levels. Users without administrative privileges are limited to menu access for viewing purposes only. Those users with administrative privileges have complete access to all menu settings, which can be modified as necessary for customizing or optimizing instrument operation (selectable in User Setup, *Figure 2.6*). The **Login** feature is intended to prevent unauthorized changes to instrument operation, allowing it to retain current settings unless an authorized user logs in with valid credentials *(Figure 2.3)*.

To log in to the analyzer, click **File > Login**. Press the ID line.

Figure 2.3 – Login Screen

A touchscreen keyboard should automatically pop-up on the screen *(Figure 2.4).*

Figure 2.4 – Touchscreen Keyboard

Using the touchscreen keyboard, enter the username ID. Then press the Password line and enter the user assigned password. After proper user credentials have been entered, press the OK button to complete the Login process.

> **NOTE:** At any attempt to access a screen that requires administrative privileges, the **Login** screen will automatically pop-up and prompt the user for the required credentials.

> **NOTE:** The dropdown menu will read Logout if a valid login has already been entered *(Figure 2.5)*.

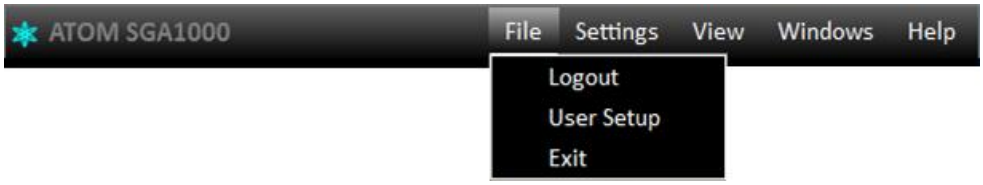


Figure 2.5 – User Already Logged In

There is an auto-logoff feature in place to automatically logout any user after 15 minutes of inactivity. After this time, any screen that requires administrative privileges to change or modify settings will automatically cause the Login Screen to reappear and prompt the user to re-enter the required credentials.

Section 2.1.2 User Setup

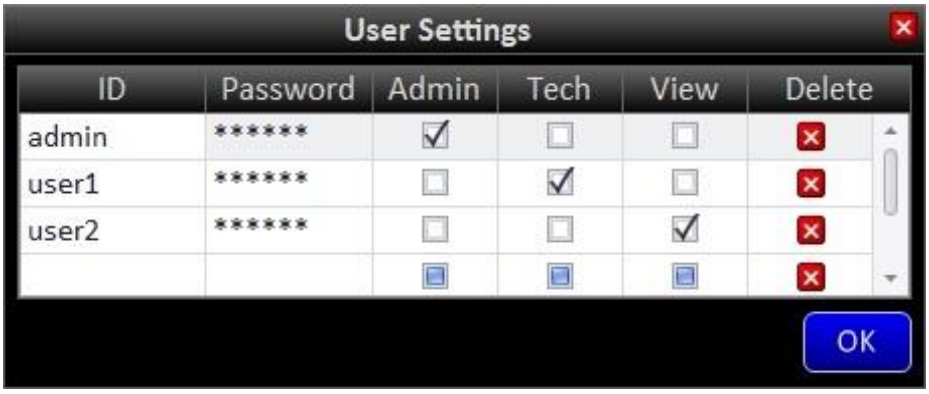


Figure 2.6 – User Settings Screen

The User Setup screen is accessed from **File > User Setup**. Four levels of users are defined in the ATOM GUI: Admin, Tech, View and Other (no box selected). Below is a description of each user's rights:

	Admin	Tech	View
View any GUI screen	X	X	X
Modify analyzer parameters	X	X	
Modify user privileges	X		

When logged in as an Admin, pressing the X box will delete the user profile (Admin cannot be deleted). To change a user level, clicking the corresponding desired box will change user privileges. To add a user, click the ID field and enter the user name, a password and user level are then selected to finish user registration. Default password is "0".

Section 2.1.3 Exit

By clicking **File > Exit**, the GUI program will close; however the TraceS-1000 main program will continue to run if there are no operational restrictions, such as loss of purge or other system critical alarm function.

Section 2.2 Settings

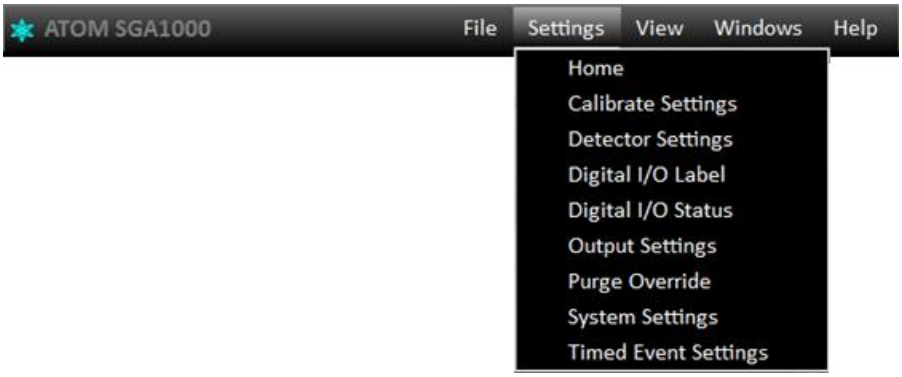


Figure 2.7 – Settings Dropdown Menu

Section 2.2.1 Home

The Home Screen is the top screen in the Settings menu and is considered to be the primary user interface for an overview of routine analyzer operation. *(Figure 2.8)*. The Home menu functions are arranged in groups and are discussed separately.

Figure 2.8 – Home Screen Detailed

Stream Selection and information

In this part of the home screen, the user may select which streams are run by checking the box adjacent to the desired stream. When a stream is under analysis, a green radio button is activated next to the stream being analyzed.

The user may choose the number of cycles ran during each stream analysis. Clicking on the Cycles number will open a text box which allows the user to select up to 9 cycles per analyses.

The Cycles Run counter indicates analysis progression. When all cycles requested by the user are completed, the analyzer switches to the other stream (if both streams are checked).

Run Cycle Status

The Run Cycle Status section of the Home Screen displays information regarding various aspects of the Run Cycle in process.

Start/Stop Button:
The analyzer software is designed so that the Analysis Cycle runs all the time, and will automatically restart upon restoring power after a power shutdown. Exceptions to the continuous run feature are:

1. There is an Alarm condition.
2. The Run Cycle is manually stopped.
3. The analyzer is Purging due to an Auto Calibration Check, or return to Process.
4. The analyzer is Holding as part of the Run Cycle Mode.

When the button is labeled STOP with a green LED, a cycle is either running, or is scheduled to run. Pressing this button will cause the cycle to stop after the current cycle has completed. When stopped, this button will be labeled START with the LED off. Pressing this button again will change the label to STOP and initiate a new cycle run.

Event Indicator
Beneath the START/STOP button is an indicator that displays various events related to the Run cycle. Some of the events the Event Indicator will display are, Not Ready, Holding and Purging. Whenever a cycle is currently running, it will display timed events as they occur such as Injecting, Baseline Evaluation and Peak Integration periods.

Cycle Time
The Cycle Time in the Run Cycle Status displays the current cycle time in elapsed seconds. The standard cycle time for the TraceS-1000 is 100 seconds. Once the current cycle is complete, it will start a new cycle at time 0.

Cycle Number
The Cycle Number displays the total number of completed cycles the analyzer has run since the analyzer was started. This number will increase until the cycle is stopped and will continue to increase once the cycle has restarted. This number will only be reset on power down of the detector or analyzer.

System Control

The System Control section of the Home Screen shows the status of the PMT and UV Lamp voltages, the presence of any Zero baseline offset value, and status of the TraceS-1000 alarm system.

PMT HV

This button controls high voltage to the Photo-Multiplier Tube and indicates whether it is ON or OFF. The LED will be GREEN if powered ON and is turned OFF by pressing the button to toggle.

UV Lamp

This button controls power to the Excimer Lamp Module and operates in similar to the PMT HV button in its ON/OFF functionality.

Zero BL

This button allows any baseline level to be zeroed for graphic display purposes, or the analyzer analog output when the detector signal is selected. This function must be enabled in the Detector Settings Screen which will be discussed later in the Software Operation section. Zeroing the baseline level will not affect acquired results or calculations of total sulfur composition.

Analyzer Alarm Status

This line will display **Normal** with green LED when the analyzer is running properly. This line will display **Warning** with yellow LED when something on the TraceS-1000 requires attention but is not critical enough to affect normal analyzer function. Should a system critical situation arise, this line will display **Alarm** with red LED indicating an alarm condition exists. If this occurs, the TraceS-1000 is designed to stop the current Run Cycle, which may also include combustion furnace shutdown, and activate the Global Alarm. *(Figure 2.9)*

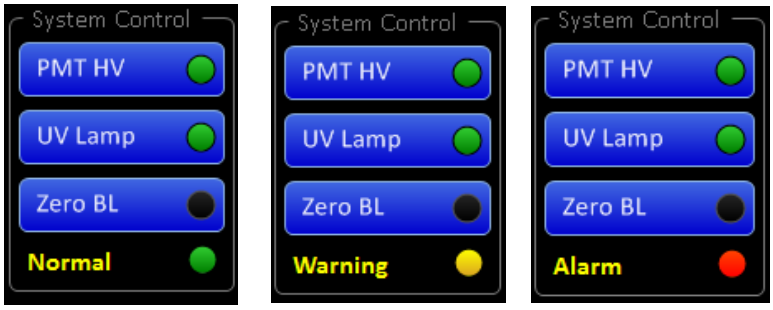


Figure 2.9 – Normal, Alarm, and Warning Status

NOTE: The status of this indicator will also be prominently flashed on the menu bar should the TraceS-1000 go into either WARNING or ALARM mode.

Variable Display Section

The Variable Display section allows monitoring of up to three user selected variables with associated bar graphs whose ranges can be chosen as necessary to provide a customizable display, depending on customer preference. Although any combination of variables can be chosen, the graphs are set by default to Detector mV, Stream 1 ppm and Stream 2 ppm. These displays will hold their current value until a new value is calculated, replacing the old reading with the most recent one. Pressing any of the three buttons above the graphs will open a list of available display variables, which can be selected by highlighting the intended variable and pressing the **OK** button. *(Figure 2.10)*

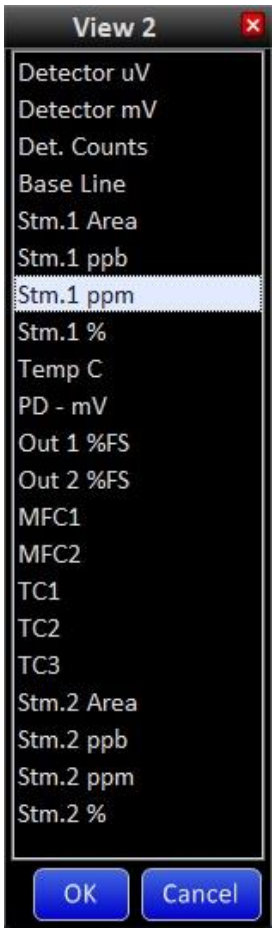


Figure 2.10 – Variable Display Selection Menu for View 2

Pressing the RANGE button allows the bar graph range to be selected in a likewise fashion. The desired range is chosen by selecting the adjacent radio button *(Figure 2.11).*

Alternatively, it is possible to choose a user defined range in the bottom last line of the table.

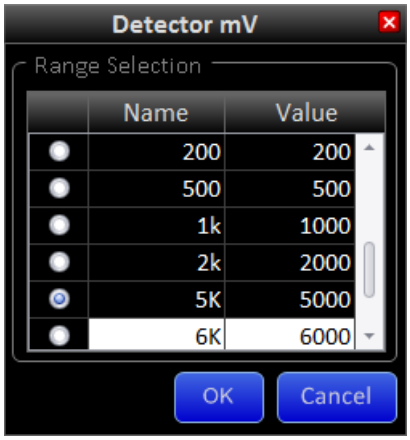


Figure 2.11 – Variable Range Selection Menu

Section 2.2.2 Calibrate Settings

The Calibrate settings screen *(Figure 2.12)* is where all information regarding instrument calibration and associated calibration results are displayed.

To access this screen press **Settings > Calibrate Settings**

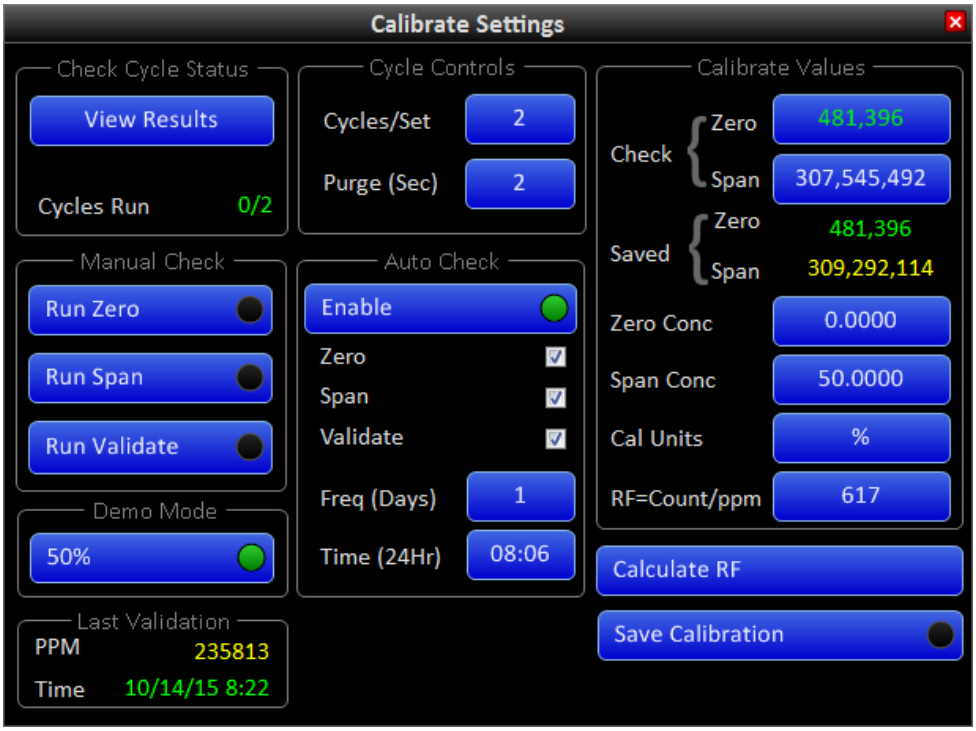


Figure 2.12 – Calibrate Settings Screen

Check Cycle Status

The Check Cycle Status allows the user to monitor and review acquired Check Cycle results, as well as the progress of the Check Cycles in progress.

View Results

Pressing the **View Results** button opens a separate menu and displays up to ten runs in a Cycle Set, allowing them to be viewed as they occur during Manual or Auto Check Runs. The results displayed are computed with the Response Factor (RF) currently in use *(Figure 2.13)*.

If a calibration check is in progress, results are updated in real-time as they occur. If the last calibration check is finished, these results will display all acquired values within the last calibration check set. Although "check calibration" results can be viewed at any time, they will be wiped clean and replaced with new data whenever the next Manual or Auto Check calibration is performed. Both Zero and Span sections display Area and Concentration values associated with the calibration check, as computed with the previously accepted Response Factor (RF).

Check Calibration Results

Run	Zero		Span	
	Area	Conc %	Area	Conc %
1	0	0.00	309,236,128	50.36
2	0	0.00	308,633,134	50.26
3	0	0.00	306,712,151	49.95
4	0	0.00	304,737,106	49.63
5	0	0.00	306,421,694	49.90
6		0.00		0.00
7		0.00		0.00
8		0.00		0.00
9		0.00		0.00
10		0.00		0.00
Average	0	0.00	307,148,042	50.02

Figure 2.13 – Check Calibration Results Screen

Cycles Run

The Cycles Run Line indicates the number of completed runs from the number of cycles selected for the calibration check set.

Cycle Controls

The Cycle Control section of the menu allows the user to set the number of calibration cycles desired for each Check Calibration Set, as well as the amount of purge time between cycles.

Cycles/Set

The **Cycles/Set** button allows any number of cycles to be selected between 1 and 10 for the desired set of runs. This number of cycles will be applied to each Zero, Span or Validate samples when selected. By pressing the **Cycles/Set** button a window will pop-up as well as the touchscreen keyboard in order to enter the desired number of cycles to be run. Press OK to set this value. *(Figure 2.14)*

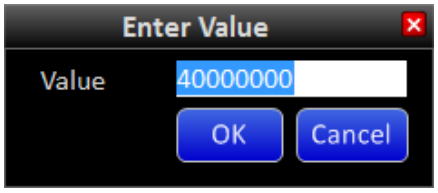


Figure 2.14 – Enter Value Screen

NOTE: The Enter Value Screen will pop-up throughout the software when required.

Purge (Sec)

The **Purge (Sec)** button allows the user to select the purge time between sets. This is intended to allow sample concentrations to reach equilibrium prior to starting a calibration check set. The optimal time setting will depend on sample flowrates and dead volume between the selection valves and analyzer.

The purge time will be applied during transition times between running process and a calibration check sample, between each set of calibration checks, and before returning to running the process sample.

If the analyzer is in purge mode, the Home Screen will display **Purging** on the event line and the clock counter will decrement from the chosen setting to "0" seconds.

***** Note:*** A loss of purge will cause the analyzer to go into "Alarm", and the analysis is immediately stopped. If this Alarm event occurs right after sample injection, then this sample will still be present in the system even after the alarm condition clears. Once the Alarm is cleared, the analyses resume after purging for the set duration (**Purge (Sec)** set as shown above under Calibration Settings).

If the purge is set for a shorter duration, it may not be enough to sweep the previously injected sample out of the system, before the next sample injection. This increases the probability of system coking. To avoid this, it is ***recommended that the Purge Time be set to a minimum of 60 seconds***.

Calibrate Values

This section displays all values used or associated with instrument calibration.

Check Zero and Span

The **Check Zero** and **Check Span** buttons display acquired values from the most recent calibration check. After the calibration checks are finished average calculated areas of Zero and Span will be displayed in these buttons. These values will be used for analyzer recalibration if considered acceptable by the user. Calculated values can be overridden with any User specified value.

Saved Zero and Span

Values on these lines display previously accepted areas utilized for calibration purposes.

Zero and Span Concentrations

The **Zero Conc** and **Span Conc** buttons allow the user to enter known concentration of samples, generally utilizing the certified values provided by the calibration gas supplier.
The **Cal Units** button allows the user to select the concentration for both values to be entered in either percent or PPM.

RF=Count/ppm

The RF=Count/ppm button displays the most current response factor. The response factor (RF) is primary number used to calibrate the instrument. The number represented as Counts/PPM is a value proportional to the difference in area divided by difference in concentration.

If modification to the calculated RF is preferred, or instrument performance utilizing a randomly selected RF without calibration is desired, the user merely presses the RF=Count/ppm button and enters the chosen RF.

Manual Check

The Manual Check section allows the user to manually run a ZERO, SPAN, or VALIDATE set of run cycles. The ZERO and SPAN functions will use the sample bottles that are connected to their respective inputs to calibrate the TraceS-1000. The VALIDATE function will run any concentration of a known sample to ensure the TraceS-1000 accurately measures the intended concentration.

Auto Check

The Auto Check section of the Calibration Settings allows the user to set up routine calibration checks.

The **Enable** button enables or disables auto check feature, as indicated by the embedded LED. Any or all of the three possible gas standards can be included in the Auto Check run by selecting the adjacent box to include a checkmark. The user can also specify the desired auto check schedule utilizing the **Freq (Days)** and **Time (24Hr)** buttons. The time of day is always entered in 24-hour format.

Demo Mode

The **Demo Mode** button allows the user to substitute previously recorded data in place of real-time detector data without having to run actual samples. The Demo Mode feature is enabled by pressing the button as indicated by the lit LED.

If the SGA is analyzing process sample when Demo Mode is enabled, normal detector signals will be substituted with pre-recorded data from a 50% concentration sample at the end of the current Run Cycle.

If the SGA is analyzing calibration sample, whether in Manual or Automatic mode, the 50% concentration sample data will be substituted whenever Span is selected.

If Zero gas is selected, a different set of pre-recorded data representing near-zero sample concentration will be utilized. If Validate is selected, pre-recorded data representing 25% total sulfur sample concentration will be utilized.

It is important to note that there are a total of 7 continuous runs recorded for each of the above pre-recorded concentrations. If more than 7 cycles are selected to run in a cycle set, the pre-recorded analysis data will merely repeat every 7 cycles, and include any portion thereof necessary to complete the intended set. The detector will return to processing normal real-time signals after DEMO mode is turned OFF.

Last Validation

This section of the menu shows the last validation the TraceS-1000 performed with the date and time.

Calculate RF

After Manual or Auto Check is complete, the analyzer will display the new data for zero and span values in the "Check" section. Pressing the "Calculate RF" will automatically calculate the response factor based on the difference between Zero and Span areas from the latest Check Calibration run.

Save Calibration

Whenever any calibration check information has changed, such as completion of a calibration set, manual change to calibration check values, or a response factor that has either been calculated or manually entered, the **Save Calibration** LED will indicate new calibration values that remain to be entered. All changes will not come into effect until the **Save Calibration** button is pressed.

Section 2.2.3 Detector Settings

The Detector Settings screen contains information about the detector and settings that can be altered *(Figure 2.15)*.

To access this menu press **Settings > Detector Settings**

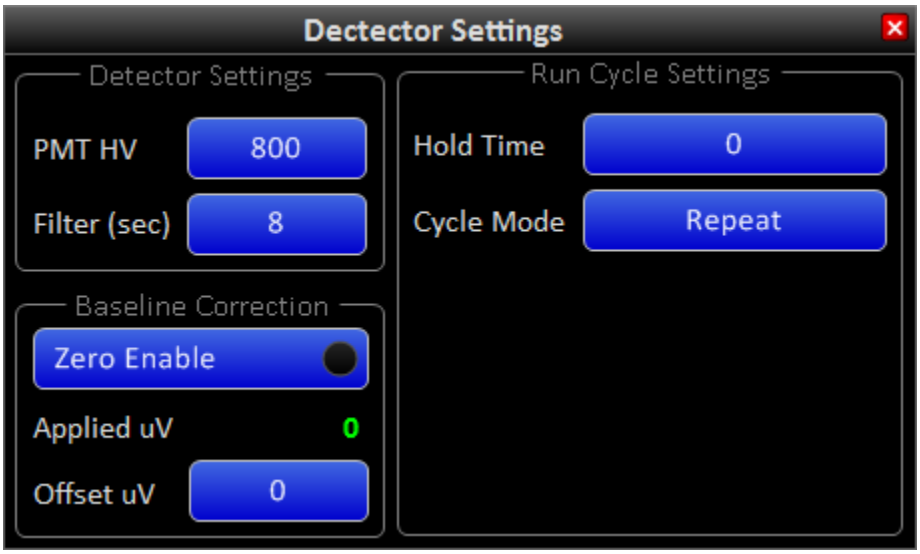


Figure 2.15 – Detector Settings Screen

Detector Settings

This part of the menu allows the user to change the PMT HV (Photo-Multiplier Tube High Voltage) and change the filtering constant of the data collected.

The PMT HV button lets the user change the high-voltage applied to the PMT to adjust detector sensitivity and associated peak height to the desired level. The PMT HV default value is 800V, but is typically modified as necessary at the factory. The maximum voltage setting is 1099 volts.

The Filter (sec) button controls the detector filtering constant, or a rolling "box-car" average of individual 1-sec detector count readings. The optimal setting for the TraceS-

1000 is 8 seconds for best results, which is a time constant that allows maximum smoothing of detector data without significantly affecting overall peak height.

Baseline Correction

This section allows the detector baseline to be modified as desired for graphing or output purposes.

The Zero Enable button allows the baseline to be zeroed either manually, or automatically. To turn this function ON press the Zero Enable button and the indicator will turn GREEN. To turn it OFF press the button again and the indicator will be BLACK.

Manual zeroing of the baseline is accomplished by pressing the Zero BL button in the System Control Section of the Home Screen. Automatic zeroing of the baseline is defined in the Timed Events Settings and will occur during the programmed time. Even if the Zero Enable button is enabled, a program time of "0" will prevent automatic zeroing of the baseline.

Applied µV

The Applied µV line displays the voltage applied to the normal detector baseline to shift it to zero. This value is cumulative each time the baseline is zeroed either manually or automatically. When the Zero Enable button is turned off, any cumulative offset value is dropped and the baseline will return to its normal state.

Offset µV

Whether the Zero Enable button is enabled or not, the Offset µV button allows the user to readjust the baseline to any desired value.

Run Cycle Settings

The Run Cycle Settings allow the mode of cycle operation to be selected. The three modes of operation are **Repeat**, **Hold** and **Stop**.

If the selected mode is **Stop**, a running cycle will stop at the end of programmed cycle time. If the selected mode is **Repeat**, a new cycle will immediately restart after the current cycle ends. If the selected mode is **Hold**, a new cycle will start after the Hold time has elapsed. Whether the analyzer is in Repeat or Hold modes, cycles will run continuously until a) the cycle is manually stopped; b) an alarm condition arises; or c) power to the analyzer is turned off.

Section 2.2.4 Digital I/O Label

The Digital I/O Label screen contains assigned names for all digital inputs and outputs *(Figure 2.16)*.

To access this menu press **Settings > Digital I/O Labels**

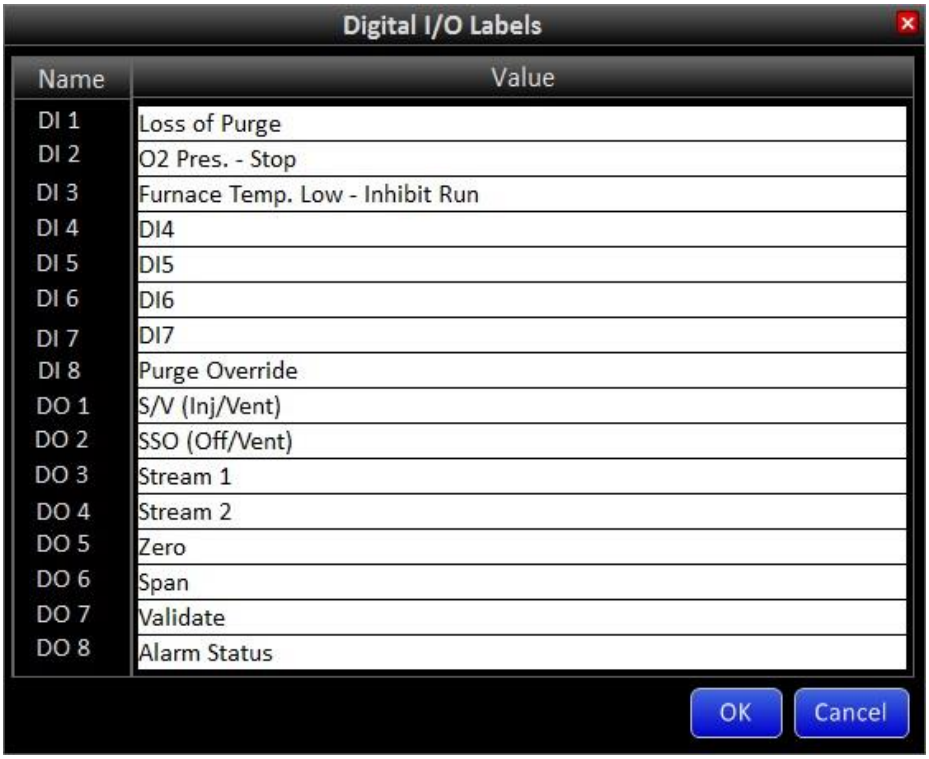


Figure 2.16 – Digital I/O Labels Screen

The Digital I/O labels above have been assigned as default names by the factory. To change any of these, the text is selected by pressing the desired line, which will pull up the touchscreen keyboard. The user then enters any alternate name or text desired, and presses the **OK** button.

Section 2.2.5 Digital I/O Status.

The Digital I/O Status screen is consolidated screen to check the status of all the digital inputs and outputs *(Figure 2.17)*.

To access this menu press **Settings > Digital I/O Status**

Figure 2.17 – Digital I/O Status Screen

DI (Digital Input) Status

This section displays the digital inputs in their normal operating state. Digital inputs 1-3 reflect the presence of system critical parameters that are described in the System Setting menu. Digital inputs 4-7 are unassigned with current SGA software. Digital input 8 has been configured to operate as a digital output and is essentially considered "DI-9".

DO (Digital Output) Status.

This section displays the status of all digital outputs as indicated by the associated LED. The digital outputs are configured as 24V DC signals that operate a variety of valves and relays from the External Interface board. When the analyzer is running, these outputs automatically turn on and off as required by timed events and calibration settings. For troubleshooting purpose these outputs can be manually turned on and off, only after the run cycle is stopped.

Section 2.2.6 Output Settings

The Output Settings screen allows the user to select the desired variable and scaling for both Analog Output channels available with TraceS-1000 *(Figure 2.18)*.

To access this menu press **Settings > Output Settings**

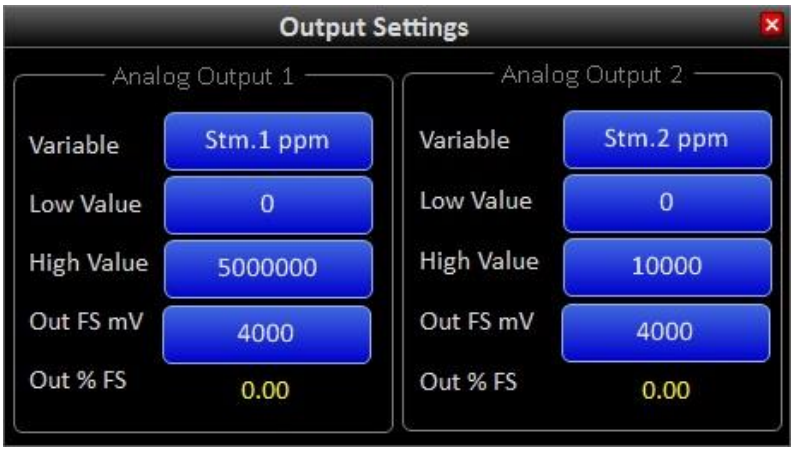


Figure 2.18 – Output Settings Screen

The Output Settings menu is divided into two identical sections for Analog Output 1 and Analog Output 2. Pressing the **Variable** button will open a list of available parameters from which the user can choose the desired variable by selecting the adjacent radio button (Figure 2.19). The **Low Value** and **High Value** buttons permit the input range to be defined, regardless of the variable selected. Pressing these buttons will open the touchscreen keyboard and enable modification as necessary.

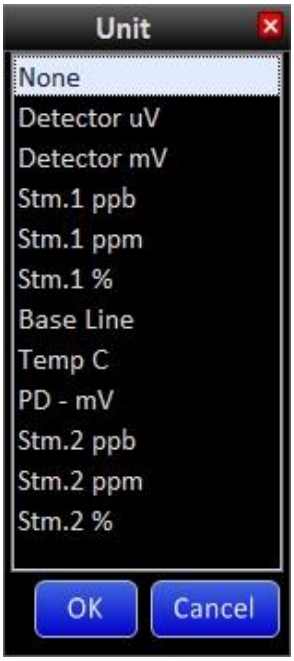


Figure 2.19 – Output Variables Dropdown Menu

The **Out FS mV** button allows the output range of the associated DAC to be set. The 18-bit DAC's have a specified output of 0-4000mV. Although lowering this value will allow 100% of range High Value to be achieved at a lower output voltage, the total number of bits representing this value would be correspondingly reduced. In order to capitalize on all available 18-bits of resolution,

and to satisfy the Signal Conditioner input requirement of 0-1 VDC, the circuitry incorporates a 4:1 voltage divider built into the SP-2000 signal processing detector board. Therefore, even though the **Out FS mV** is set to 4000mV, the resulting DAC analog voltage output is reduced to 1000mV at this setting.

The Out % FS Line will always indicate the current variable value relative to the variable range in percent full scale.

Section 2.2.7 Purge Override

The TraceS-1000 has been certified for use in Class 1, Division 2 hazardous locations and purge pressure is necessary for maintaining certification requirements *(See Section 6).* The analyzer purge is intended to maintain positive pressure on the analyzer enclosures to prevent ingress of potentially hazardous atmospheres. Purge monitoring of the TraceS-1000 is accomplished utilizing the Cyclops Z-purge device *(See Section 5).*

The purge override feature *(Figure 2.19)* is incorporated into the SGA software to permit analyzer operation without enclosure purge pressure. This enables the enclosure doors to be open for inspection or maintenance of the analyzer when the area is known to be non-hazardous.

Access this mode by pressing **Settings > Purge Override**

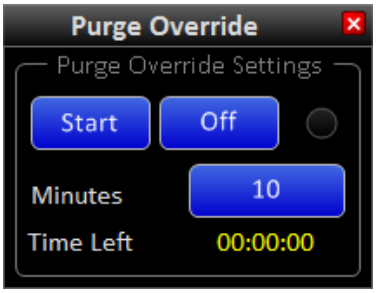


Figure 2.19 – Purge Override Menu

The default time for Purge Override is 10 minutes. Pressing the **Start** button initiates the Purge Override function for the designated time. The time at the bottom of the menu reflects time remaining before the Purge Override function is disabled.

Should a different Purge Override time be desired, pressing the **Minutes** button will open an Enter Value window that allows the user change the Purge Override time up to 1,092 minutes, or just over 18 hours. Should more time than the originally entered time be necessary, the user may enter a new value at any time. Pressing the **Off** button will revert back to normal operation, but Purge Override should only be stopped after the enclosure doors have been closed and purge is reestablished to avoid shutdown of furnace and Run Cycles.

Section 2.2.8 System Settings

The System Settings menu allows the user to configure WARNINGS and ALARMS for the TraceS-1000. To access this menu press **Settings > System Settings**

System parameters are arranged in two groups. The top four parameters are digital inputs that monitor operational requirements, the first three of which are assigned and last being unassigned. The assigned parameters (Loss of Purge, O_2 Pressure Low and Furnace Temperature Low) are considered to be system critical conditions and are already configured for Alarm by default. The DI4 parameter is unassigned and can be utilized as a customer configurable digital input *(Figure 2.20).*

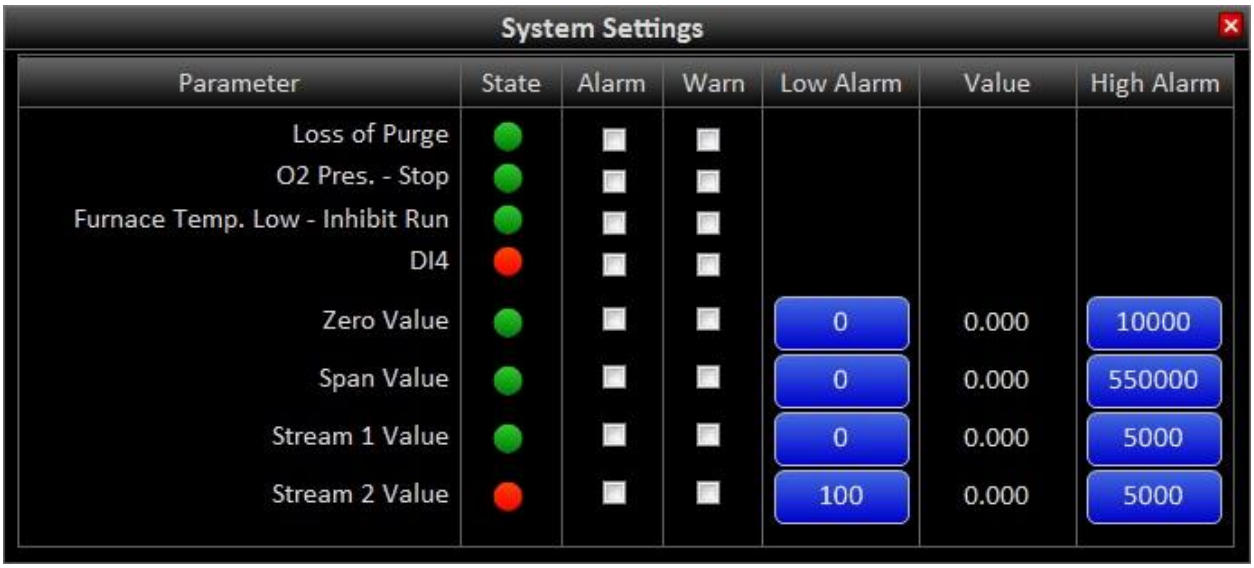


Figure 2.20 – System Settings Screen

The designated trip points for the system critical parameters are as follows:

Parameter	**Trip Condition**
Loss of Purge	Enclosure Pressure Falls below 0.2" H_2O pressure
O_2 Pressure Low	Zero Air Used for Combustion less than 20 PSIG
Furnace Temp Low	Combustion Furnace Temperature less than 1025°C

The remaining parameters are not system critical, but are intended to monitor results calculations for Zero Value, Span Value, Stream 1 and Stream 2. These parameters allow the user to select both Low Alarm and High Alarm limit settings, by entering the desired value in ppm after pressing the associated button. The most recent calculated values are also displayed between the High/Low limit settings for reference. Any or all of the System parameters shown can be programmed to generate a WARNING or ALARM if triggered.

NOTE: The values used for alarm triggers in the Zero, Span and Stream sections are averaged values. To modify the number of runs in the Zero and Span average, please refer to section 2.2.2, for the Stream average, please refer to section 2.3.3.

Alarm

If an ALARM status is enabled for any parameter, and that parameter falls out of its designated range, the TraceS-1000 will trigger an alarm that will be indicated by a red LED in the State column *(Figure 2.21).*

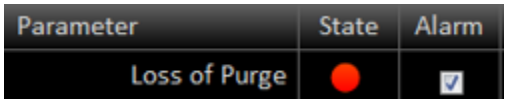


Figure 2.21 – Loss of Purge Alarm

Any ALARM state will be reflected by the Analyzer Alarm Status line at the bottom of the System Control section of the Home Screen *(Figure 2.10)*. The message ALARM!, will also be prominently flashed in the Main Menu bar in large red text *(Figure 2.22)*.

Figure 2.22 – Main Menu Alarm

As soon as an ALARM state is triggered, the analyzer is designed to immediately shutdown power to the combustion furnace and stop any currently running cycle. In addition, the GLOBAL ALARM relay will be activated. Run Cycles will automatically resume as soon as all alarm conditions are cleared, and after any programmed Purge time has elapsed. This also means that all alarm conditions must be clear before any Run Cycles can be started.

***NOTE:** The default ALARM assignment for system critical parameters **should never be changed**, unless necessary in special situations, such as troubleshooting or demonstration purposes. Disabling these alarms or changing the status to WARNING can result in damage to the system and void the warranty.*

Warning

If a WARNING status is enabled for any parameter and that parameter falls out of its designated range, the TraceS-1000 will trigger a warning that will be indicated by a yellow LED in the State column. Similar to ALARM status, the Warning will be also be reflected by the Analyzer Alarm Status in the System Control section of the Home Screen, as well as be prominently flashed in the Main Menu bar *(Figure 2.23)*.

Figure 2.23 – Main Menu Warning

Any parameter enabled to generate a WARNING status, should it fall outside the designated range, is not considered to be a critical parameter for system operation. It is primarily intended to alert the user to a condition that may require intervention. It should be noted that Loss of Purge is hardwired to shut down power to the furnace regardless of whether that parameter is checked for ALARM, WARNING, or neither. However, Run Cycles will only be stopped when an ALARM condition exists.

NOTE: If disabling the alarm or warning is desired before the condition is restored, the user may simply uncheck the box until the parameter is to be monitored again.

NOTE: If both ALARM and WARN are checked for any specific parameter, the priority will always be given to the ALARM whenever that parameter is out of range.

Section 2.2.9 Timed Event Settings

The Timed Event Settings menu allows the user to configure all timing functions associated with the Run Cycle *(Figure 2.24).* To access this menu press **Settings > Timed Events.**

Figure 2.24 – Timed Event Settings Screen

The Timed Events Settings menu contains 6 separate Cycle Timed Events. These events are defined by 10 programmed timing entries that stipulate Run Cycle control and operation. Timed Events within this menu include:

Event Name	Description
Inj Start	Sample Valve is turned ON to Inject Sample in Loop

Inj Stop	Sample Valve is turned OFF to Reload Sample Loop
SSO/ARV Start	Sample Shut Off turned ON relieving Excess Pressure to Atmospheric Reference Vent
SSO/ARV Stop	Sample Shut Off turned OFF returning Normal Sample Flow through Inject Valve
Auto Zero	Sets Time when Auto Zero of Baseline is Performed (Setting of 0 = Off)
BL Start	Initiation of Baseline Evaluation Period; Values Averaged Establishing BL Value.
BL Stop	Completion of Baseline Evaluation; BL Average used to Correct Area Count Readings
Peak Start	Initiation of Peak Integration Period; Begin Summation of BL Corrected Readings
Peak Stop	Completion of Peak Integration Period; Sum All Data to Generate Peak Area Value
Cycle Secs	Sets Cycle duration and Defines completion of the Cycle Time.

To change the timing entry for any of these events, press the associated button that will open an Enter Value screen. The user enters the desired time in seconds and presses the **OK** button. Generally speaking, all settings provided in the Timed Events menu by the factory have already been optimized for best analyzer performance. Although the user is at liberty to make changes to these settings, analyzer performance cannot be guaranteed whenever factory settings have been modified from their original values.

NOTE: A value of zero (0) in the Timed Events Settings will turn off the event

Section 2.3 View

The View menu group contains submenus that provide information regarding instrument performance, but does not contain any settings related to instrument operation. *(Figure 2.25)*

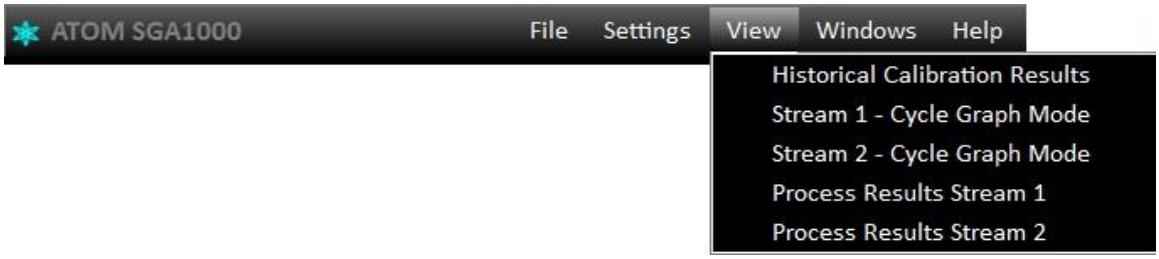


Figure 2.25 – View Dropdown Menu

Section 2.3.1 Historical Calibration Results

The Historical Calibration Results menu allows the user to review previous calibration results that were archived by pressing the **Calibrate and Save** button in the Calibration Settings menu. *(Figure 2.26).* To access this menu press **View > Historical Calibration Results.**

Figure 2.26 – Historical Calibration Results Screen

The menu is similar to the Check Calibration Results menu, but with supplemental information. The top line shows the date and time the displayed calibration information was saved. Pressing the down arrow located on the far right of the Date/Time Bar opens a list of all previously saved calibration results. The user can scroll through the list to select the desired calibration date, and then press OK to view the prior calibration results *(Figure 2.27).*

Figure 2.27 – Historical Calibration Results Dropdown Menu

The central section provides individual peak areas and concentrations, as well as the average of all completed cycles run. The Value Used section contains the final values selected for use. In other words, even though the analyzer computes the average area for Check Zero and Check Span concentrations in the Check Calibration process, the user may have used an alternate value for computing the "Calculated and Used" RF. User modification of these values will be evident if there is a difference between Average values and "Value Used".

Section 2.3.2 Cycle Graph Mode

The Cycle Graph menu is a graphical representation of the detector signal as it occurs in real time during the Run Cycle. This screen allows the user to ascertain general characteristics such as baseline noise, peak profile and peak integration period from one or more sequential analysis *(Figure 2.28).*

To access the Cycle Graph Screen press, **View > Cycle Graph Mode.**

Figure 2.28 – Cycle Graph Mode Screen for Stream 1

Cycle Graph

The Cycle Graph is a typical X-Y graphical display plotting detector counts versus time in seconds. Individual data points are computed and plotted for each second of the programmed cycle time.

The graph also displays the Start and Stop time of the Peak Integration Window as denoted by the two vertical red lines. The software is designed to sum all baseline corrected areas within this window, or between 20 and 70 seconds in this example.

A feature only available when one series is selected for plotting in Display Cycles is a vertical line cursor with an associated text box. The user may press anywhere within the plot area to activate this cursor, causing an X-Y text box to appear. The user may move the cursor anywhere along the signal to display the time-counts values of the nearest data point. The text box will not appear until there is recorded data within the current Run Cycle *(Figure 2.29).*

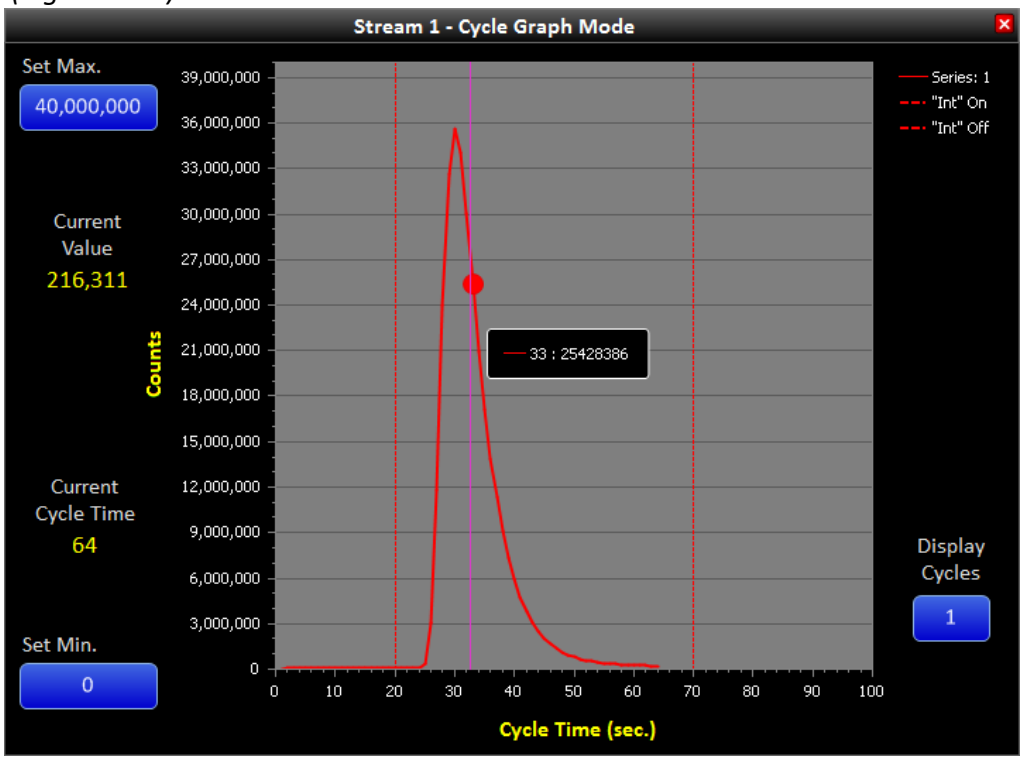


Figure 2.29 – Viewing Specific Data Points on Cycle Graph

Set Min and Set Max

These buttons allow the user to change the minimum and maximum scaling of the Cycle Graph. The scaling feature enables significant flexibility of the displayed data, depending on user preference.

Display Cycles

This button allows the number of cycles to be displayed as series, allowing graphical comparison of previous Run Cycles. Any number of sequential analyses may be chosen which are represented as Series 1-7 on the right side of the Cycle Graph.

The Series colors have been selected to convey temporal information related to the Run Cycle in the order in which the analyses occurred. The series colors are as follows:

Series 1	Red
Series 2	Orange
Series 3	Yellow
Series 4	Green
Series 5	Light Blue
Series 6	Dark Blue
Series 7	Purple

The most recent series will always be red. As additional cycles are run, the color for the displayed series are scrolled such that the data represented by a particular color is always shifted to the next Series color at the beginning of a new cycle *(Figure 2.30).*

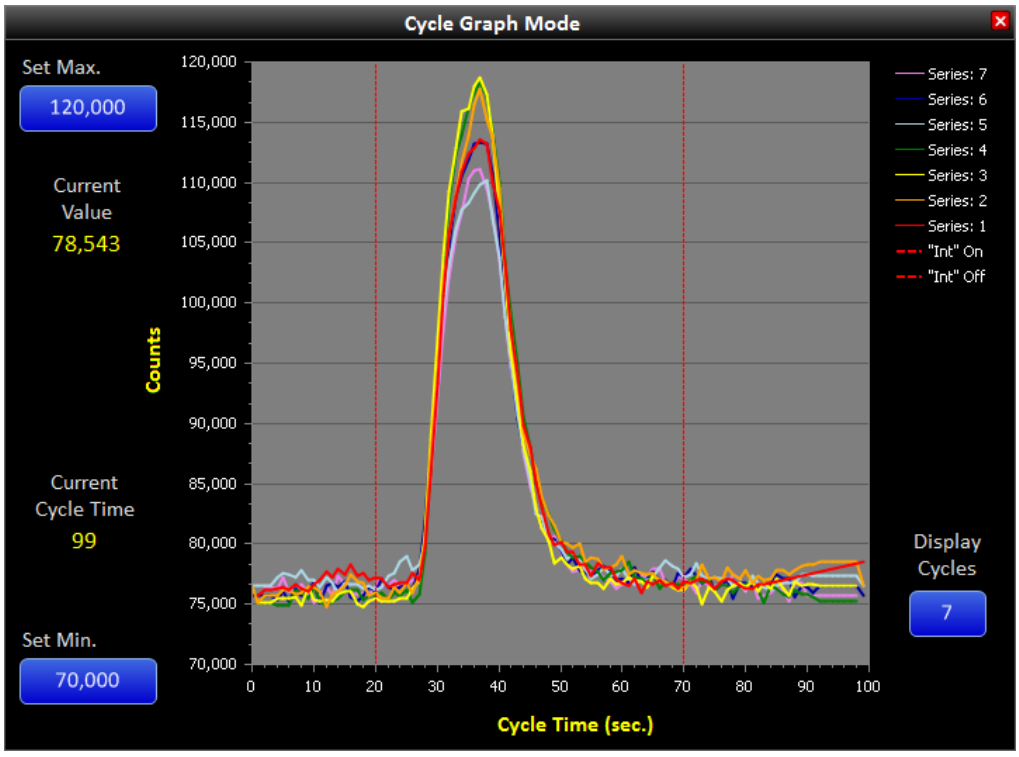


Figure 2.30 – Cycle Graph Displaying Multiple Trace Concentration Peaks

NOTE: If there is more than one series selected to be graphed, the previously described vertical cursor displaying the time and detector counts is disabled.

Current Value

This shows the current value as it rises and falls throughout the cycle period.

Current Cycle Time

This is the same number that is displayed on the Home Screen and shows the current cycle time for convenience.

Section 2.3.3 Process Results

The Process Results menu screen allows the user to view analysis results in percent concentration of completed process samples run *(Figure 2.31).*

Open this screen by pressing **View > Process Results.**

Figure 2.31 – Process Results Screen for Stream 1 and Stream 2

The Process Results menu screen displays a list of the last 10 samples run. The most recent sample is listed at the top and results will scroll down as subsequent samples are run.

The average concentration is displayed at the bottom of the table and includes the selected number of most recent runs. To select the number of runs included in the average, press the button adjacent to "Conc. Average" to open a select text box.

NOTE: If concentration is chosen as an output of the analyzer, the average concentration calculated above is outputted. To output the concentration for each single run (as displayed on the home screen), select a Conc. Average of 1.

Section 2.4 Windows

The Windows menu screens allow the user to organize any open menus.

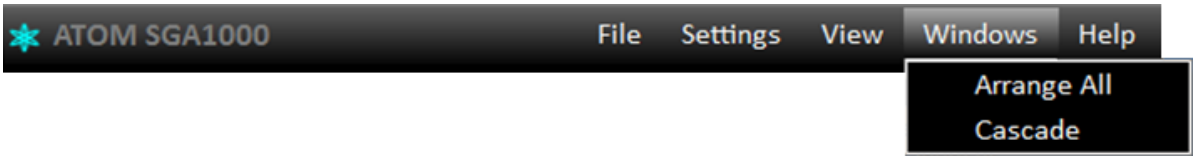


Figure 2.32 – Windows Dropdown Menu

Due to the relatively large size of the available menus in relation to the size of the TraceS-1000 touchscreen computer display, the only practical arrangement option is to cascade open windows. The **Cascade** function stacks menu screens utilizing the title bar for reference in the order they were opened. Selecting either **Arrange All** or **Cascade** options generates identical arrangement of menu screens, such as in the example below. *(Figure 2.33)*

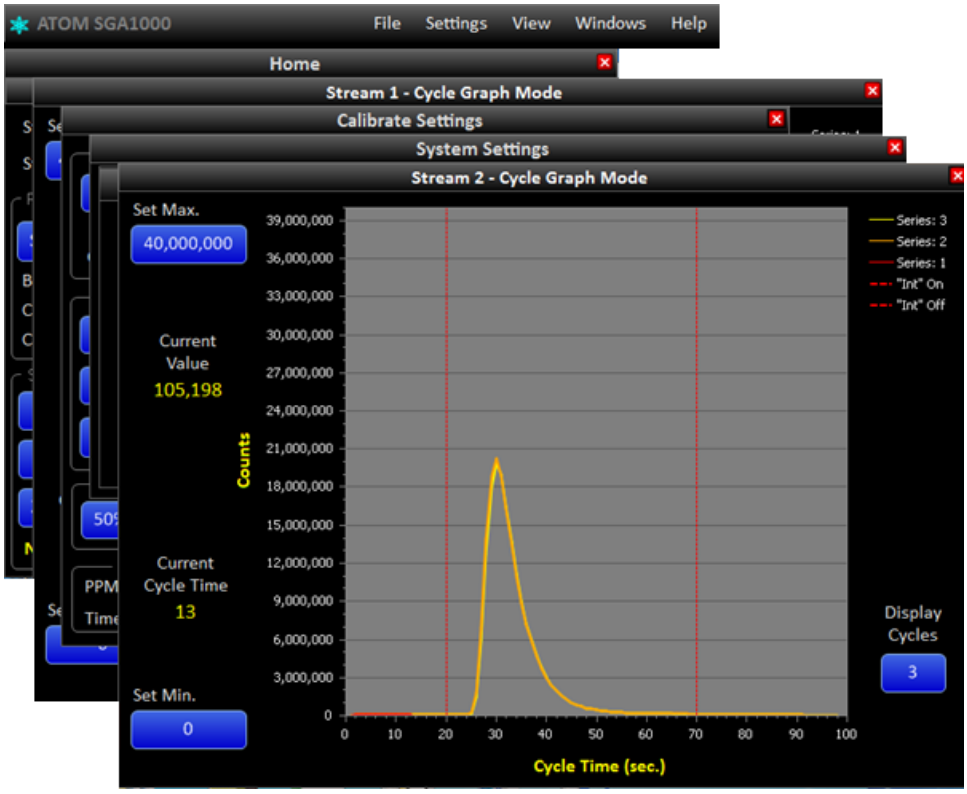


Figure 2.33 – Cascaded Menus

Section 2.5 Help

The **Help** section contains a single drop down selection menu *(See Figure 2.34).*

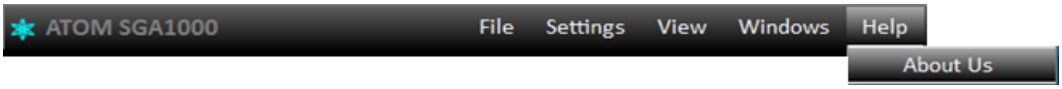


Figure 2.34 – Help Dropdown Menu

To access the **About Us** menu press **Help > About Us** *(See Figure 2.35)*.

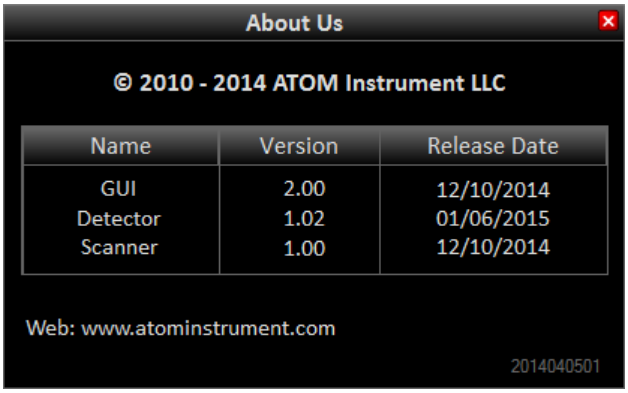


Figure 2.35 – About Us Screen

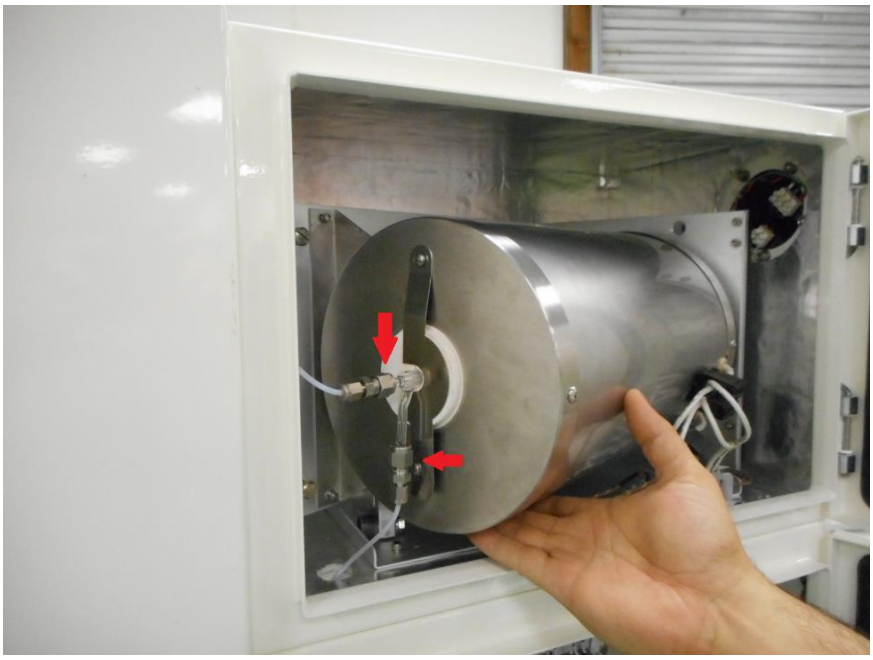
The **About Us** Menu Screen displays information regarding the software version and associated release dates of three separate programs. The GUI, Detector and Scanner programs have distinct functions, but work in conjunction with each other to provide comprehensive control of the TraceS-1000 instrument and user interface.

Section 3 – Basic Maintenance Guide

Section 3.1 Combustion Tube Replacement

Begin by loosening the two screws indicated above inside the furnace chamber

Gently swing the furnace outward. The furnace incorporates a special roller bearing for support and allows near effortless movement.

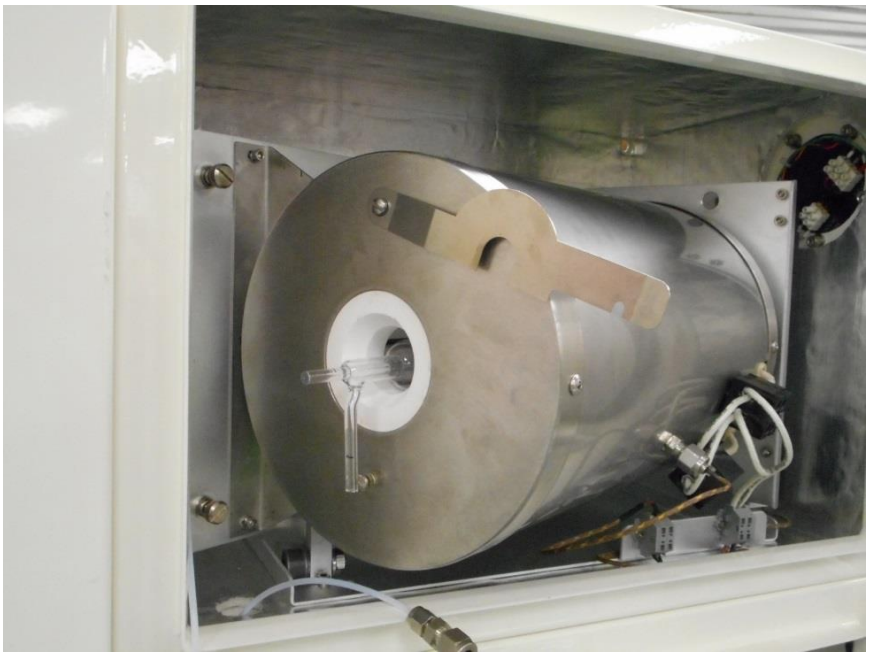


Loosen and detach combustion tube inlet and outlet fittings

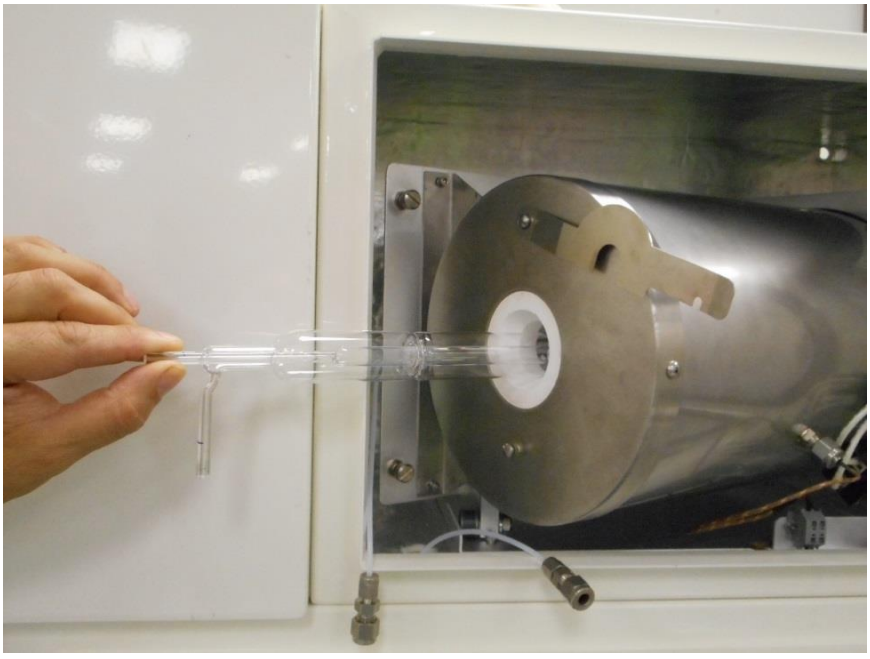
Fittings shown detached from combustion tube

Press and rotate the insulator clamp to allow access to the ceramic insulators

Carefully remove both ceramic insulators



The combustion tube is now ready to be removed



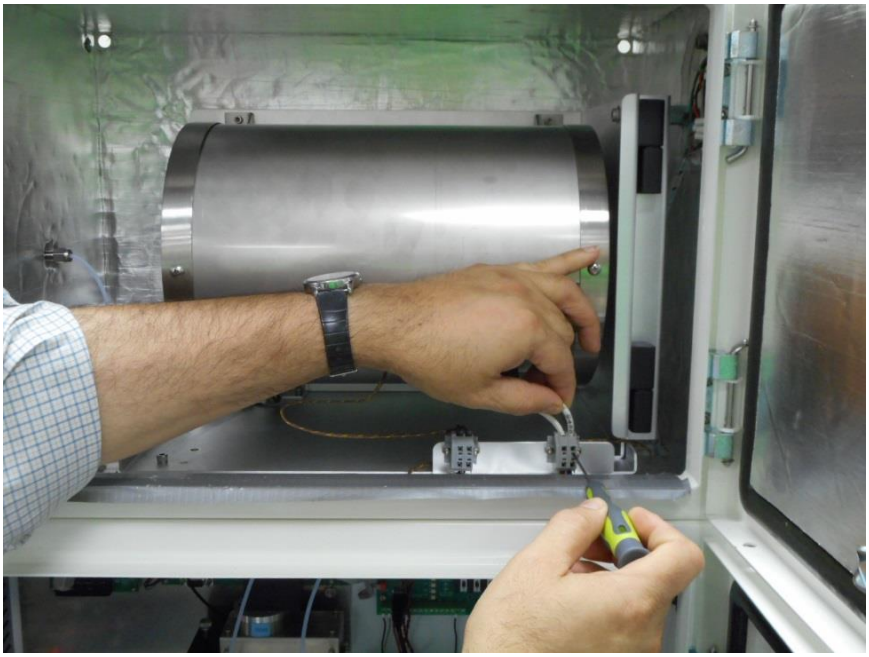
Carefully and slowly remove the combustion tube from the furnace

Insert a new combustion tube, replace ceramic insulators, rotate and secure insulator clamp.

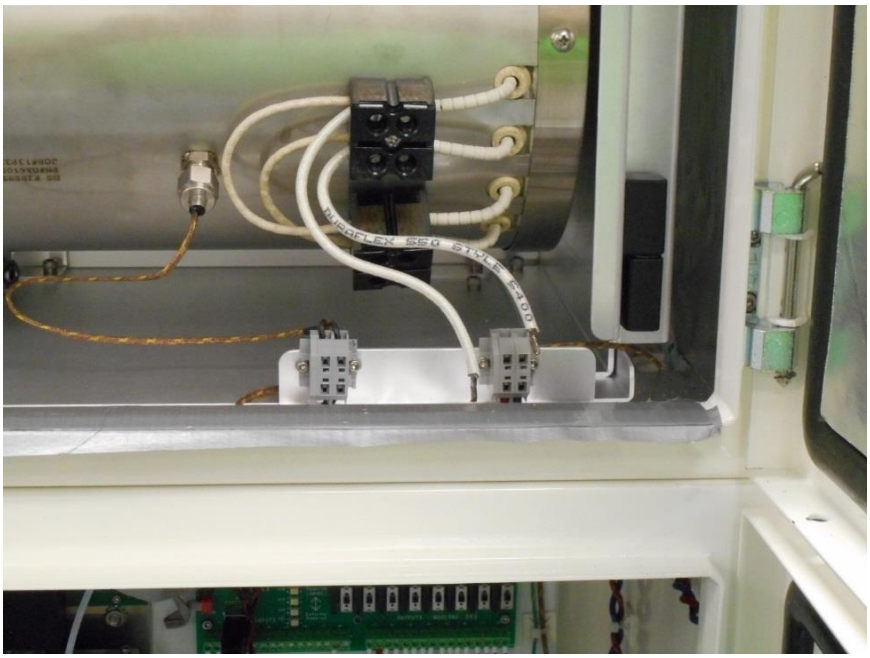
Re-attach combustion tube fittings, carefully roll furnace back in place and retighten screws.

Section 3.2 Furnace Replacement

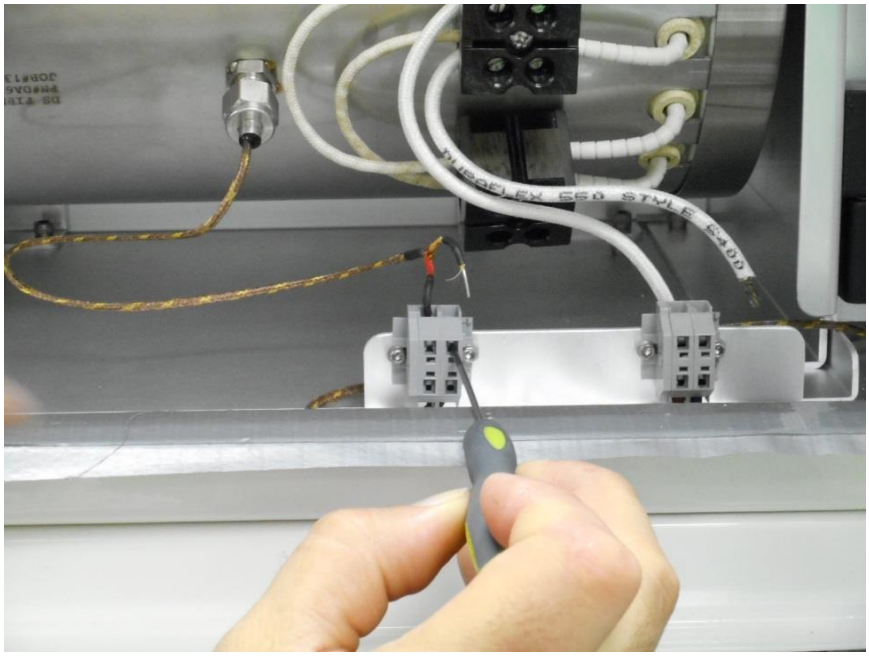
Begin by loosening both screws indicated above



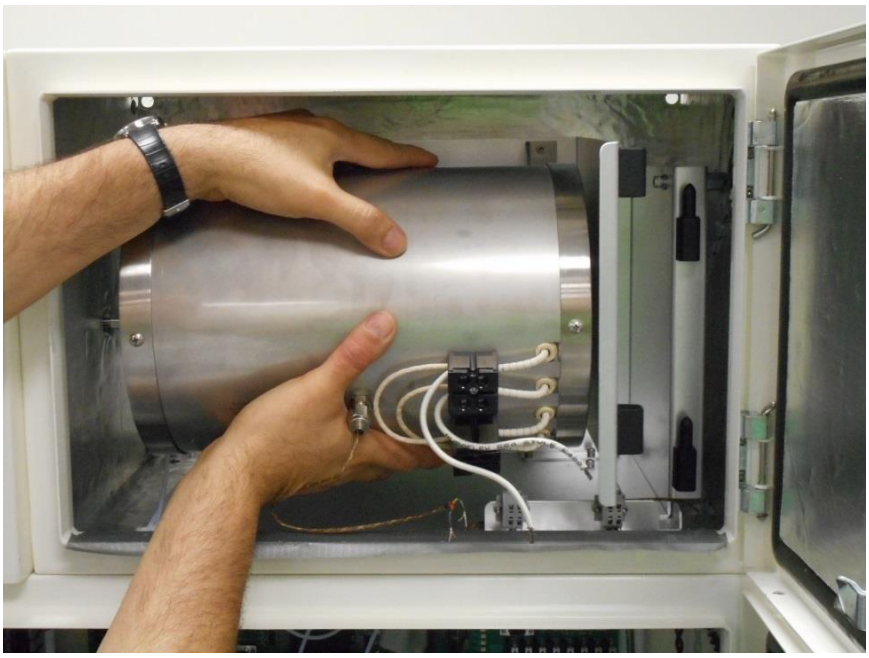
Using a small screwdriver to compress the terminal spring, remove both heater wires



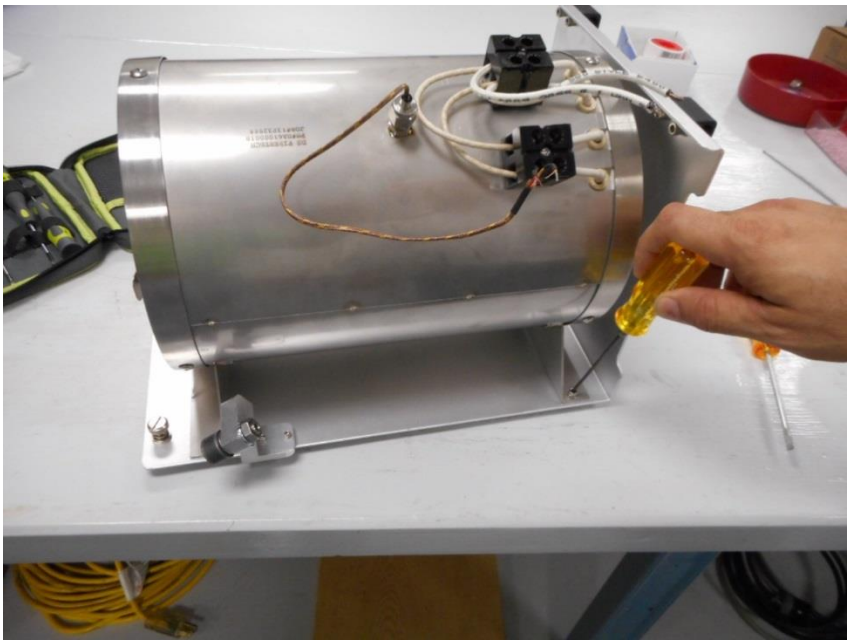
Heater wires removed from terminals



Repeat the above and remove both thermocouple wires from the terminals

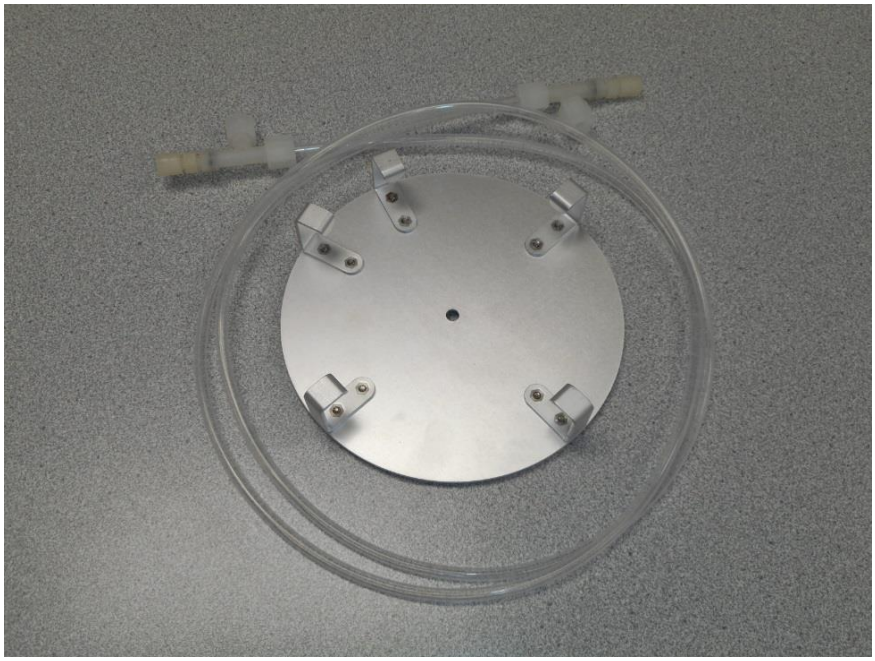


Carefully lift the furnace up off of the pin hinges and remove from the furnace chamber

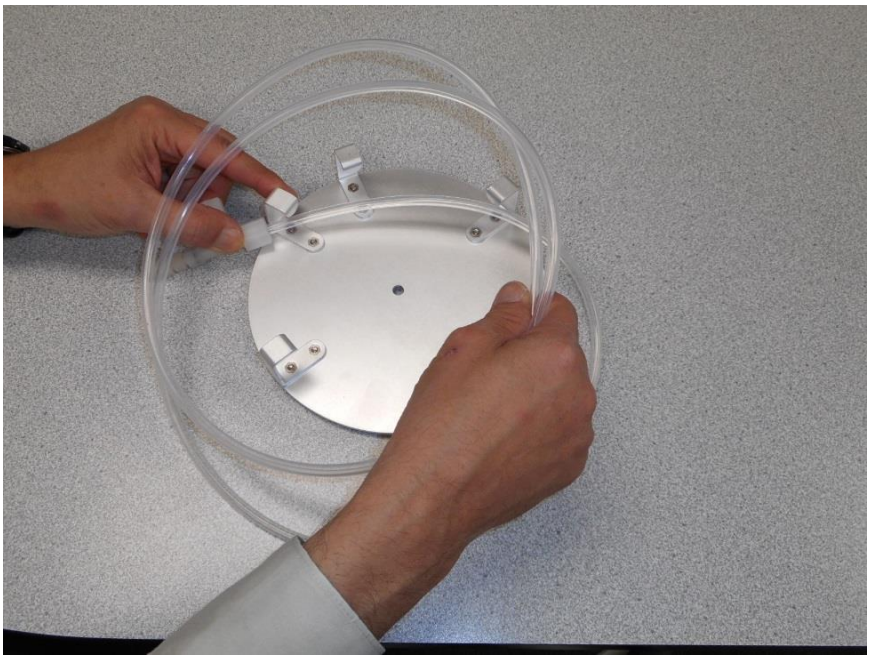


Remove all four furnace mount screws to complete the disassembly process

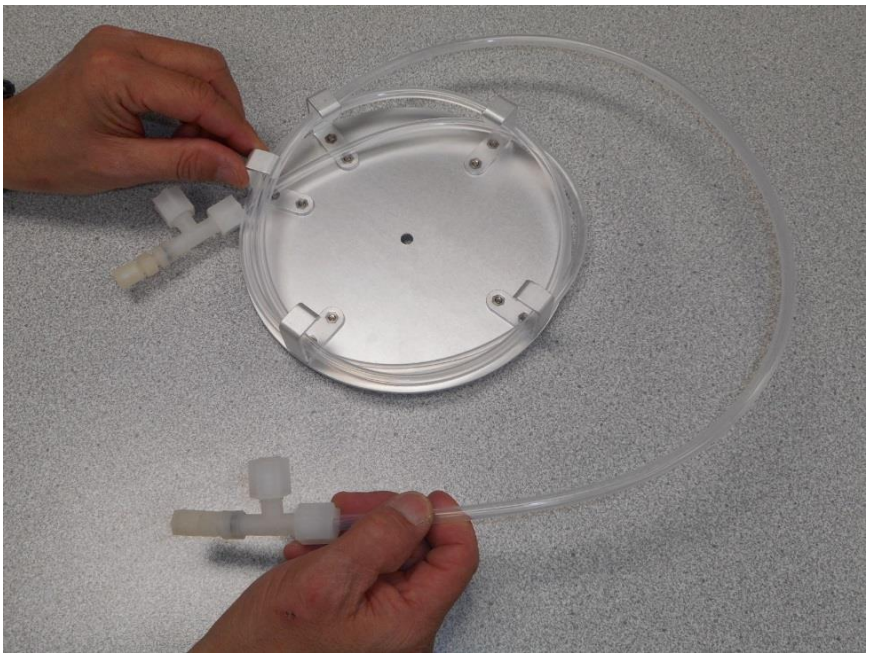
Section 3.2 Membrane Dryer Replacement



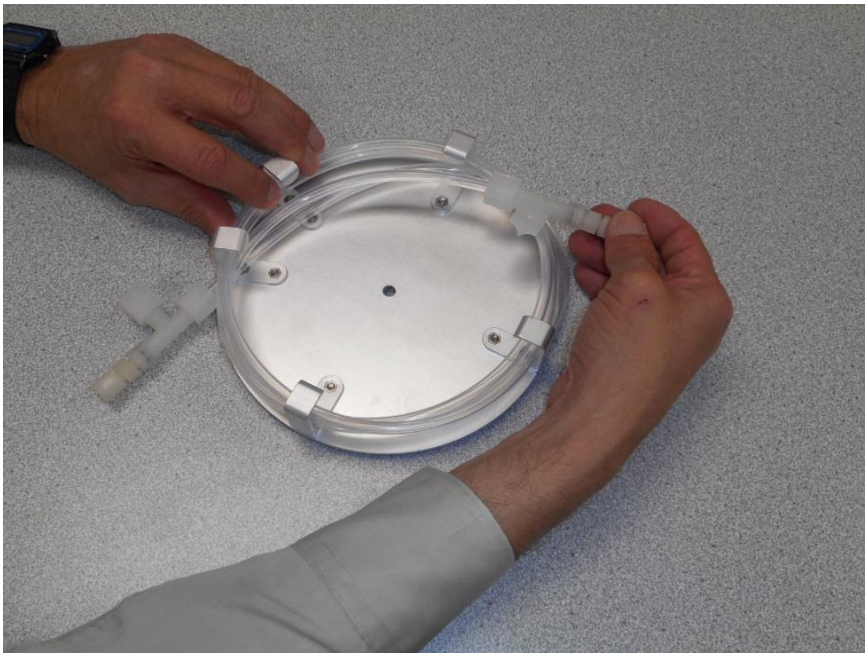
Orient the permeation tube fitting as shown



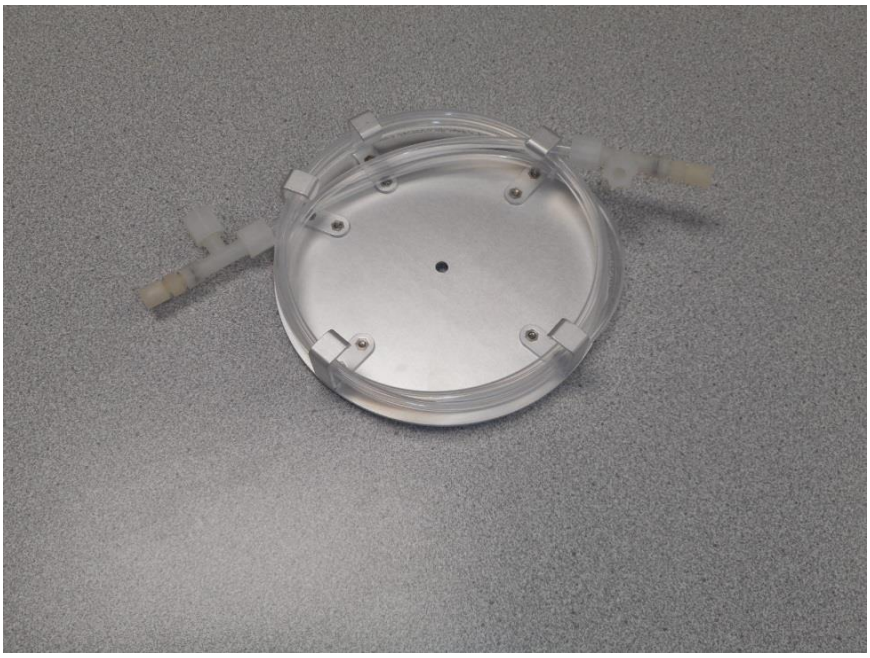
Begin by placing the tubing inside of the mounting bracket



Continue winding, stacking the dryer layer upon layer

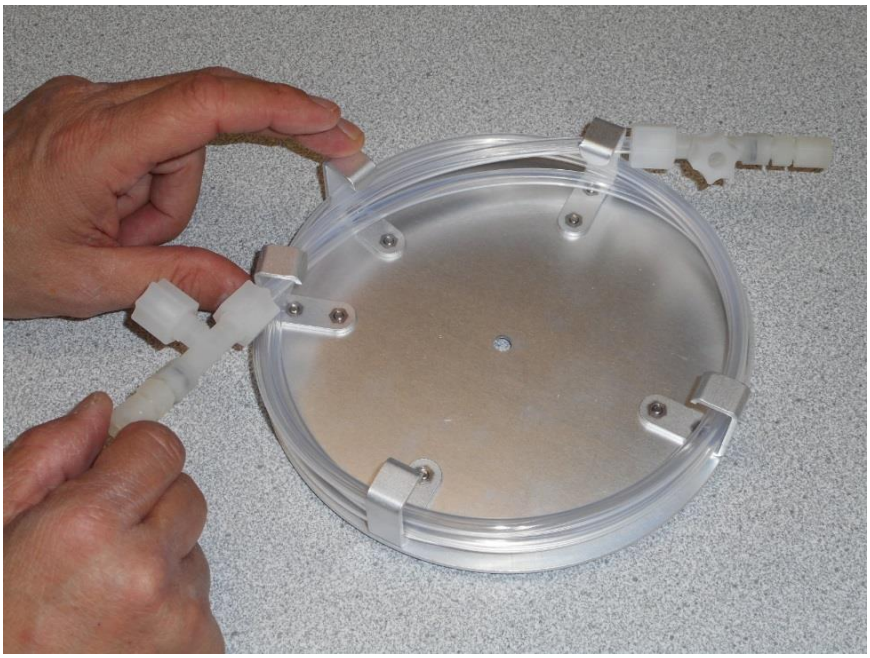


Until dryer has been completely wound

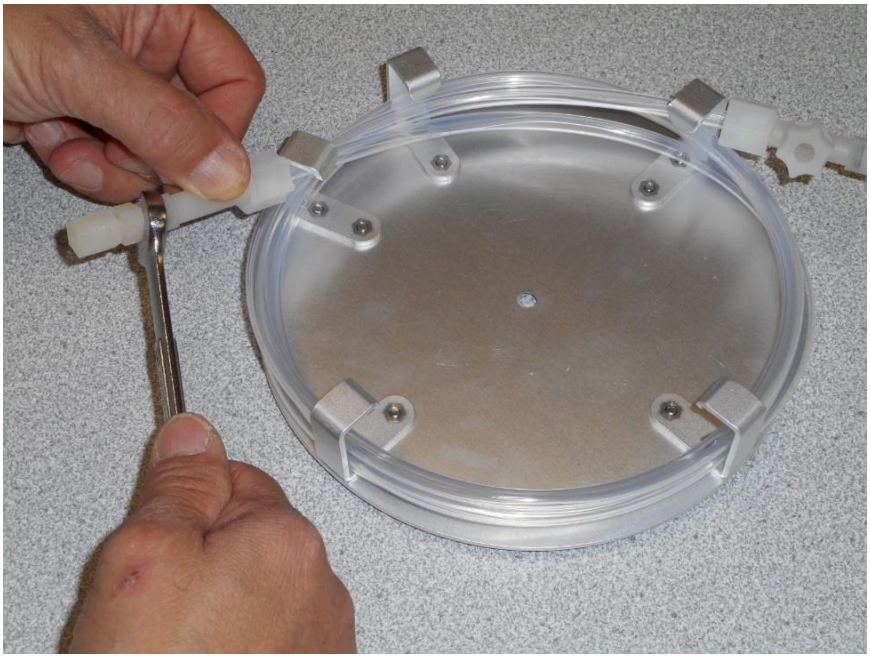


After winding, the Perma Pure Dryer should look like this

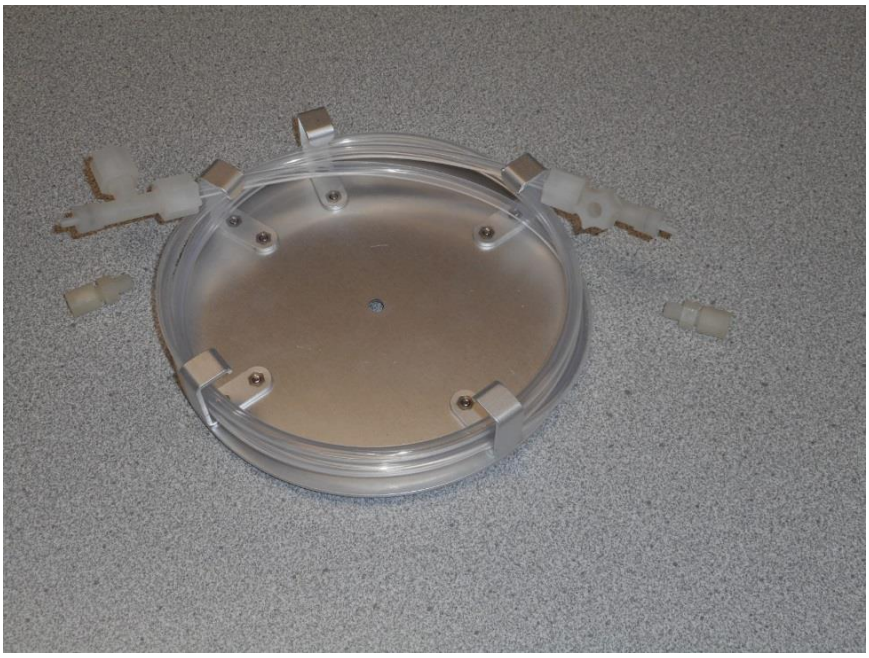
Next, lift tubing to push the first fitting back inside



Then bring to the top against the mounting bracket

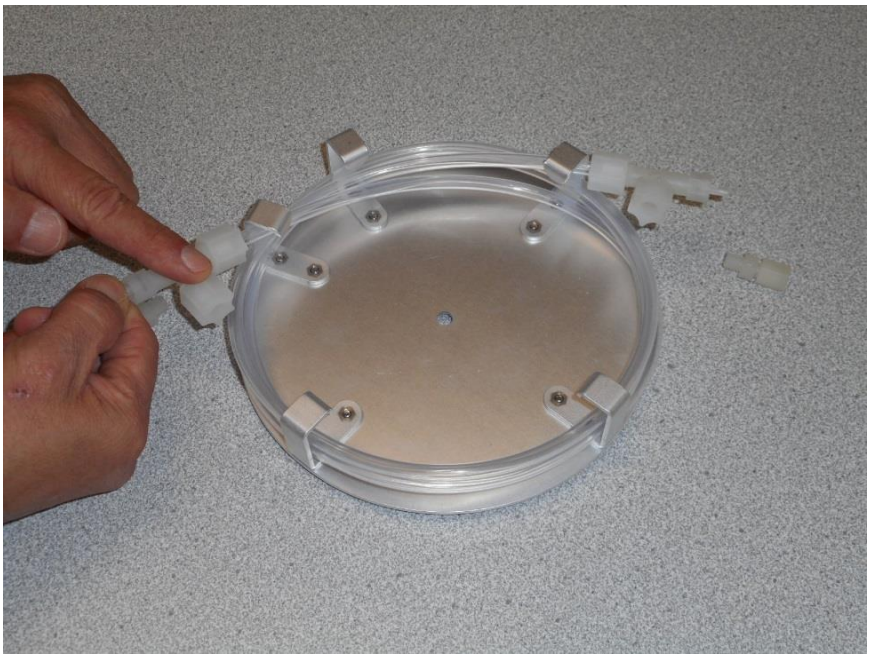


Using a 7/16" wrench, loosen and remove the 1/8" fittings on both ends

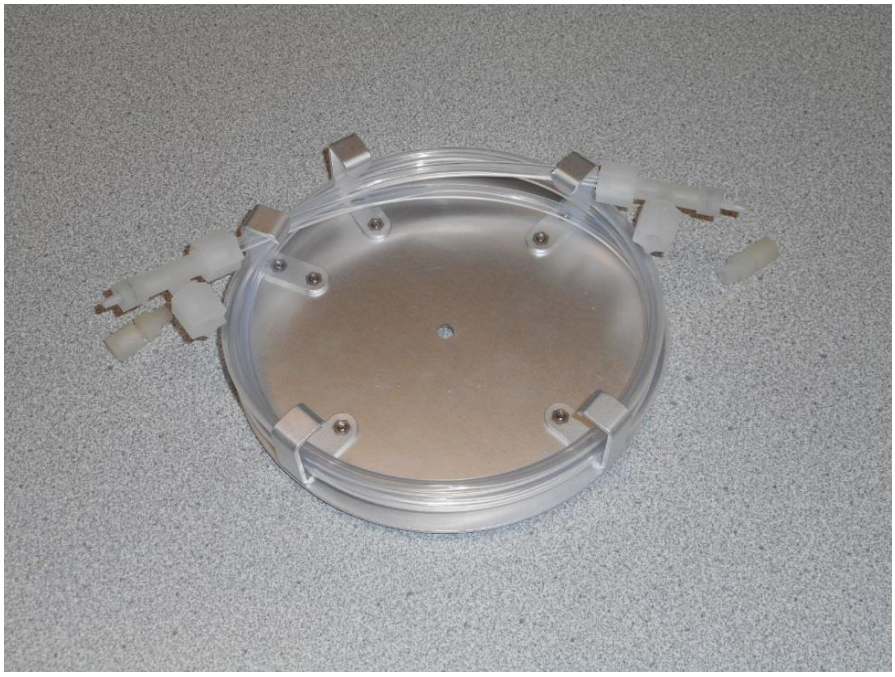


The dryer should look like this after both end fittings are removed

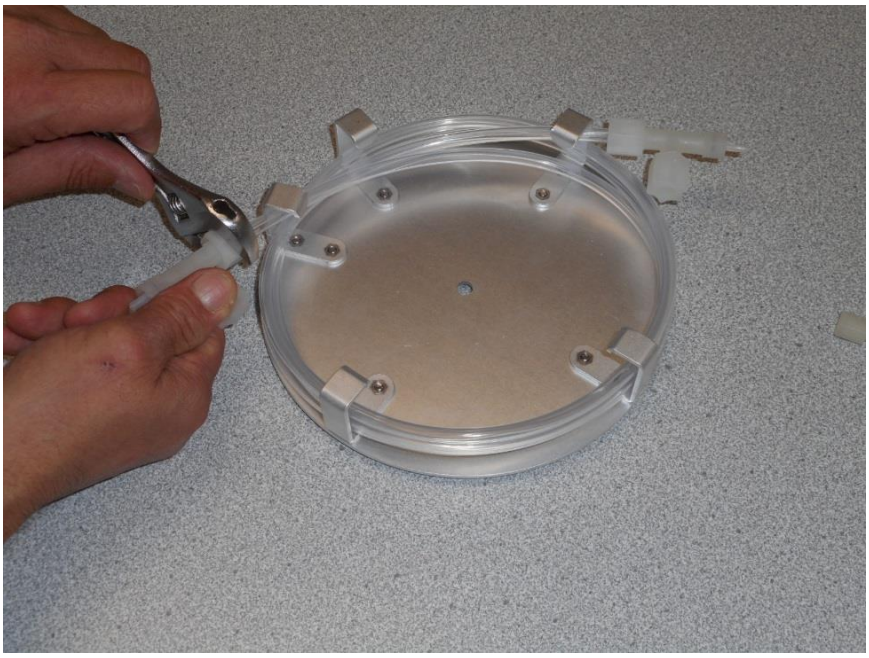
Next, loosen but <u>do not remove</u> the ¼" inch fitting on both ends



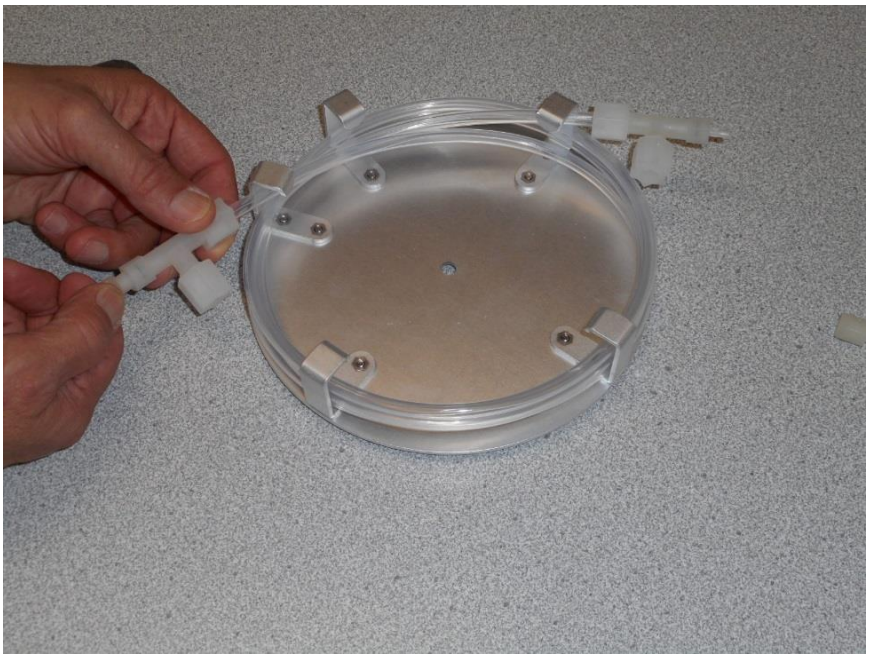
Holding the inner tube, rotate the T-fitting to point toward the inside on both ends



The dryer should then look like this



Re-tighten both ¼"T-fittings



Lastly, re-attach both 1/8" inch end fittings

The Membrane dryer is now ready to be reinstalled on the analyzer.

Section 3.3 Shinko Temperature Controllers

The TraceS-1000 has three separate temperature zones controlled by Shinko Model DCL-33A temperature controllers, which include the Sample Enclosure, Combustion Furnace and Main Enclosure. These DIN rail mounted controllers are approximately located in the center of the Main Enclosure, and are underneath the right-hand side of the detector module. *(Figure 3.1)*

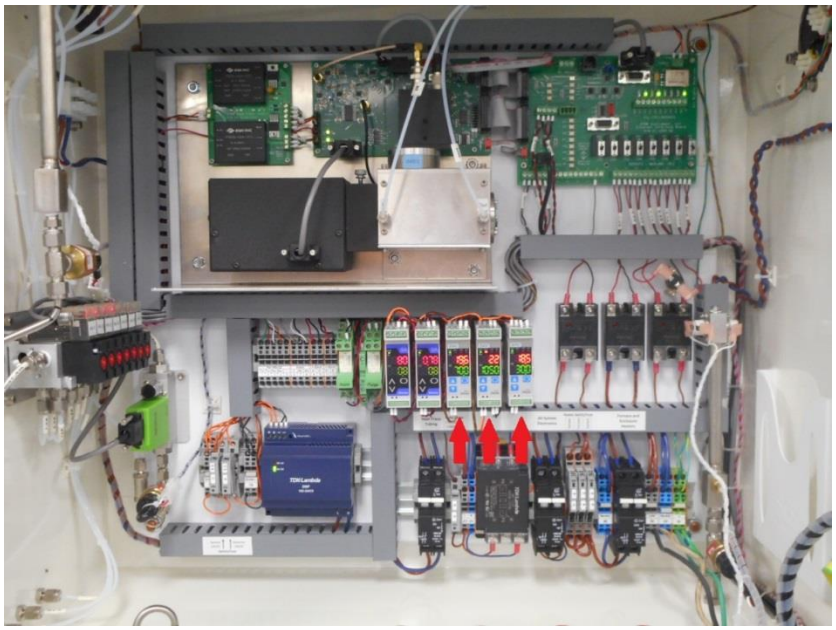


Figure 3.1 – Shinko Temperature Controllers

Factory recommended temperature set-points are as follows:

1. Sample Enclosure: 70°C (or sufficient to prevent any condensation of sample)
2. Combustion Furnace: 1050°C (minimum for complete sample combustion and Sulfur conversion)
3. Main Enclosure: 30°C (may be increased to 40°C if necessary in warmer environments)

The temperature controller settings have been programmed into the instrument installed controllers at the factory and are included in this manual for reference purposes only. The following page contains factory settings for the three Model DCL-33A Temperature Controllers for the TraceS-1000. *(Section 3.3.1)*

For complete instructions and menu navigation for the parameters below, refer to the Shinko DCL-33A Indicating Controller Instruction Manual.

Note: Although autotuning is a routine function which is part of analyzer testing at the factory, it is recommended that subsequent autotuning of these controllers is performed in the field for best results.

Section 3.3.1 Shinko Temperature Controller Programmed Settings

Step	7-Segment Display	Parameter Function	Sample Enclosure Heater	Combustion Furnace Heater	Main Enclosure Heater
Main setting mode					
1	SV	Desired value	70.0	1050	30.0
Sub setting mode					
1	AT	Auto tuning perform/cancel	AT	AT	AT
2	P	OUT propotional band.	Auto calc	Auto calc	Auto calc
3	I	Intergral time	Auto calc	Auto calc	Auto calc
4	d	Derivative time	Auto calc	Auto calc	Auto calc
5	n	Anti-reset windup	Auto calc	Auto calc	Auto calc
6	c	OUT propotional cycle	Auto calc	Auto calc	Auto calc
7	rSET	Manual reset	Skip	Skip	Skip
8	A1	Alarm value	Skip	25	Skip
9	HBU	Heater burnout alarm valve	Skip	Skip	Skip
10	LP_T	Loop break alarm time	0	0	0
11	LP_H	Loop break alarm span	0.00	0	0.00
Auxillary function setting mode 1					
1	Lock	Set value lock	----	----	----
2	Sb	Sensor correction	0.0	0.0	0.0
3	cSEL	Communication protocol	non	non	non
4	cno	Instrument number	0	0	0
5	cSP	Communication speed	96	96	96
6	cPr	Parity	Skip	Skip	Skip
7	cSt	Stop bit	Skip	Skip	Skip
Auxillary function setting mode 2					
1	SEn	Input type	t.C	n C	t.C
2	SrLH	Scaling high limit	80.0	1100	40.0
3	SrLL	scaling low limit	60.0	1000	20.0
4	dP	Decimal point place	Skip	Skip	Skip
5	FILT	PV filter time constant	0.0	0.0	0.0
6	oLH	OUT high limit	100	100	100
7	oLL	OUT low limit	0	0	0
8	HYS	OUT ON/OFF hysteresis	Skip	Skip	Skip
9	AL 1F	Alarm type	----	HL	----
10	A1LA	Alarm action Energized/De-energigized	Skip	non	Skip
11	AHLd	Alarm HOLD function	Skip	nonE	Skip
12	A1HY	Alarm hysteresis	Skip	5.0	Skip
13	A1dY	Alarm action delay timer	Skip	0	Skip
14	conT	Direct/Reverse control	HEAT	HEAT	HEAT
15	AT_b	AT bias	20.0	20	20.0
16	SV_b	SVTC bias	0.0	0	0.0
17	FUnc	Output status when input abnormal	Skip	Skip	Skip
18	EoUT	Controller/Converter	Skip	Skip	Skip

Section 3.4 Shinko Signal Conditioners

The TraceS-1000 has two analog outputs that utilize Shinko, Model SAU-1 DIN rail mounted Signal Conditioners. These modules have been configured to deliver a 4-20mA output, with a 0-1VDC input signal. These controllers are located in the center of the Main Enclosure, to the left of the three temperature controllers. *(Figure 3.2)*

The intended analyzer variable for the controller input is selected from the Output Settings of the SGA analyzer software utilizing the computer touchscreen. The variable can then be ranged within the same menu as desired, which will deliver the 0-1VDC signal from the SP-2000 Signal Processing Detector board DAC to the Shinko Signal Conditioner input. *(Section 3.4.1)*

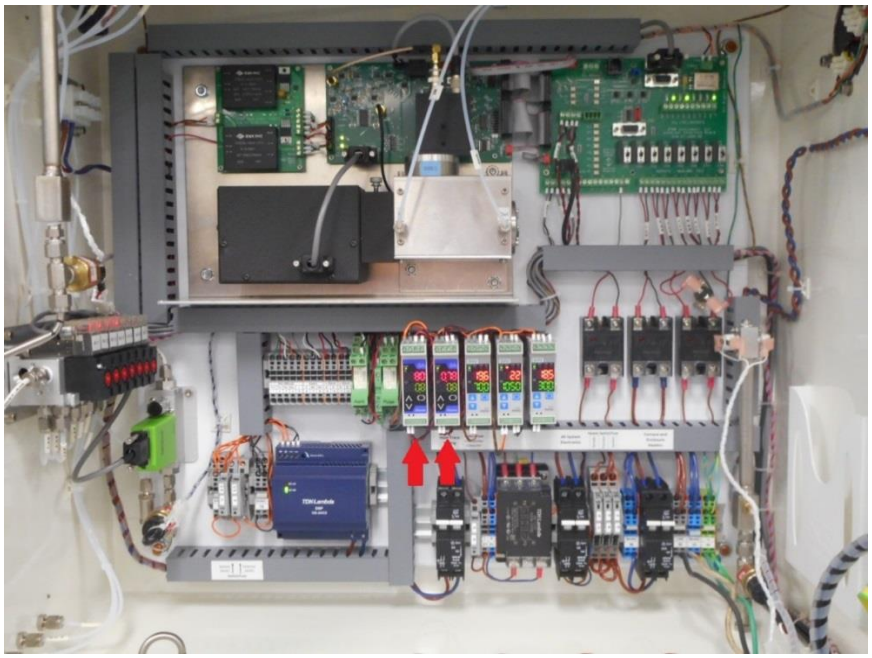


Figure 3.2 – Shinko Signal Conditioners

The two Signal Conditioning Modules have been programmed by the factory for the following:

	Input	**Output**	**Reading**
Channel A:	0-1VDC	4-20mA	0-9999 (ppm when Conc. is the variable, ranged 0-1%)
Channel B:	0-1VDC	4-20mA	0-9999 (ppm when Conc. is the variable, ranged 0-1%)

Section 3.4.1 Shinko Signal Conditioner Programmed Settings

Step	7-Segment Display	Parameter Function	Ch A (4-20 mA)	Ch B (4-20 mA)
		Adjustment mode		
1	oZr 1	Output zero	0.00	0.00
2	oSP 1	Output span	0.00	0.00
3	oZr2	Output 2 zero	Skip	Skip
4	oSP2	Output 2 span	Skip	Skip
5	I ZEr	Potentiometer zero input	Skip	Skip
6	I SPA	Potentiometer zero output	Skip	Skip
		Setup mode		
1	Loct	Set value lock	----	----
2	SEnS	Input	dcV	dcV
3	dcV	DC voltage input range	0 1V	0 1V
4	dP	Decimal point place	0	0.00
5	SrLL	Output 0% value	0	0.00
6	SrLH	Output 100% value	9999	50.00
7	FILr	Filter time constant	0.0	0.0
8	So	Sensor correction	0	0.00
9	oUrP	Output	420A	420A
10	oUrS	Output Normal/Reverse	norL	norL
11	bUrn	Burnout	Skip	Skip
12	dISP	Display	dUAL	dUAL
13	rIME	Indication time	00.00	00.00

Section 3.5 Updating Software

The TraceS-1000 computer software and detector firmware are easily upgraded as revisions become available from the factory. The GUI and scanner software reside on the solid-state hard drive of the touchscreen computer. The detector firmware can be upgraded utilizing what is known as a bootloader program, which is accessible from the program icon located on the desktop. Future updates may include changes to any, or all embedded programs. Instructions for how to load and update the TraceS-1000 software to include the latest released revisions are included below.

Section 3.5.1 Installing the GUI and Scanner software using the installer program

Initial setup:

1. Stop the analysis/cycle (if running)

2. Before closing the atom.exe software note the information underlined in red. The settings/values shown in figure 3.1 are for example only and will be different for each user.

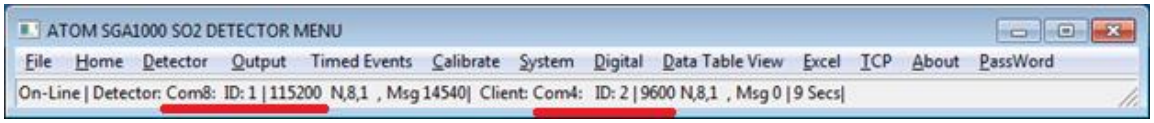


Figure 3.1

3. Close atom.exe 

4. In the GUI go to **Settings>Detector Settings** and note the PMT HV value.

5. Close GUI

6. Insert the USB thumb drive provided by ATOM in the USB2.0 port of the SGA computer.

Installer:

1. Delete the folder **C:\Apps** from the SGA computer.
2. Delete the shortcut for the GUI from the Desktop and the Taskbar
3. Open the folder "**Installers**" from the thumb drive.
4. Double click "**ATOM_SGA_Redist.exe** "
5. Click **Next** (Figure 3.2)

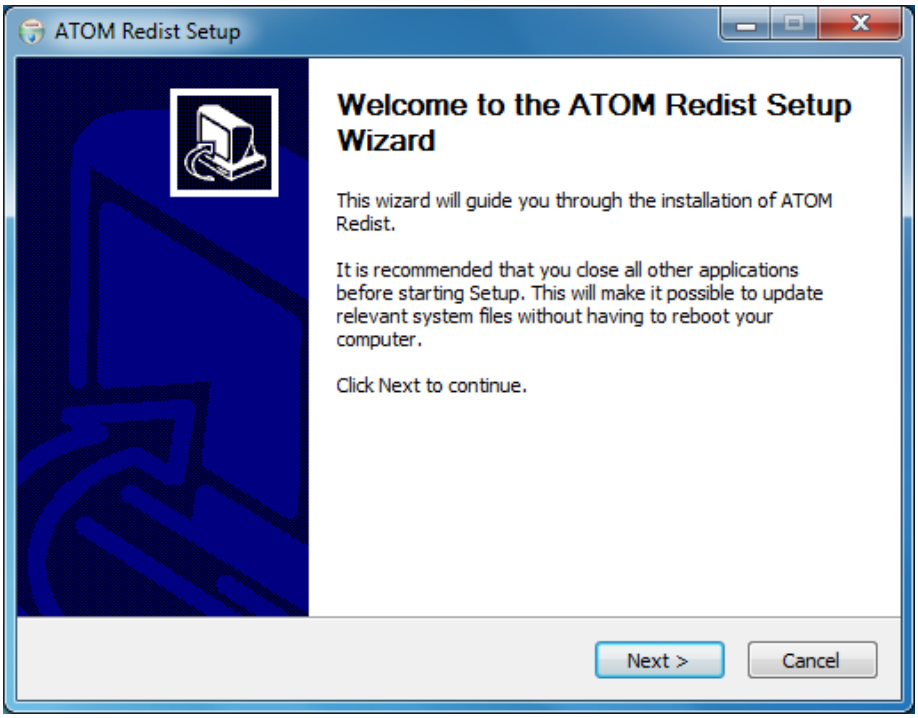


Figure 3.2

6. Click **Install** (Figure 3.3)**.** The installation will take approximately 5 minutes.

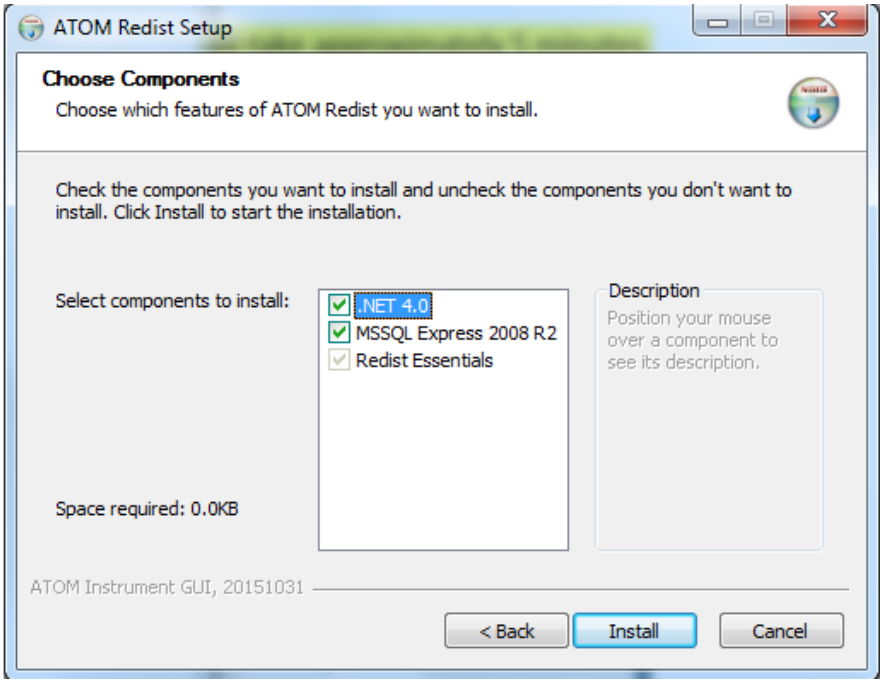


Figure 3.3

7. Click **Close** (Figure 3.4)

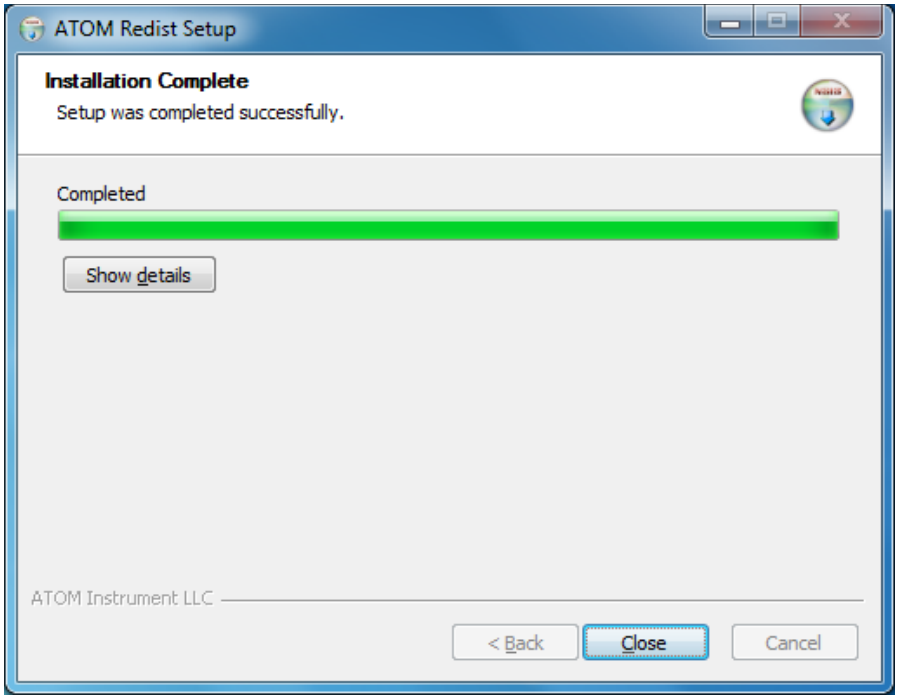


Figure 3.4

8. Double click **ATOMSGA_GUI.exe** from the **Installers** folder on the thumb drive.

9. Click **Next** (Figure 3.5)

Figure 3.5

10. Click **Install** (Figure 3.6)

Figure 3.6

11. Click **Close** (Figure 3.7)

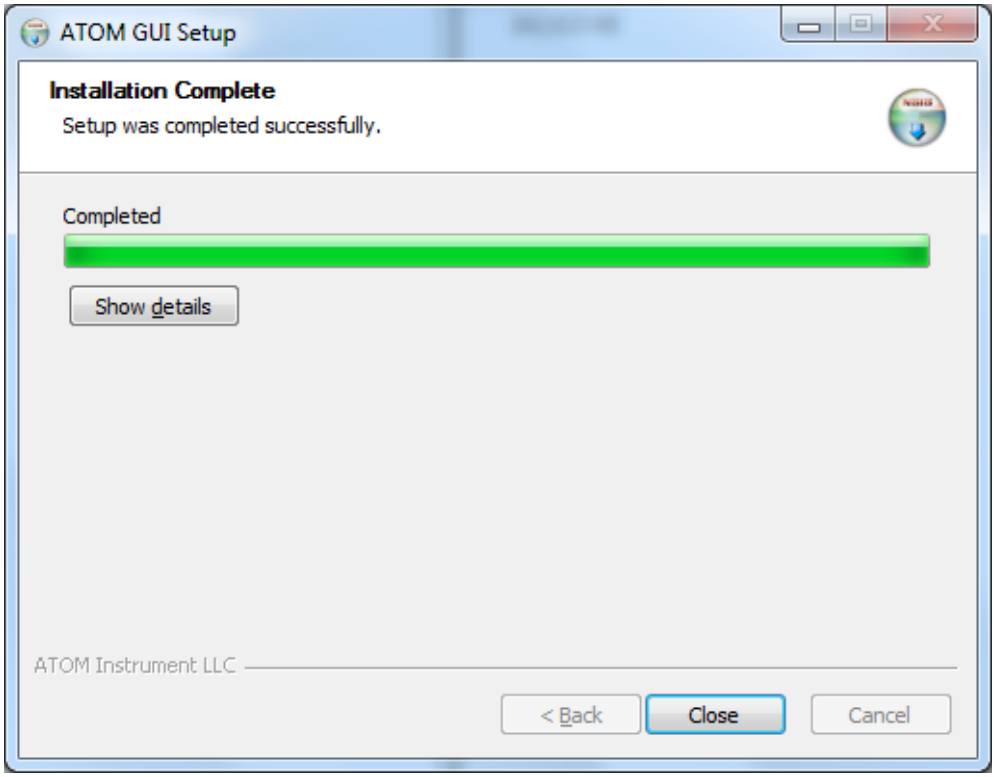


Figure 3.7

12. If needed reload the .HEX file to the SP-2000 board as described in following section

13. Restart the computer.

14. Go to **Start>All Programs>ATOM>ATOM GUI** and place a shortcut for the GUI on the Desktop and Taskbar.

15. Check the **PMT HV** value and change it back to the original value.

Section 3.5.2 Bootloader Procedure for Detector Board

This procedure replaces the embedded HEX file firmware program in the SP-2000 Signal Processing detector board microprocessor. This file must be installed separately as it cannot load automatically without accessing and utilizing the Microchip bootloader program per the following instructions below. Before beginning this procedure, the user will either need the required HEX file to already be on the computer.

Initial setup:

1. Stop the analysis/cycle (if running)

2. Before closing the atom.exe software note the information underlined in red (Figure 3.8). The values shown in figure 3.8 are for example only and will differ for each user.

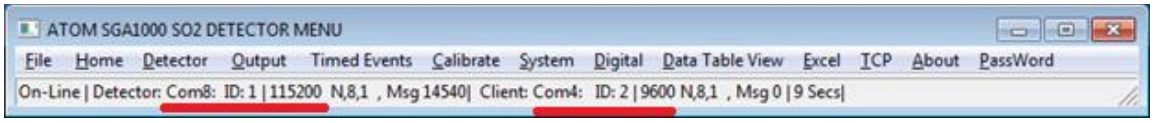


Figure 3.8

3. Close atom.exe 

4. Close GUI

Moving files:

1. In windows explorer open the folder **C:\ATOM!**

2. Delete the following files by moving them to the recycle bin
   - atom.exe
   - MAIN18F8722.HEX

3. Copy the followings files to the folder **C:\ATOM!**
   - atom.exe
   - ATOM_CFG03.txt
   - P2000.SGA.X.production.HEX

Transferring the HEX file from C:\ATOM! to the SP-2000 board:

1. Open the bootloader (Figure 3.9) software AN1310 from the Desktop of the SGA computer. From the main menu go into **Program>Settings** (Figure 3.10)

Figure 3.9: Bootloader Icon

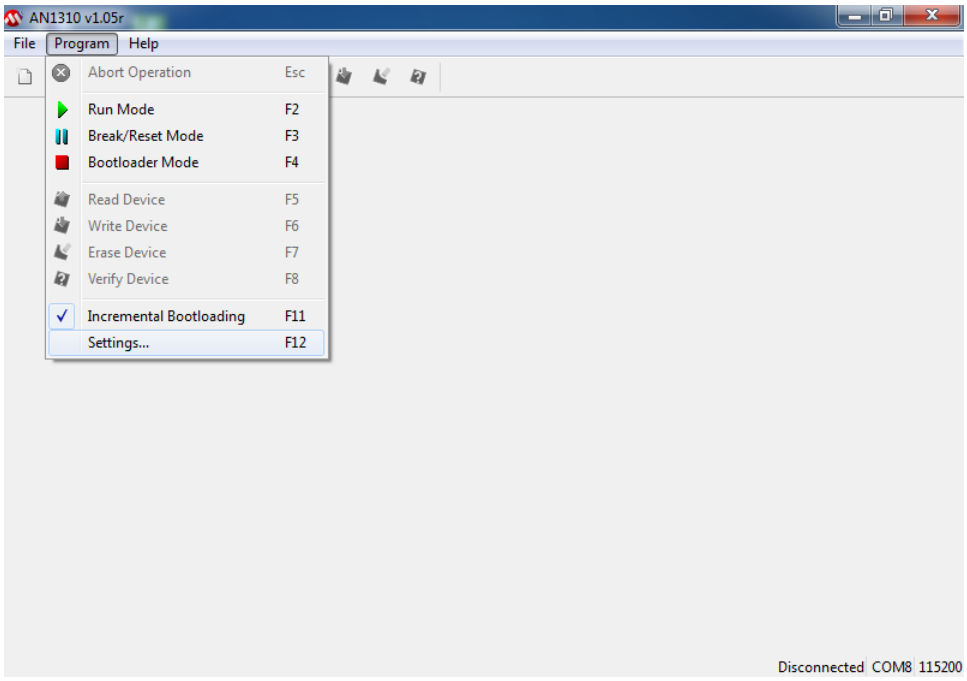


Figure 3.10

2. On the Settings screen select a baud rate of 115200. The COM Port number will be identical to the Detector COM (refer to Figure 3.11), in this example 8. The allocated COM port may also be found in **Control Panel>Device Manager** (Figure 3.12). Make sure the **FLASH Program Memory** is checked and then click **OK**

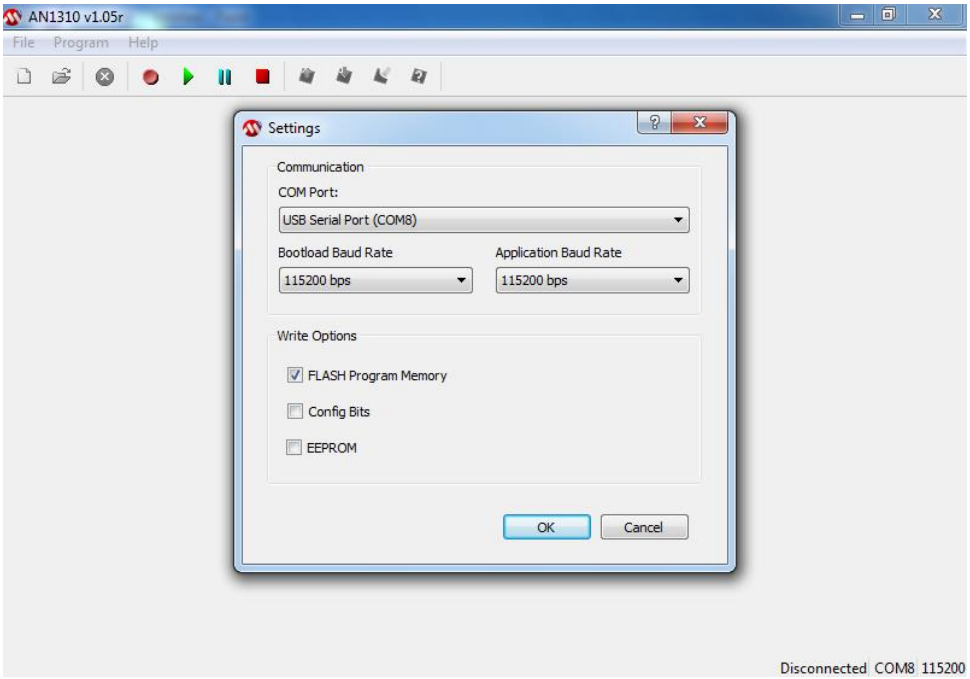


Figure 3.11

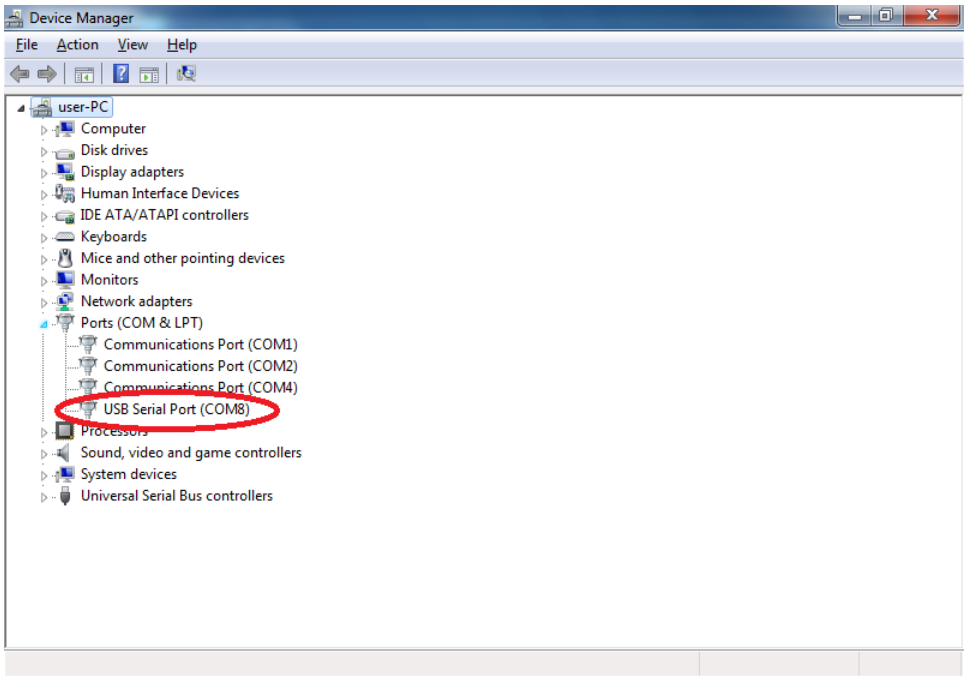


Figure 3.12

3. Press the green **Run Mode** button on the bootloader screen (Figure 3.13). At the bottom right hand side of the screen the "**Connected**" status will appear as well as the **COM** Port number.

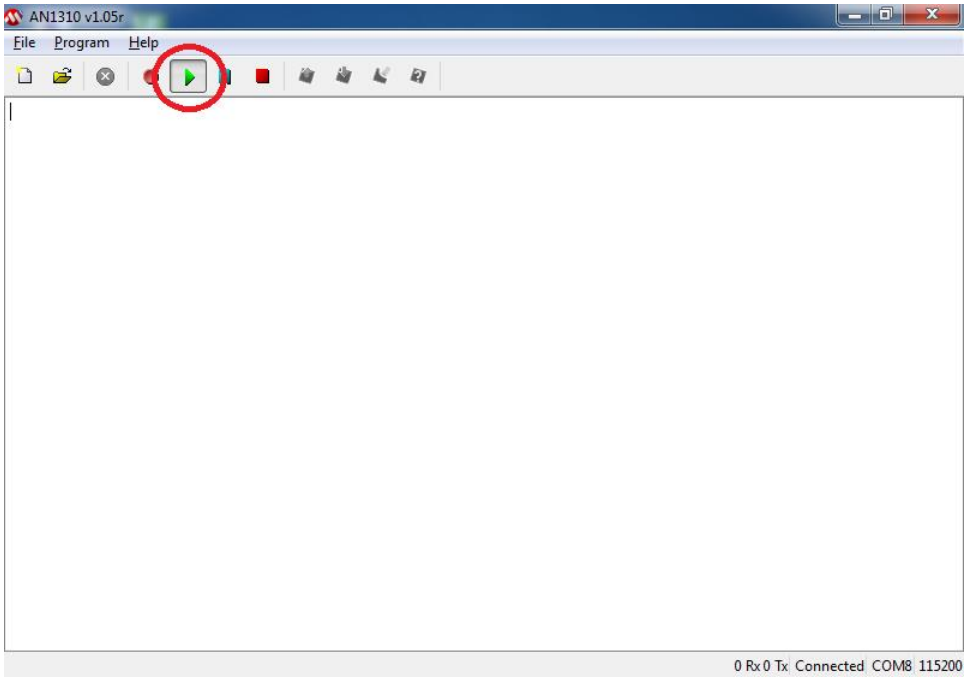


Figure 3.13

4. Press the blue **Break/Reset Mode** button (Figure 3.14). The bottom status bar will request resetting the SP-2000 board.

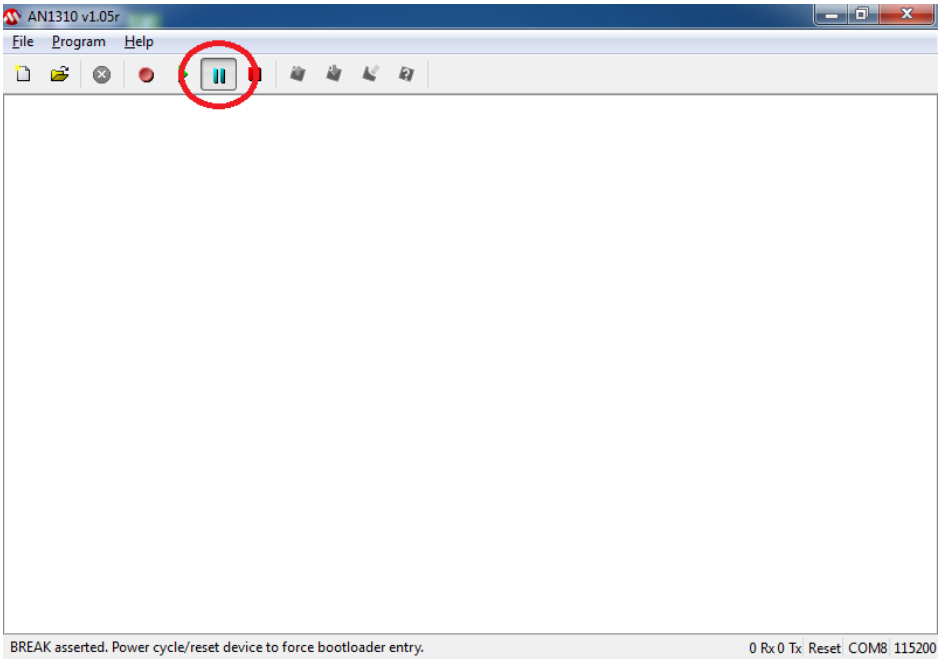


Figure 3.14

5. On the SP-2000 board inside the analyzer (Figure 3.15), press and hold for 2 seconds the Reset button. The SP-2000 board may be found behind the Detector assembly.

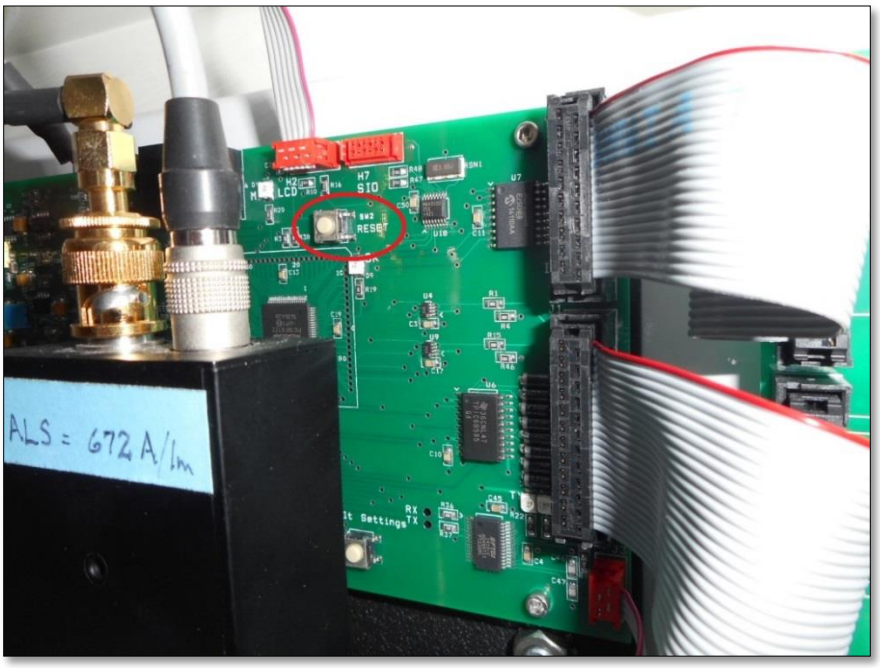


Figure 3.15

6. Press the red **Break Mode** button (Figure 3.16).

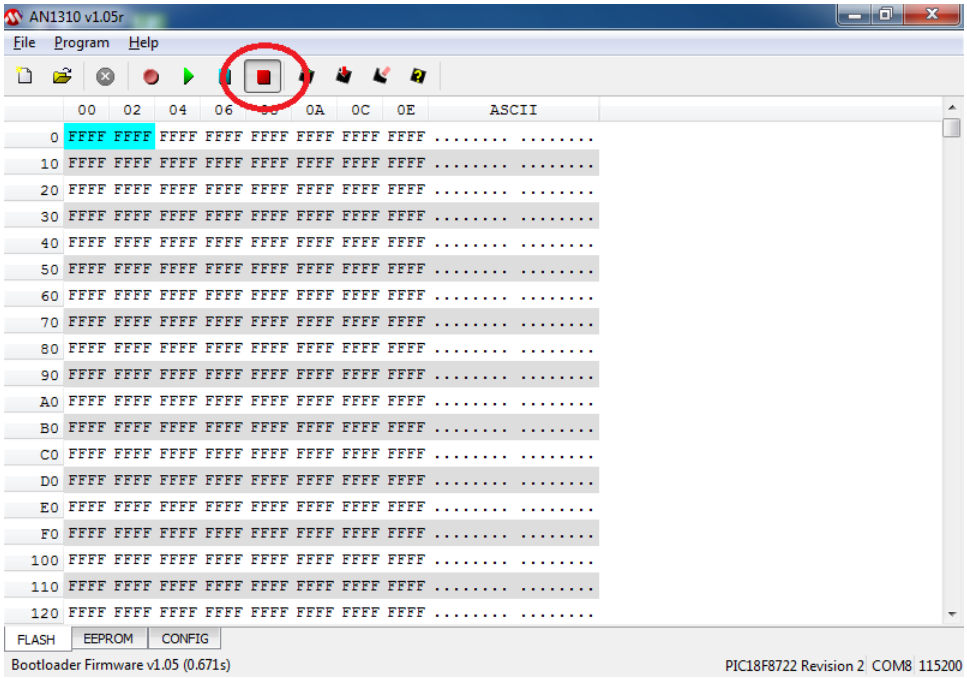


Figure 3.16

7. From the main menu select **File>Open** (Figure 3.17)

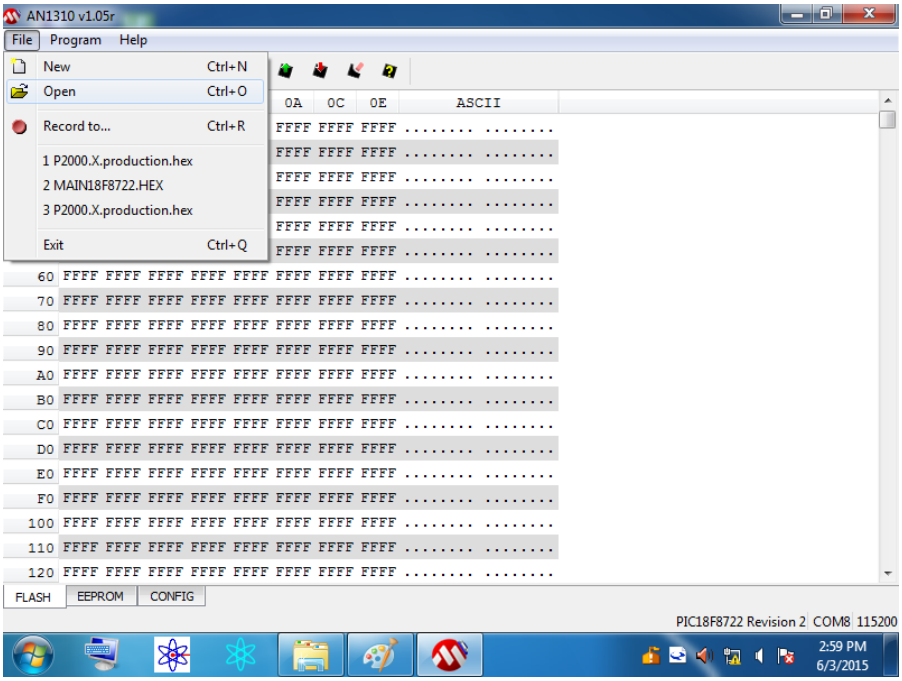


Figure 3.17

8. Select the **P2000.SGA.X.production.hex** file located in **C:\ATOM!** and click **Open** (Figure 3.18). This new software file that was previously copied in folder (Refer to Step 3 of the Moving files section).

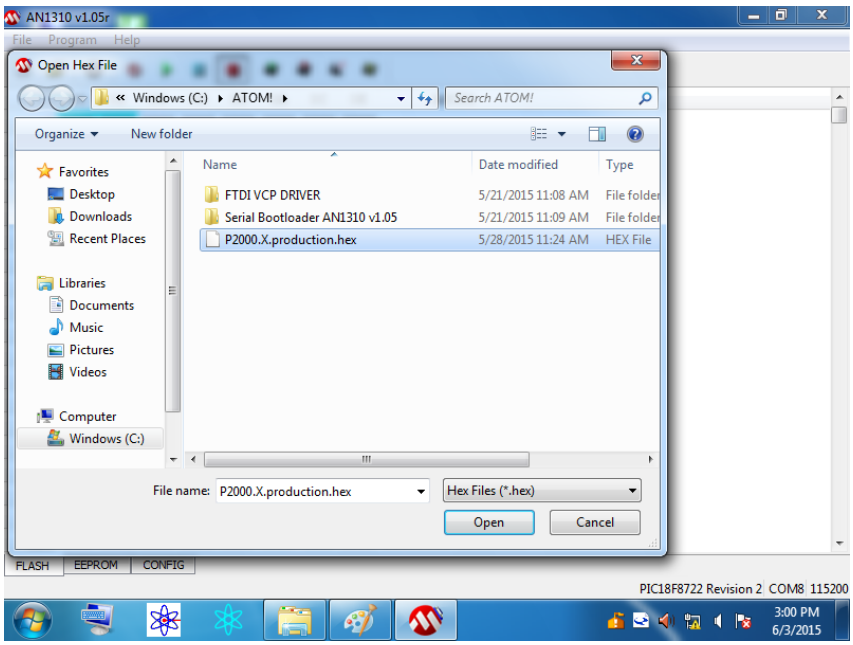


Figure 3.18

9. The bootloader screen will show new hexadecimal values. Click the **Write Device** button (Figure 3.19).

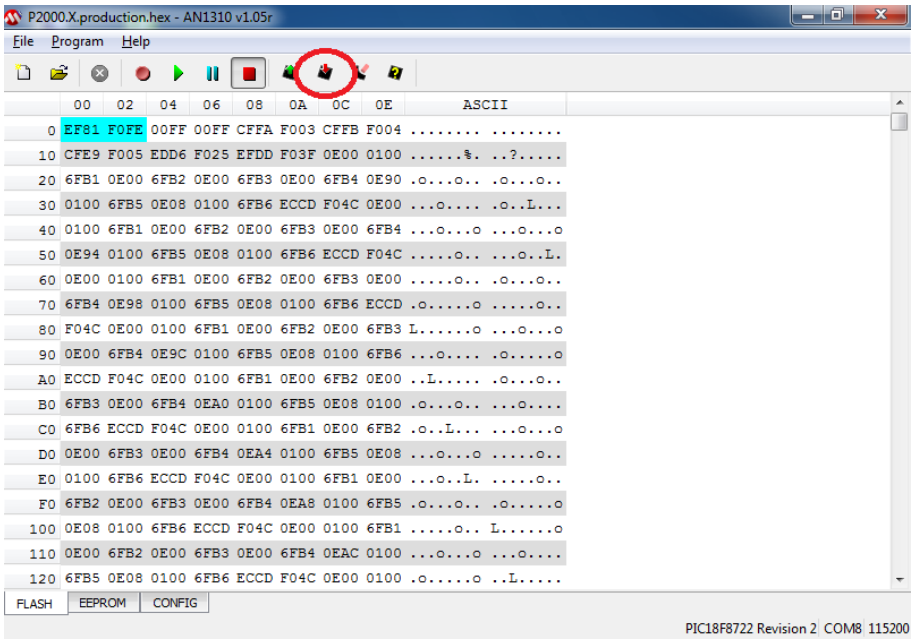


Figure 3.19

10. The bootloader software will replace the old firmware in the SP-2000 board with the new one. The bottom status bar will indicate "Write complete" when this step is done (Figure 3.20).

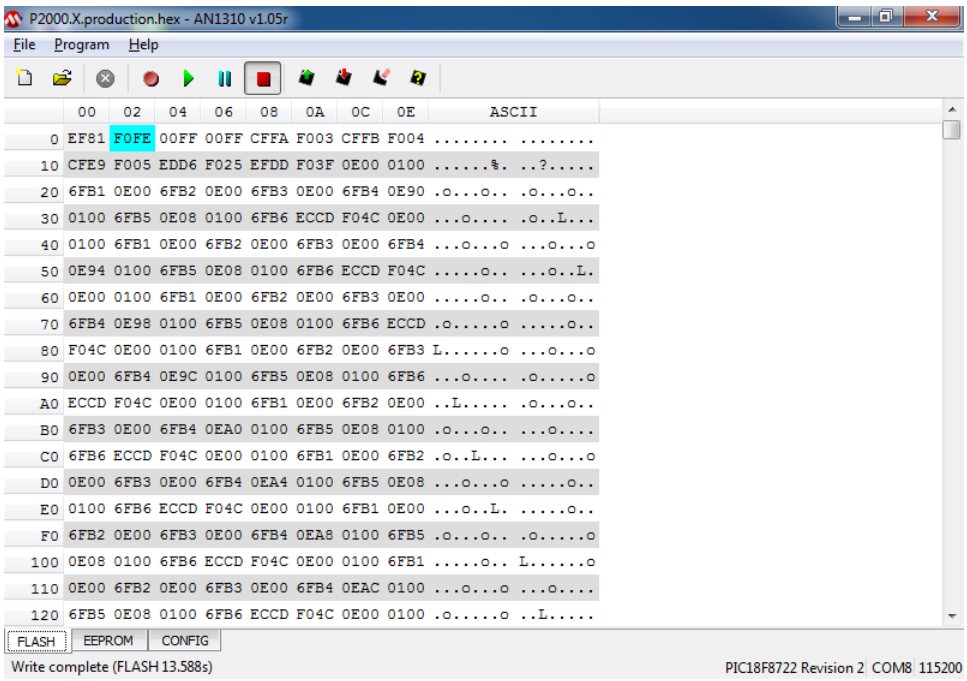


Figure 3.20

11. Close the bootloader software (Figure 3.21).

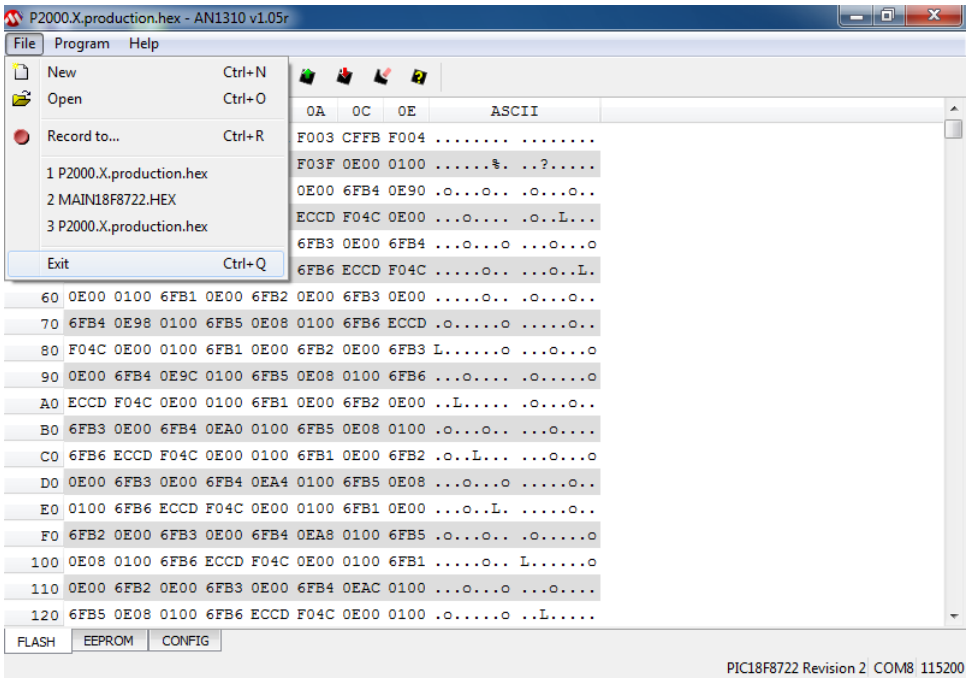


Figure 3.21

12. Press and hold for 2 seconds the Reset button on the SP-2000 board to finish this sequence.

Restoring communication settings using the configuration file:

Upon completion of the previous steps, the communications settings previously entered by the end-user will be returned to the default parameters. In order to re-establish communication with the analyzer, those parameters must be changed back to the values prior to the update.

Open the file **ATOM_CFG03.txt** located in **C:\ATOM!**. All the settings required in this section can be obtained from step 2 of the initial setup (Figure 3.1).

The first line with five single digit integers separated by commas is used to set up the MODBUS communications settings. **Do not add spaces after commas**.

The standard configuration is: **8,001,4,0,002,0**. Below is the description of each integer:

8 = Detector Com Port Number (Serial port on the SGA computer that communicates with the SP-2000 board)

001 = Detector ID Number (001 by default, must not be changed)

4 = Client Com Port Number (COM port of SGA computer assigned to RS485/422)

0 = Client Baud rate (where: 0=9,600; 1=19,200; 2=57,600; 3=115,200)

002 = Client ID (valid range for station ID assignment: 002-126)

0 = Analyzer information logging for troubleshooting (0=off, 1=on)

Save the .txt file after any changes. Open atom.exe and GUI. Upon successful update the message activity counter indicated by Msg# will keep increasing (Figure 3.22).

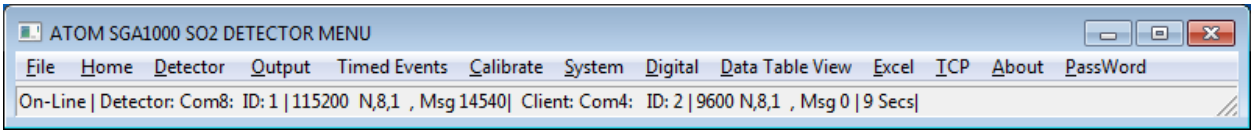


Figure 3.22

Section 4 – TraceS-1000 MODBUS Digital Communications

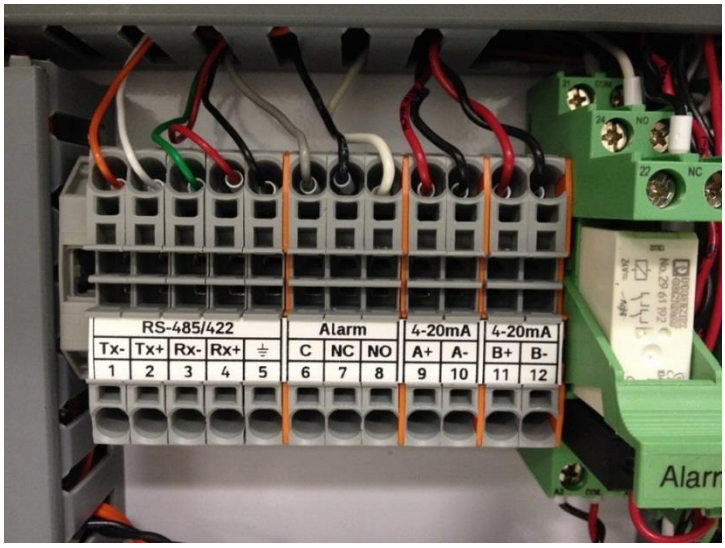
Section 4.1 Customer Connections

The TraceS-1000 System supports both RS485 half-duplex and RS422 full-duplex communication for client access to the ATOM Database. User communications cable should be connected as specified below, depending upon COM type.

The COM 4 Port on the touchscreen computer which includes a DB-9 connector and associated label with communication signals is assigned to the following Pins:

	RS-485	RS-422
1 TX-	X	X
2 TX+	X	X
3 RX-		X
4 RX+		X
5 GND	X	X

The DB-9 pins are connected to a terminal strip within the TraceS-1000 Main Electronics Enclosure. Locate the User Connection Terminal Strip within the SGA cabinet

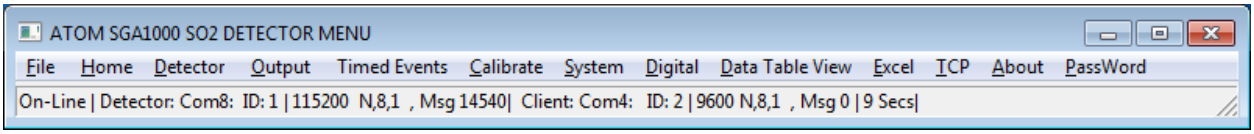


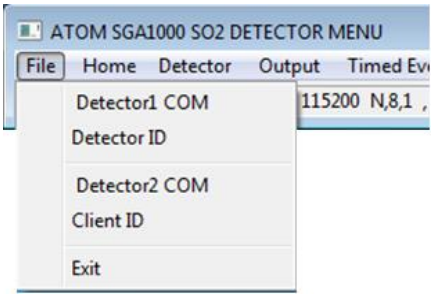
For MODBUS RS-485: Connect to terminals 1,2,5

For MODBUS RS-422: Connect to terminals 1,2,3,4,5

Section 4.2 Communication Settings

Once customer connections have been wired, click on the ATOM Icon to open the ATOM program, which will display the main menu.





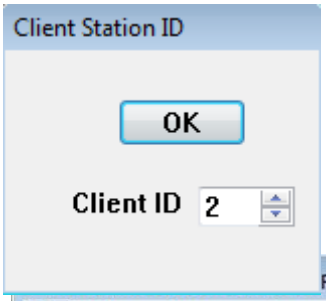
Click File to reveal a drop down menu.

The Scanner Program is used to configure the COM Ports.
Other Menu selections allow assignment of Client Station ID and Baud Rate.

Select Client COM

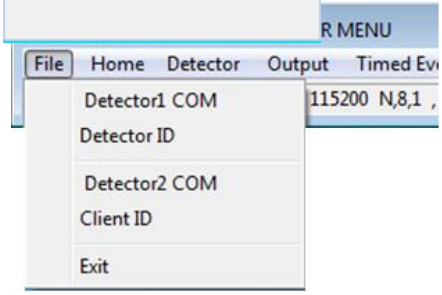
The Client COM selection allows the user to specify the Client COM port and Baud Rate.

Highlight the desired COM port (The label placed on the back of the SGA computer shows COM4 port number for RS-485/422) for the Client connection, and then set the desired baud rate to match Client requirements. Press OK.



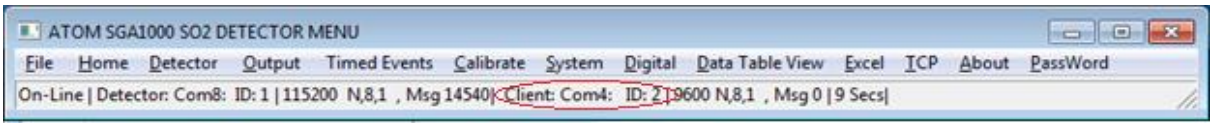
Click on File\ Client ID

Select the station ID for the Client system. This will be the station ID for the MODBUS algorithm used by the ATOM TraceS-1000 system. The valid range for station ID assignment is 002-126. By default, Client ID should be set to 2.



Close and reopen ATOM.exe for the settings to take effect

The ComPort number, baud rate and client ID selected in above steps will be displayed in the main screen of ATOM.exe. Upon successful communication link with the client system the message activity is indicated by Msg#.



Section 4.3 Modifying communication settings using the configuration file

The communication settings described above can also be changed by modifying the configuration file. To do so, open the file ATOM_CFG02.txt located in C:\ATOM!

The first line with five digit integers separated by commas is defined as follow: 8,001,4,0,002

Where:

8 = Detector Com (This serial port on the SGA computer communicates with the Detector board)

001 = Detector ID

4 = Client Com (This is the COM port of SGA computer designated for RS485/422)

0 = Client Baud rate (where: 0=9.6kb, 1=19.2kb, 2=57.6kb, 3=115.2kb)

002 = Client ID (valid range for station ID assignment is 002-126)

After any changes, save the .txt file and restart ATOM.exe for changes to take effect.

Section 4.4 MODBUS Function Code Description

The ATOM TraceS-1000 is a "MODBUS Slave" while the client is the "MOSBUS Master". All commands supported are 8-byte length as described below:

|Address ID| Function code |Start Ho|Start Lo|Data #pts Ho|Data #pts Lo|CRC0|CRC1|

Where:

- Address ID is the address that the station ID ATOM software must find to start a message.
- Function code is a value 1 to 6 declaring what function is to be performed (see below).
- Start HO is the starting register higher order 8-bits. Start LO is the starting register lower order 8-bits.These two bytes are concatenated to create a 16-bit number used in the data base.
- Data #pts Ho and Data #pts Lo are two bytes concatenated to specify the number of registers designated in the MODBUS message.
- CRC0 and CRC1 are two bytes concatenated to specify the CRC of the MODBUS message. Security is maintained by computing the CRC of the message first six bytes and comparing to the last two bytes for a match. A message is not processed if the two CRC's do not match.

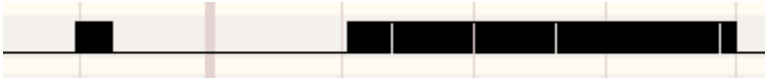
- Function code 1: Read Relay coils (R1-R32 range).
- Function code 2: Read Input Status Registers (R10001-R10032 range).
- Function code 3: Read discrete 16-bit holding Registers (R40001-R40040 range).
- Function code 3: Read discrete 32-bit holding Registers (R40041-R40120 range) where: R40041-42 is the first par, R40119-120 is the last pair.
- Function code 4: Read output 32-bit register pairs (R3001-R30082 range) where: R30001-02 is first pair, R30081-R30082 is last pair.
- Function code 4: Read output 16-bit registers (R30083-R30120 range) where: range is 16-bit registers.
- Function code 5: set relay coil register (R1-R40).
- Function code 6: preset single holding register (R40001-R40120).

The double registers specified in function code 3 and 4 must be recognized as 32-bit data to interpret it properly.

Section 4.5 Reading Algorithm

The MODBUS data is typically a near continuous stream of data packets from the Client. The ATOM software is self-aligning regardless of where it starts listening to packets. This is accomplished by starting with an index of zero. The byte read must equal the Station ID if the index is zero. If not, the alignment procedure begins again without incrementing the index. Alignment is achieved within 8 characters of a packet for the ATOM TraceS-1000. When a character read does equal the ID, the index is advanced from 0 to 1. The next character read must equal an allowable function code (1-6). If there is no match the index is reset to 0. Under this scenario, the reception of packets will self-synchronize. If we have a match on the first and second byte, read the next 6 bytes. At this point we have 8 bytes in a receive register. Perform a CRC on the first six characters and compare with the 7^{th} and 8^{th} characters. There must be a CRC match to process the received packet. If there is no match, the index is again reset to 0 and the process of data

capture and qualification repeats. Upon detection of a complete and valid packet the received 8-byte packet is transferred to private processing area. The "Save Packet" function is called which executes a function (1-6) as defined by the function code byte in the 2nd byte of the saved packet. The ATOM software creates a reply message for the Client and transmits it back to the client. A message stream resembles the image below showing the command on the left and the response on the right.



Response time is approximately 10ms after the packet is decoded before a reply message is sent.

Example of reading a single unsigned 32-bit register

In the example below, registers pair R30169 and R30170 are the ppm value. Use function code 4 with an offset of 68 in the MODBUS message to read it.

Example MODBUS query: **02 04 00 44 00 02 31 ED**

Where:
02 = ID
04 = Function Code
00 44 = address offset = 68
00 02 = number of registers requested
31 ED = CRC

Example of MODBUS response, returns 4 bytes from offset 68 : **02 04 04 00 07 B1 84 0D 76**

Where:
02 = ID
04 = Function Code
04 = Byte Count
00 07 B1 84 = 504,196 ppm
0D 76 = CRC

Section 4.6 ATOM Instrument SGA1000 MODBUS Map

The MODBUS Data Model presents six database areas that SGA1000 data may be read from or written to. The areas are defined as follows:

ATOM MODBUS Database Model			
Database Area	Name	Register Designation	Default Data Type
1	Coils/Boolean	00001 – 00032	Boolean
2	Input Status	10001 – 10040	Boolean

3	Input Register pairs	30001 – 30080	32-bit Integer
4	Input Register	30083 – 30120	16-bit Integer
5	Input Register	30121 – 30158	16-bit Integer
6	Input Register pairs	30165 – 30274	32-bit Integer
7	Holding Register	40001 – 40040	16-bit Integer
8	Holding Register pairs	40041 – 40120	32-bit Integer
9	Holding Register pairs	40121 – 40200	32-bit Integer
10	Holding Register	40201 – 40240	16-bit Integer

Each discrete data element within the MODBUS database is called a register. Register addressing resolves the database area in which it resides as well as the element offset within the area. For example, the register address of 30083 indicates the integer value stored in register 83 within the Input Registers data base area. MODBUS address 00004 indicates the current Boolean value in register 4 of the Discrete Coil Register area in the data base.

Another aspect of the MODBUS register convention is that some registers are Read-Only from the Host system while other areas are **Read/Write**.

- The Input Status Registers (1xxxx) and the Output Status registers (3xxxx) are Read-Only registers. The Host system is only able to read the values placed into these register areas.

- The Coil Registers (0xxxx) and the Holding Register (4xxxx) are Read/Write registers. The host has read/write access to the registers in these areas. These areas are where Command and Operating Parameter values are written from the Host system. Read only data from the field unit can be placed into these registers as well.

Registers in 3xxxx and 4xxxx range have segments dedicated for 32-bit Integers. These registers require two sequential 16-bit registers. See description in the map.

This data base exists to allow communication from/to the SGA1000 to the ATOM Scanner/GUI program and a RS-485 link for a MODBUS client system.

Controls at the ATOM Scanner program allow the administrator to program the COM Port, Baud Rate and MODBUS ID for the ATOM Scanner and the RS485 Client link.

Client Access: Although the entire ATOM database is available, a client may only have interest in certain data areas. Here is a selection of typical monitor points.

Standby, Process, Calibration, Validation Status and concentration to monitor

10003	Process State (Stream 1)	1=Process on Stream 1 (Boolean)
10007	Validating	1=Validation in Process (Boolean)
10008	Alarm State	Alarm Status (Boolean)
10019	Purging	1=Purging in Process (Boolean)
10024	Calibrating	1=Calibration in Progress (Boolean)
10025	Running	1=Status Run Mode (Boolean)

10026	Holding	S1=status IDLE (Boolean)
10032	Fresh Data	"1" indicates Fresh Data (auto cleared at the end of next peak acquisition (about 70 seconds has elapsed) while in Process state)
30069-30070	Ppm (Cycle Concentration results)	concentration in ppm this current cycle (32-bit integer)

Minimal client monitoring algorithm:

The client could read 10001-10040 (5-bytes) twice per minute for changes in system status. Registers 30069-30070 could be read when the fresh data flag sets. At least 70 seconds elapses before "Fresh Data" self clears for the next cycle.

Discrete Coil Registers

Range 00001-00032

R#	Mnemonic	Description (Boolean Commands)
1	New SRN	1=New Sequential Record Number written
2	ARun	Start/Stop a RUN; 0=OFF, 1=ON
3	Calibrate Check Zero	Start/Stop a Calibrate Zero Function
4	Calibrate Check Span	Start/Stop a Calibrate Span Function
5	Calibrate Validate	Start/Stop a Validate Function
6	Manual Zero Set	0=idle, 1=manual zero set
7	Ignore Data	Analyzer Online =0; Analyzer Offline =1
8	Reserved	
9	Calculate RF	1=Save and Calculate a Response Factor
10	Override	1=Purge Override ON; 0=OFF
11	BL_Set	1=takes current detector reading to calculate offset
12	BL_Enable	1=Base Line Enable for "Zero Baseline"
13	Lamp State	Lamp On/Off Control; 0=OFF, 1=ON
14	PMT State	PMT On/Off Control; 0=OFF, 1=ON
15	Auto Cal Enable	1=Automatic Calibrate Enable
16	Sync Calendar	1=synchronize calendar to the PC
17	SV State DO	S/V (Sample Valve) 0=OFF, 1=ON
18	SSO State DO	SSO (Sample Shut Off) 0=OFF, 1=ON
19	Stream 1 State DO	Process Stream 1 (test control of DO)
20	Stream 2 State DO	Process Stream 2 (test control of DO)
21	Zero State DO	Zero (test control of DO)
22	Span State DO	Span (test control of DO)
23	Validate State DO	Validate (test control of DO)
24	Alarm State DO	Alarm Status (test control of DO)
25	Playback	Control of recorded data playback 0=OFF, 1=ON
26	Auto Cal Event	Not user programmable
27	Set Lock	Not user programmable

28	Data Ready	Not user programmable
29	Cal Parm Change	Is set to "1" if any cal parameters have been modified
230	Historical	Not user programmable
31	Reserved	
32	Check Sum Request	Set to "1" to request Checksum from Atom
33	Stream 1 Enable	1=Stream 1 selected/running
34	Stream 2 Enable	1=Stream 2 selected/running

Discrete Input Status Registers

Range: 10001-10056

R#	Mnemonic	Description (connected to physical outputs)
10001	SV State	Inject / Vent Valve (S/V) Status
10002	SSO State	Sample Shut Off / Vent (SSO) Status
10003	Stream 1 State	Process Stream 1 Status
10004	Stream 2 State	Process Stream 2 Status
10005	Zero State	Zero calibration Status
10006	Span State	Span calibration Status
10007	Validate State	Validate calibration Status
10008	Alarm State	Alarm Status

R#	Mnemonic	Description (8 bits mapped to physical inputs)
10009	DI1	Digital Input 1
10010	DI2	Digital Input 2
10011	DI3	Digital Input 3
10012	DI4	Digital Input 4
10013	DI5	Digital Input 5
10014	DI6	Digital Input 6
10015	DI7	Digital Input 7
10016	DI8	Digital Input 8

R#	Mnemonic	Description (Boolean Status)
10017	Overriding	1=currently in Purge Override; 0=not in Purge Override
10018	New Cycle Request	Not user programmable
10019	Purging	1=Purging in Process
10020	Check Sum Complete	0=currently performing or not yet performed checksum; 1=has completed a checksum
10021	BL_Corrected	Data has been offset by baseline corrected value
10022	Logging	Logging to Data Base

10023	Reserved	
10024	Calibrating	1=Calibration in Progress
10025	Running	1=In Run Mode
10026	Holding	1=Status IDLE
10027	Stop Pending	Indicates that Atom will go into HOLD state at end of run
10028	Injecting	1=Inject Event (sample being injected)
10029	Fresh Reading	1=new reading posted
10030	Event Base Line	1=Event Base Line acquisition
10031	Event Peak	1=Event Peak acquisition
10032	Fresh Data	1=Fresh Data available
10033	MFC1 Status	Not available
10034	MFC2 Status	Not available
10035	TC1 Status	Not available
10036	TC2 Status	Not available
10037	Span Status	Not available
10038	Reserved	
10039	Stream 1 Status	Indicates alarm condition of stream 1
10040	TC3 Status	Not available
10041	Check Sum Valid	1=valid checksum; 0=error
10042	Block Ready 0	Not user programmable
10043	Block Ready 1	Not user programmable
10044	Stream 1 State	1=currently running; 0=not currently running
10045	Stream 2 State	1=currently running; 0=not currently running
10046	Process State	1=currently running; 0=not currently running
10047	Calibrate State	1=currently running; 0=not currently running
10048	Stream 2 Status	Indicates alarm condition of stream 2
10049	Zero Signal	1=selected and in queue
10050	Span Signal	1=selected and in queue
10051	Validate Signal	1=selected and in queue
10052	User Halt Signal	1=selected and in queue
10053	User Start Signal	1=selected and in queue
10054	Reserved For Q	Not available
10055	Reserved For Q	Not available
10056	Reserved For Q	Not available

Discrete Output Registers

Range: 30001-30120

R#	Mnemonic	Description (32-bit RO registers)
30001-30036	Reserved	
30037-30038	Applied uV	Applied Baseline offset in microvolts
30039-30040	BL Temp Corrected	Not available
30041-30042	Reserved	
30043-30044	MFC1Value	Mass Flow Controller 1 Value
30045-30046	MFC2Value	Mass Flow Controller 2 Value

30047-30048	TC1 Value	Temperature Controller 1 Value
30049-30050	TC2 Value	Temperature Controller 2 Value
30051-30052	TC3 Value	Temperature Controller 3 Value
30053-30054	TOD	Time of Day (secs since midnight)
30055-30056	Span Cal Avg PPM	Not available
30057-30058	PMT ave	PMT average (signed 32-bit)
30059-30060	Elapse Seconds	Seconds elapsed since start of cycle
30061-30062	Reserved	
30063-30064	PD average	Photo Diode 1 sec average
30065-30066	Base Line Average	baseline average in detector counts
30067-30068	Area Of Peak Stream 1	Stream 1 peak area in detector counts
30069-20070	Cycle ppm	concentration in ppm of current cycle
30071-30072	mV_Out	PMT reading in millivolts
30073-30074	uV_Out	PMT reading in microvolts
30075-30076	Area Of Peak Stream 2	Stream 2 peak area in detector counts
30077-30078	Reserved	
30079-30080	Cycle_ppb	concentration in ppb of current cycle
30081-30082	Reserved	

R#	**Mnemonic**	**Description (16-bit RO registers)**
30083	Reserved	
30084	PCT_FS_DAC1	% of Full Scale for DAC1
30085	TC77_Sensor	Temperature in deg C (scaled)
30086	Demo Code	Value between 0-3; selects a preset conc for playback
30087	Cycle#	Number of current cycle
30088	Warn States	Bit defined system warnings
30089	Numbr Cycles	Number of cycles completed
30090	Alarm Status	Bit defined results of warn/alarm tests
30091	Reserved	
30092	Version Num	Firmware version ID
30093	PCT_FS_DAC2	% of Full Scale for DAC2
30094	Date Code	Days since 1-1-1900 – 32768 (s/w release)
30095	Num of Cal Cycle	Number of Calibration Cycles set to run
30096	Override Timer	Secs remaining in cabinet purge override
30097	Numbr Cal Cycles	Cycle number being run
30098	Alarm States	Bit defined system warnings
30099	Stream 1 Progress	Number of current cycle being run out of total requested
30100	Stream 2 Progress	Number of current cycle being run out of total requested
30101	Density Reading S1	not applicable
30102	Density Reading S2	not applicable
30103-30120	Reserved	

R#	Mnemonic	Description (32-bit RO registers)
30121-30122	PA1_S2 (Stream 2-1 Area)	Concentration for Stream 2 Peak Area 1 – scrolling array of 10 concentration values in ppm x 100. Oldest data if the array over-written each cycle.
30123-30124	PA1_S2 (Stream 2-2 Area)	Concentration for Stream 2 Peak Area 2
30125-30126	PA1_S2 (Stream 2-3 Area)	Concentration for Stream 2 Peak Area 3
30127-30128	PA1_S2 (Stream 2-4 Area)	Concentration for Stream 2 Peak Area 4
30129-30130	PA1_S2 (Stream 2-5 Area)	Concentration for Stream 2 Peak Area 5
30131-30132	PA1_S2 (Stream 2-6 Area)	Concentration for Stream 2 Peak Area 6
30133-30134	PA1_S2 (Stream 2-7 Area)	Concentration for Stream 2 Peak Area 7
30135-30136	PA1_S2 (Stream 2-8 Area)	Concentration for Stream 2 Peak Area 8
30137-30138	PA1_S2 (Stream 2-9 Area)	Concentration for Stream 2 Peak Area 9
30139-30140	PA1_S2 (Stream 2-10 Area)	Concentration for Stream 2 Peak Area 10
30141-30142	PA1_S1 (Stream 1-1 Area)	Concentration for Stream 1 Peak Area 1 – scrolling array of 10 concentration values in ppm x 100. Oldest data if the array over-written each cycle.
30143-30144	PA1_S1 (Stream 1-2 Area)	Concentration for Stream 1 Peak Area 2
30145-30146	PA1_S1 (Stream 1-3 Area)	Concentration for Stream 1 Peak Area 3
30147-30148	PA1_S1 (Stream 1-4 Area)	Concentration for Stream 1 Peak Area 4
30149-30150	PA1_S1 (Stream 1-5 Area)	Concentration for Stream 1 Peak Area 5
30151-30152	PA1_S1 (Stream 1-6 Area)	Concentration for Stream 1 Peak Area 6
30153-30154	PA1_S1 (Stream 1-7 Area)	Concentration for Stream 1 Peak Area 7
30155-30156	PA1_S1 (Stream 1-8 Area)	Concentration for Stream 1 Peak Area 8
30157-30158	PA1_S1 (Stream 1-9 Area)	Concentration for Stream 1 Peak Area 9
30159-30160	PA1_S1 (Stream 1-10 Area)	Concentration for Stream 1 Peak Area 10
30161-30162	S1_Cycle_ppb	Most recent Stream 1 cycle conc in ppb
30163-30164	S2_Cycle_ppb	Most recent Stream 2 cycle conc in ppb
30165-30166	Ppb Stream 1 1	Scrolling array of 10 values with most recent Stream 1 concentration in ppb in these registers
30167-30168	Ppb Stream 1 2	Concentration for Stream 1 ppb 2
30169-30170	Ppb Stream 1 3	Concentration for Stream 1 ppb 3
30171-30172	Ppb Stream 1 4	Concentration for Stream 1 ppb 4
30173-30174	Ppb Stream 1 5	Concentration for Stream 1 ppb 5
30175-30176	Ppb Stream 1 6	Concentration for Stream 1 ppb 6
30177-30178	Ppb Stream 1 7	Concentration for Stream 1 ppb 7
30179-30180	Ppb Stream 1 8	Concentration for Stream 1 ppb 8
30181-30182	Ppb Stream 1 9	Concentration for Stream 1 ppb 9
30183-30184	Ppb Stream 1 10	Concentration for Stream 1 ppb 10
30185-30186	Ppb Stream 1 ave	Average Concentration in ppb of preset numbers of cycles for Stream 1
30187-30188	Span ppb Cal 1	Scrolling array of 10 values with most recent Span concentration in ppb in these registers

30189-30190	Span ppb Cal 2	Concentration for Span ppb 2
30191-30192	Span ppb Cal 3	Concentration for Span ppb 3
30193-30194	Span ppb Cal 4	Concentration for Span ppb 4
30195-30196	Span ppb Cal 5	Concentration for Span ppb 5
30197-30198	Span ppb Cal 6	Concentration for Span ppb 6
30199-30200	Span ppb Cal 7	Concentration for Span ppb 7
30201-30202	Span ppb Cal 8	Concentration for Span ppb 8
30203-30204	Span ppb Cal 9	Concentration for Span ppb 9
30205-30206	Span ppb Cal 10	Concentration for Span ppb 10
30207-30208	Span ppb Cal ave	Average Concentration in ppb of run cycles for Span
30209-30210	Checksum	Output of detector firmware checksum
30211-30212	PPBA1_S2 (Stream 2 ppb)	Scrolling array of 10 values with most recent Stream 2 concentration in ppb in these registers
30213-30214	PPBA2_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 2
30215-30216	PPBA3_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 3
30217-30218	PPBA4_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 4
30219-30220	PPBA5_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 5
30221-30222	PPBA6_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 6
30223-30224	PPBA7_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 7
30225-30226	PPBA8_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 8
30227-30228	PPBA9_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 9
30229-30230	PPBA10_S2 (Stream 2 ppb)	Concentration for Stream 2 ppb 10
30231-30232	PPBave_S2 (Stream 2 ppb)	Average Concentration in ppb of preset numbers of cycles for Stream 2
30233-30234	Zero Area 1 Calibrate	Scrolling array of 10 values with most recent Zero Area in these registers
30235-30236	Zero Area 2	Zero Calibration Area 2
30237-30238	Zero Area 3	Zero Calibration Area 3
30239-30240	Zero Area 4	Zero Calibration Area 4
30241-30242	Zero Area 5	Zero Calibration Area 5
30243-30244	Zero Area 6	Zero Calibration Area 6
30245-30246	Zero Area 7	Zero Calibration Area 7
30247-30248	Zero Area 8	Zero Calibration Area 8
30249-30250	Zero Area 9	Zero Calibration Area 9
30251-30252	Zero Area 10	Zero Calibration Area 10
30253-30254	Zero Area Ave Calibrate	Avg Area of run cycles for Zero Calibration
30255-30256	Zero ppb 1 Calibrate	Scrolling array of 10 values with most recent Zero concentration in ppb in these registers
30257-30258	Zero ppb 2 Calibrate	Concentration for Zero ppb 2
30259-30260	Zero ppb 3 Calibrate	Concentration for Zero ppb 3
30261-30262	Zero ppb 4 Calibrate	Concentration for Zero ppb 4
30263-30264	Zero ppb 5 Calibrate	Concentration for Zero ppb 5
30265-30266	Zero ppb 6 Calibrate	Concentration for Zero ppb 6

30267-30268	Zero ppb 7 Calibrate	Concentration for Zero ppb 7
30269-30270	Zero ppb 8 Calibrate	Concentration for Zero ppb 8
30271-30272	Zero ppb 9 Calibrate	Concentration for Zero ppb 9
30273-30274	Zero ppb 10 Calibrate	Concentration for Zero ppb 10
30275-30276	Zero ppb Ave Calibrate	Average Concentration in ppb of preset numbers of cycles for Zero
30277-30278	Span 1 Area Calibrate	Scrolling array of 10 values with most recent Span Area in these registers
30279-30280	Span 2 Area Calibrate	Span Calibration Area 2
30281-30282	Span 3 Area Calibrate	Span Calibration Area 3
30283-30284	Span 4 Area Calibrate	Span Calibration Area 4
30285-30286	Span 5 Area Calibrate	Span Calibration Area 5
30287-30288	Span 6 Area Calibrate	Span Calibration Area 6
30289-30290	Span 7 Area Calibrate	Span Calibration Area 7
30291-30292	Span 8 Area Calibrate	Span Calibration Area 8
30293-30294	Span 9 Area Calibrate	Span Calibration Area 9
30295-30296	Span 10 Area Calibrate	Span Calibration Area 10
30297-30298	Span Area Ave Calibrate	Avg Area of run cycles for Span calibration
30299-30300	Validate 1 ppb	Scrolling array of 10 values with most recent Validate concentration in ppb in these registers
30301-30302	Validate 2 ppb	Concentration for Validate ppb 2
30303-30304	Validate 3 ppb	Concentration for Validate ppb 3
30305-30306	Validate 4 ppb	Concentration for Validate ppb 4
30307-30308	Validate 5 ppb	Concentration for Validate ppb 5
30309-30310	Validate 6 ppb	Concentration for Validate ppb 6
30311-30312	Validate 7 ppb	Concentration for Validate ppb 7
30313-30314	Validate 8 ppb	Concentration for Validate ppb 8
30315-30316	Validate 9 ppb	Concentration for Validate ppb 9
30317-30318	Validate 10 ppb	Concentration for Validate ppb 10
30319-30320	Validate 1 ppb Average	Average Concentration in ppb of preset numbers of cycles for Validate
30321-30322	Validate 1 Area	Scrolling array of 10 values with most recent Validate Area in these registers
30323-30324	Validate 2 Area	Validate Calibration Area 2
30325-30326	Validate 3 Area	Validate Calibration Area 3
30327-30328	Validate 4 Area	Validate Calibration Area 4
30329-30330	Validate 5 Area	Validate Calibration Area 5
30331-30332	Validate 6 Area	Validate Calibration Area 6
30333-30334	Validate 7 Area	Validate Calibration Area 7
30335-30336	Validate 8 Area	Validate Calibration Area 8
30337-30338	Validate 9 Area	Validate Calibration Area 9
30339-30340	Validate 10 Area	Validate Calibration Area 10
30341-30342	Validate Area Average	Avg Area of run cycles for Validate calibration

Discrete Input Register

Range: 40001-40128

R#	Mnemonic	Description (16-bit RW registers)
40001	Output Average	Number of process outputs to be averaged
40002	Inject Valve Start	time in seconds from start of cycle to inject valve start
40003	Inject Valve Stop	time in seconds from start of cycle to inject valve stop
40004	SSO Valve Start	time in seconds from start to SSO valve start
40005	SSO Valve Stop	time in seconds from start to SSO valve stop
40006	Base Line Start	Cycle Time to start baseline acquisition
40007	Base Line Stop	Cycle Time to stop baseline acquisition
40008	Auto Zero Time	AutoZero secs in cycle time
40009	Peak Start Time	Cycle Time to start peak acquisition
40010	Peak Stop Time	Cycle Time to stop peak acquisition
40011	Run Mode Cycle Sec	Time in seconds for 1 cycle
40012	Instrument Status	Bit level definition for internal use only
40013	TOD_Sync_H	Time of Day Sync Higher (upper 16-bits)
40014	TOD_Sync_L	Time of Day Sync Lower (lower 16-bits)
40015	State Flag	Bit level define last settings saved in flash
40016	Purge Seconds	Purge Time in seconds when mode switch occurs
40017	Span Conc Warn	Span concentration warning setting
40018	Span Conc Alarm	Span concentration alarm setting
40019	Zero Conc Alarm	Zero concentration alarm setting
40020	FS_DAC1	Full Scale DAC1 in millivolts
40021	FS_DAC2	Full Scale DAC2 in millivolts
40022	Zero_DAC1	DAC1 zero value
40023	Zero_DAC2	DAC2 zero value
40024	Auto Cal Freq Days	Auto Calibration frequency in days
40025	Reserved	
40026	Alarm Mask	Bit mask to enable alarm monitor
40027	Cal Cycles	Number of calibration cycles
40028	Averages	Smoothing filter setting (number between 1 and 8)
40029	DAC1_PV	DAC1 process variable choice
40030	Cycle End	Cycle stop: 0=stop, 1=repeat, 2=hold
40031	PMT_Volts	PMT Volts (value between 0 and 999)
40032	Reserved	reserved
40033	Number Of Cycles	Number of Cycles to run
40034	Reserved	reserved
40035	DAC2_PV	DAC2 process variable choice
40036	Cal Units	%, ppm, or ppb
40037	Override Minutes	Cabinet purge override time in minutes

40038	Secs Until Repeat	Cycle hold time minimum before a new start event
40039	TOD_Cal	Time of Day for calibrate (hh * 60 + min)
40040	Warn Mask	Bit mask for warning definition
40041	Stream 1 Runs	Total cycles of Stream 1 to run before switching
40042	Stream 2 Runs	Total cycles of Stream 2 to run before switching
40043	Stream 1 Density	Not applicable
40044	Stream 2 Density	Not applicable
40045	Calibration Density	Not applicable
40046-40080	Reserved	Reserved

R#	Mnemonic	Description (32-bit RW registers)
40081-40082	Zero Cal Average Area	Zero cal avg area response value
40083-40084	Span Cal Average Area	Span cal avg area response value
40085-40086	Counts Per ppm	computed detector counts per ppm = Response Factor
40087-40088	Zero Saved	Last saved zero value
40089-40090	Span_DAC1	Span for DAC1
40091-40092	Span_DAC2	Span for DAC2
40093-40094	BLOffset_uV	User input baseline offset value in uV
40095-40096	Span Cal ppb	Span cal conc ppb value
40097-40098	Zero Cal ppb	Zero cal conc ppb value
40099-40100	Last Validate ppm	Last value of Validate calibration conc in ppm
40101-40102	Span Saved	Last saved value of Span calibration
40103-40104	Lamp Off Reference	Lamp off reference saved in EEPROM
40105-40106	MFC1 Low	MFC1 Low range setting
40107-40108	MFC1 High	MFC1 High range setting
40109-40110	MFC2 Low	MFC2 Low Range setting
40111-40112	MFC2 High	MFC2 High Range setting
40113-40114	TC1 Low	TC1 Low Range setting
40115-40116	TC1 High	TC1 High Range setting
40117-40118	TC2 Low	TC2 Low Range setting
40119-40120	TC2 High	TC2 High Range setting
40121-40122	MFC 1 Set point	MFC 1 Setpoint setting
40123-40124	MFC2 Set point	MFC 2 Setpoint setting
40125-40126	TC1 Set point	TC 1 Setpoint setting
40127-40128	TC2 Set point	TC 2 Setpoint setting
40129-40130	TC3 Set point	TC 3 Setpoint setting
40131-40132	TC3 Low	TC 3 Low Range Setting
40133-40134	TC3 High	TC 3 High Range Setting
40135-40136	Zero Low Alarm	Zero Low alarm setting
40137-40138	Zero High Alarm	Zero High alarm setting
40139-40140	Span Low Alarm	Span Low alarm setting

40141-40142	Span High Alarm	Span High alarm setting
40143-40144	Stream 1 Low Alarm	Stream 1 Low alarm setting
40145-40146	Stream 1 High Alarm	Stream 1 High alarm setting
40147-40148	Save Process ppm	Most recent stream value saved before power interruption – modifying this value is not recommended
40149-40150	Reserved	
40151-40152	PMT Sample	Playback sample data to detector
40153-40154	Time Sample	Playback sample time to detector
40155-40156	Date Last Validate	Days since 1/1/1900 – 32768
40157-40158	Time Last Validate	Time in Sec since validation
40159-40160	Lamp on reference	Reference saved in EEPROM
40161-40162	Stream 2 Low Alarm	Stream 2 Low alarm setting
40163-40164	Stream 2 High Alarm	Stream 2 High alarm setting
40165-40240	Reserved	Reserved

Section 5 – Purge System

Section 5.1 Overview

To prevent the possibility of fire or explosion inside the enclosures of energized electrical equipment, a protective gas supply is used to dilute potentially flammable vapors to an acceptable level, creating a safe area for the devices within the enclosure. Positive pressure prevents the ingress of flammable vapors in the surrounding atmosphere from entering into the enclosure as long as positive pressure is maintained. After the enclosure is purged, power may be manually applied to the protected electrical equipment.

The Purge Solutions CYCLOPS Z – Purge Indicator provides objective evidence of positive enclosure pressure with both a visible indicator and supplied standard, a dry- contact output for remote status monitoring. The enclosure purge vent is an integrated part of the CYCLOPS Z – Purge Indicator's casing, which mounts directly to the enclosure being purged. No additional holes, sheet metal, or plumbing is required.

Section 5.2 Features

- The CYCLOPS Z – Purge Indicator mounts directly to purged enclosure. No additional sheet metal enclosures or plumbing is required. (Refer to Figures 1, 2, 3, & 4)
- Enclosure purge vent is an integrated part of the CYCLOPS Z – Purge Indicator casing. No additional holes or plumbing is required in purged enclosure. (Refer to Figure 4)
- Dry contact output for remote monitoring is supplied as standard. Contact open on alarm (Standard). Contact closed on alarm (Optional). Order optional contact closed on alarm by adding an "X" at end of Purge Solutions model number. (Refer to Figure 4)
- Rugged, visual green LED indicator. Green LED on; enclosure purge pressure at or above required pressure. Green LED off, enclosure purge pressure below required pressure.
- The CYCLOPS Z – Purge Indicator is certified to ATEX, CEC, IECEx, NEC, NFPA, UL and CE Marked for installation and use in Division 2 and Zone 2 hazardous areas.

Section 5.3 Options & accessories available

Purge Indicator Casing: Anodized aluminum (standard) 316 stainless steel (optional).

Input Voltages Available: Either 12 VDC, 24 VDC, 115 VAC, or 230 VAC.

Purge Solutions Available Models:

- Type Z – Purge Indicator: 12 VDC, Anodized aluminum, Gas hazardous area installations: Purge Solutions model number PSCZ-1A
- Type Z – Purge Indicator: 12 VDC, 316 stainless steel, Gas hazardous area installations: Purge Solutions model number PSCZ-1S
- Type Z – Purge Indicator: 24 VDC, Anodized aluminum, Gas hazardous area installations: Purge Solutions model number PSCZ-2A
- Type Z – Purge Indicator: 24 VDC, 316 stainless steel, Gas hazardous area installations: Purge Solutions model number PSCZ-2S
- Type Z – Purge Indicator: 115 VAC, Anodized aluminum, Gas hazardous area installations: Purge Solutions model number PSCZ-3A
- Type Z – Purge Indicator: 115 VAC, 316 stainless steel, Gas hazardous area installations: Purge Solutions model number PSCZ-3S
- Type Z – Purge Indicator: 230 VAC, Anodized aluminum, Gas hazardous area installations: Purge Solutions model number PSCZ-4A
- Type Z – Purge Indicator: 230 VAC, 316 stainless steel, Gas hazardous area installations: Purge Solutions model number PSCZ-4S
- Type Z – Purge Indicator: 12 VDC, Anodized aluminum, Dust hazardous area installations: Purge Solutions model number PSCZ-1AD
- Type Z – Purge Indicator: 12 VDC, 316 stainless steel, Dust hazardous area installations: Purge Solutions model number PSCZ-1SD
- Type Z – Purge Indicator: 24 VDC, Anodized aluminum, Dust hazardous area installations: Purge Solutions model number PSCZ-2D
- Type Z – Purge Indicator: 24 VDC, 316 stainless steel, Dust hazardous area installations: Purge Solutions model number PSCZ-2SD
- Type Z – Purge Indicator: 115 VAC, Anodized aluminum, Dust hazardous area installations: Purge Solutions model number PSCZ-3AD
- Type Z – Purge Indicator: 115 VAC, 316 stainless steel, Dust hazardous area installations: Purge Solutions model number PSCZ-3SD
- Type Z – Purge Indicator: 230 VAC, Anodized aluminum, Dust hazardous area installations: Purge Solutions model number PSCZ-4AD
- Type Z – Purge Indicator: 230 VAC, 316 stainless steel, Dust hazardous area installations: Purge Solutions model number PSCZ-4SD

Vortex Cabinet Cooler Kit: For applications where thermal management of electrical cabinets and control panels are required; Purge Solutions offers Vortex Cabinet Cooler assemblies, which provide cooling capacities for your application and maintain a NEMA 4 and 4X (IP66) rating for installation and use in hazardous area. Contact your local Purge Solutions representative or the factory for sizing of system and installation information.

Continuous Dilution Purge Gas Inlet Kit: For interfacing and regulating pressure of protective gas supply to enclosure. Small Continuous Dilution Purge Gas Inlet Kit for enclosures with a volume

up to 15 cubic feet (425 liters). Model number PSO-SCD-A is our small aluminum version and PSO-SCD-S is our small stainless version. Small Continuous Dilution Purge Gas Inlet Kit supply gas inlet to regulator is 1/4-18 FNPT. Medium Continuous Dilution Purge Gas Inlet Kit for enclosures with a volume up to 75 cubic feet (2,125 liters). Model number PSO-MCD-A is our medium aluminum version and PSO-MCD-S is our medium stainless version. Medium Continuous Dilution Purge Gas Inlet Kit supply gas inlet to regulator is 3/8-18 FNPT. Large Continuous Dilution Purge Gas Inlet Kit for enclosures with volumes up to 200 cubic feet (5,663 liters). Model number PSO-LCD-A is our large aluminum version and PSO-LCD-S is our large stainless version. Large Continuous Dilution Purge Gas Inlet Kit supply gas inlet to regulator is 1/2-14 FNPT. All kits include input fitting, regulator, gauge, bracket and mounting hardware.

Manual Leakage Compensation Purge Gas Inlet Kit: Having two outlets from manifold able to increase the amount of purge gas to enclosure during dilution may be manually selected to speed up dilution of potentially flammable materials to an acceptable level, reducing dilution time and permitting a more rapid restoration of power to purge protected equipment. Small Manual Leakage Compensation Purge Gas Inlet Kits are for enclosures with a volume up to 15 cubic feet (425 liters). Model number PSO-SLC-A is our small aluminum version and model number PSO-SLC-S is our small stainless steel version. Small Manual Leakage Compensation Purge Gas Inlet Kit supply gas inlet to regulator is 1/4-18 FNPT. Medium Manual Leakage Compensation Purge Gas Inlet Kits are for enclosures with a volume up to 75 cubic feet (2,125 liters). Model number PSO-MLC-A is our medium aluminum version and model number PSO-MLC-S is our medium stainless steel version. Medium Manual Leakage Compensation Purge Gas Inlet Kit supply gas inlet to regulator is 3/8-18 FNPT. Large Manual Leakage Compensation Purge Gas Inlet Kit is for enclosures with volumes up to 200 cubic feet (5,663 liters). Model number PSO-LLC-A is our large aluminum version and PSO- LLC-S is our large stainless steel version. Large Manual Leakage Compensation Purge Gas Inlet Kit supply gas inlet to regulator is 1/2-14 FNPT. All kits include input fittings, regulator, gauge and manifold block.

Back-Up Purge Gas Kit: In the even that the initial protective gas supply is lost, a back-up source of protective gas may be automatically applied to the protected enclosure. Purge Solutions model number is PSO-BUPG-K

Back-Up Vent Kit: To protect the enclosure from over pressure; Purge Solutions offers two sizes of back-up vents. The first size is our Small Back–Up Vent for enclosures with a volume up to 15 cubic feet (425 liters). Model number PSO-SBUV-S is our small side mount version and model number PSO-SBUV-T is our small top mount version. The second size we offer is our Medium Back-Up Vent for enclosures with volumes up to 75 cubic feet (2.125 liters). Model number PSO-MBUV-S is our medium side mount version and model number PSO-MBUV-T is our medium top mount version. The third size we offer is our Large Back-Up Vent for enclosures with volumes up to 200 cubic feet (5,663 liters). Model number PSO-LBUV-S is our large side mount version and

model number PSO-LBUV-T is our large top mount version. All Back-Up Vents are constructed of 316 stainless steel and come with all mounting hardware.

Protective Gas Loss Indicator Kit: An explosion-proof differential pressure switch may be installed to provide an alarm contact output signal to indicate the loss of the backup source of protective gas. Another explosion-proof differential pressure switch may be installed on the main protective gas supply to indicate that the primary protective gas pressure is adequate. Purge Solutions model number is PSO-PGLI-K.

Differential Pressure Gauge Kit: Purge Solutions also offers an all stainless steel differential pressure gauge kit, which can be mounted on left side model number PSO-DPG-L, right side model number PSO-DPG-R, top model number PSO-DPG-T or bottom model number PSO-DPG-B of enclosure.

GENERAL SPECIFICATIONS:

Casing Dimensions:
4.5" diameter x 1.9" tall (114.3mm diameter x 48.3mm tall).

Operating Temperature Range:
- 40ºF to 150ºF (- 40ºC to 65ºC).

Purge Pressure Lower Limit:
0.20 inches H20 (0.50 mbar).

Casing:
Anodized aluminum, 2.48 lbs. (1.13 kg), IP66, NEMA 4, (standard). 316 stainless steel, 6.70 lbs. (3.04 kg), IP66, NEMA 4X, (optional).

Power Input / Consumption:
0.5 Watts max.

Voltage:
12 VDC model (11 VDC to 16 VDC), 47 to 63 Hz.
24 VDC model (19 VDC to 28 VDC), 47 to 63 Hz.
115 VAC model (85 VAC to 160 VAC), 47 to 63 Hz.
230 VAC model (130 VAC to 265 VAC), 47 to 63 Hz.

Dry Contact Rating:

Contact open on alarm (Standard). Contact closed on alarm (Optional). 265 Volts AC / DC, 150mA max.

Standard Hardware:

All stainless steel mounting fasteners, o-ring, 1/4" (6.4mm) diameter vent restrictor, warning label, and CD with all required documentation.

Hazardous Area Approvals:

ATEX and IECEx
II 3 G Ex nA nL [pz] IIC T6 "for Zone 2 gas hazardous areas"
II 3 D Ex tD A22 IP66 T79°C "for Zone 2 dust hazardous areas"

ANSI / ISA 12.4, NEC / NFPA 496, CEC and UL
Class I, Division 2, Group A,B,C&D, T6 "for gas hazardous areas" Class II, Division 2, Group E,F&G, T6 "for dust hazardous areas"

Certified to an Ambient Temperature Range of - 40ºF (- 40ºC) <Tamb< + 149ºF (+ 65ºC) CE Marked

Section 6 – Parker Valve System

MAKE CERTAIN THE SYSTEM IN WHICH THE VALVE IS INSTALLED IS DRAINED AND/OR EXHAUSTED OF ALL PRESSURES BEFORE VALVE DISASSEMBLY OR REMOVAL OCCURS.

1. Remove the two Vent Plate Bolts using a 1/4 inch wrench.

NOTE: The heads of these bolts are protruding from the Vent Plate.

2. Set these bolts and the Vent Plate aside for later use.
3. Remove two Base Bolts using a 1/4 inch wrench.

NOTE: The heads of these bolts are protruding from the Base.

4. Set these bolts, the "Module Assembly" and two 2-008 O-Rings (face seals) aside for later use.
5. Continue removing Base Bolts, Module Assemblies and O-Rings until all have been removed.
6. Place all components in a clean, dry place until later use.

Section 6.1 Module Disassembly (refer to Figure 1)

NOTE: Module disassembly can be accomplished without removal from the system; however, insure all pressures are drained or exhausted before disassembly occurs.

Remove the four Long Bolts from the top of the Module using a 7/64 inch allen wrench.

1. Remove the four Short Bolts from the top of the Module using a 7/64 inch allen wrench.
   NOTE: The upper portion (Valve Body and all components assembled within) can now be removed from the Base.
2. Remove the Cap and Spring from the top of the Module and set aside for later use.

3. Insert one of the short bolts into a long bolt hole. Using a flathead screwdriver, pull up against the bottom of the piston head. Use the bolt head as a pivot point.

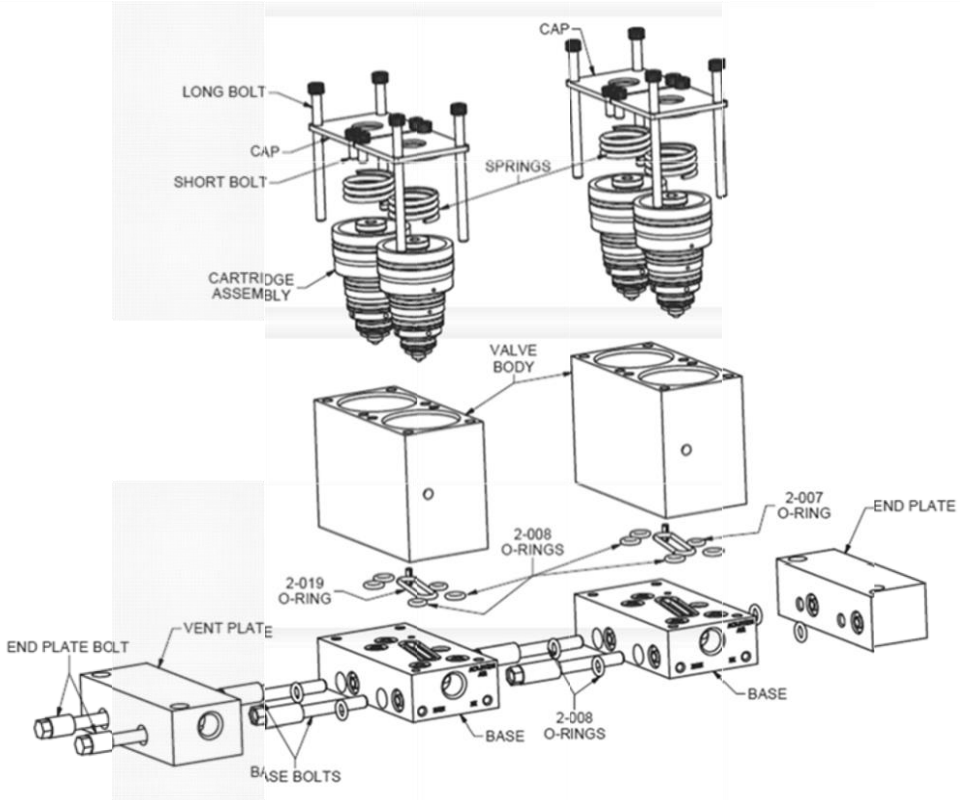


Figure 1: Gen II R-Max Stream Select System Exploded View

Cartridge Disassembly (refer to Figure 2)

Secure the hex keyed portion of the Piston using a 5/32 allen wrench, and unthread the Stem Sub by rotating it counter- clockwise using a 3/8 inch wrench.

Once unthreaded, gently pull the Piston from the top portion of the cartridge and the Stem Sub from the lower portion of the cartridge.

NOTE: Both compone ts contact o-r ng seals. Insure care is taken not to damage the sealing surfaces.

Removing the Stem Sub also releases the Center and Lower Bonnets.
Remove the two 2-007 O-Rings and the PTFE Back-up Ring from the Center Bonnet.
Remove the two 2-007 O-Rings and the PTFE Back-up Ring from the Upper Bonnet.
Remove all O-Rings from their sealing grooves.

NOTE: Careful not to mix them until reassembly has occurred.
Set aside all components in a clean, dry place for later use.

Cartridge Reassembly (refer to Figure 2)

Make certain all parts are free of dirt or other contamination before starting reassembly of this Cartridge.

NOTE: Insure all O-Rings are lubricated with an appropriate lubricant.

Install the 2-013 O-Ring onto the Lower Bonnet.
Install the 2-017 O-Ring onto the Center Bonnet.
Install the 2-018 O-Ring and 2-023 O-Ring onto the Upper Bonnet.
Install the 2-020 O-Ring onto the Piston.
Install into the small groove on the Center Bonnet and Upper Bonnet one 2-007 O-Ring, then the Backup Ring and then a second 2-007 O-Ring.

While holding the top surface of the **Lower Bonnet** against the bottom surface of the **Center Bonnet,** and holding the top surface of the **Center Bonnet** against the bottom surface of the **Upper Bonnet,** carefully insert the **Stem Sub** through the O-Ring/Backup Ring assembly installed in steps 4 & 5.

NOTE: Do not force the Stem Sub thr ugh the sealing area. Gently rotate the Stem Sub as it is pushed through the soft components.

Install the **Piston/O-ring** assembly into the top bore of the **Upper Bonnet.**

NOTE: Prior to assembly, insure the bore in which the Piston is installed is lubed with an appropriate lubricant.

Using a 5/32 allen wrench on the **Piston** and a 3/8 inch wrench on the **Stem Sub**, thread the **Piston Assembly** to the
Stem Sub. Torque to 12 in-lbs.

NOTE: Exercise care not to damage the Stem Seat.

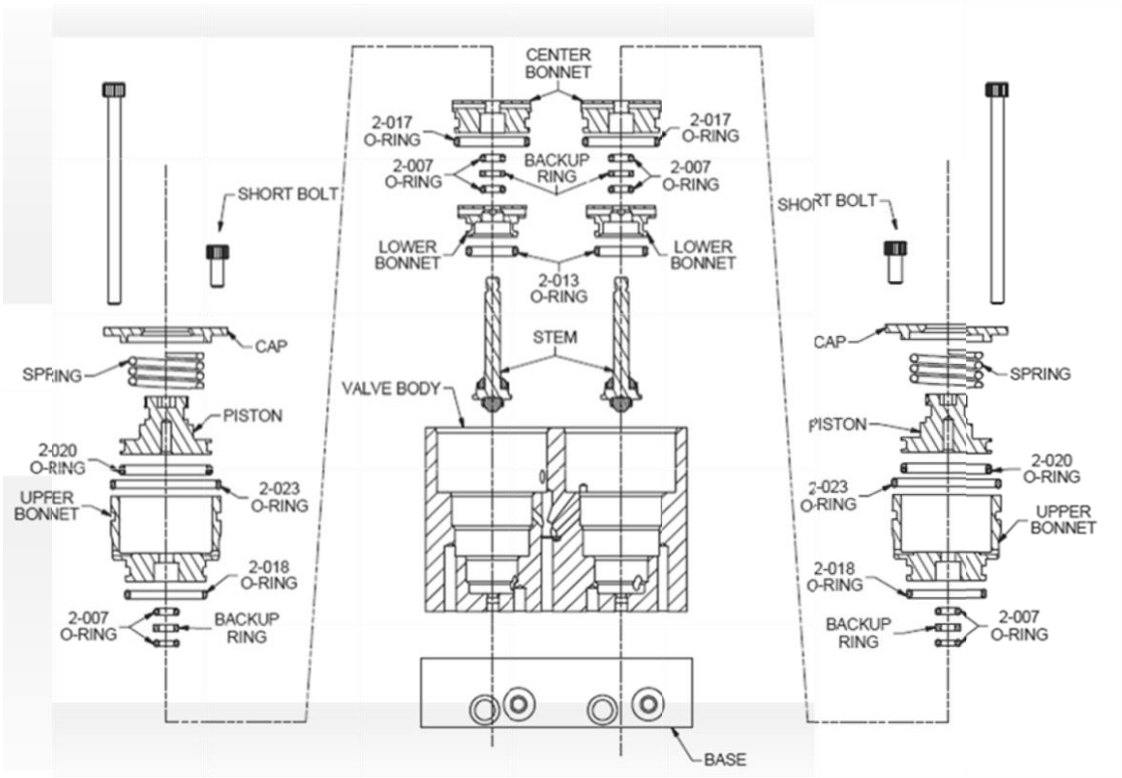
Module Reassembly (refer to Figure 1)

Make certain all parts are free of dirt or other contamination before starting reassembly of this Cartridge.

Using an appropriate lubricant, apply a light film of lube onto all inner surfaces of the **Valve Body**.
Install the **Cartridges** into the **Valve Body** until it is level with the top of the **Valve Body**.
Install the **2-007 O-Ring**, the **2-008 O-Rings** and the **2-019 O-Ring** into the appropriate grooves on the top of the **Base**.
Install the Valve Body Assembly (from step #2) onto the **Base**.

*NOTE: An alignment pin has been pressed into the **Base** to insure proper assembly.*

Place the **Springs** onto the top of the *Cartridge Assembly*.
Place the **Cap** onto the **Spring** such that the logo "Parker R-Max" can be correctly read when the base side marked "Actuation Air" is facing forward.
Install the **Long Bolts** thru the outside holes in the **Cap**.
Install the **Short Bolts** thru the inside holes in the **Cap**.
Using a 7/64 inch allen wrench, torque all *Bolts* to 25 in-lbs.



Section 6.2 System Reassembly (refer to Figure 1)

Install two 2-008 O-Rings into the grooves in the side of the End Plate.
Align the Module Assembly with the End Plate and thread two Base Bolts thru the Base portion of the Module Assembly and into the End Plate until hand tight. Using a 1/4" wrench torque to 60 in-lbs.
NOTE: A portion of the End Plate protrudes below the Module Assembly.

Install the remaining Module Assemblies by inserting the Base

Bolts thru each remaining module and into the previously assembled Base Bolts until all Module Assemblies are installed. Torque all Base Bolts to 60 in-lbs.
NOTE: During assembly, insure two 2-008 O-Rings are installed in the O-Ring grooves on each Module Assembly.

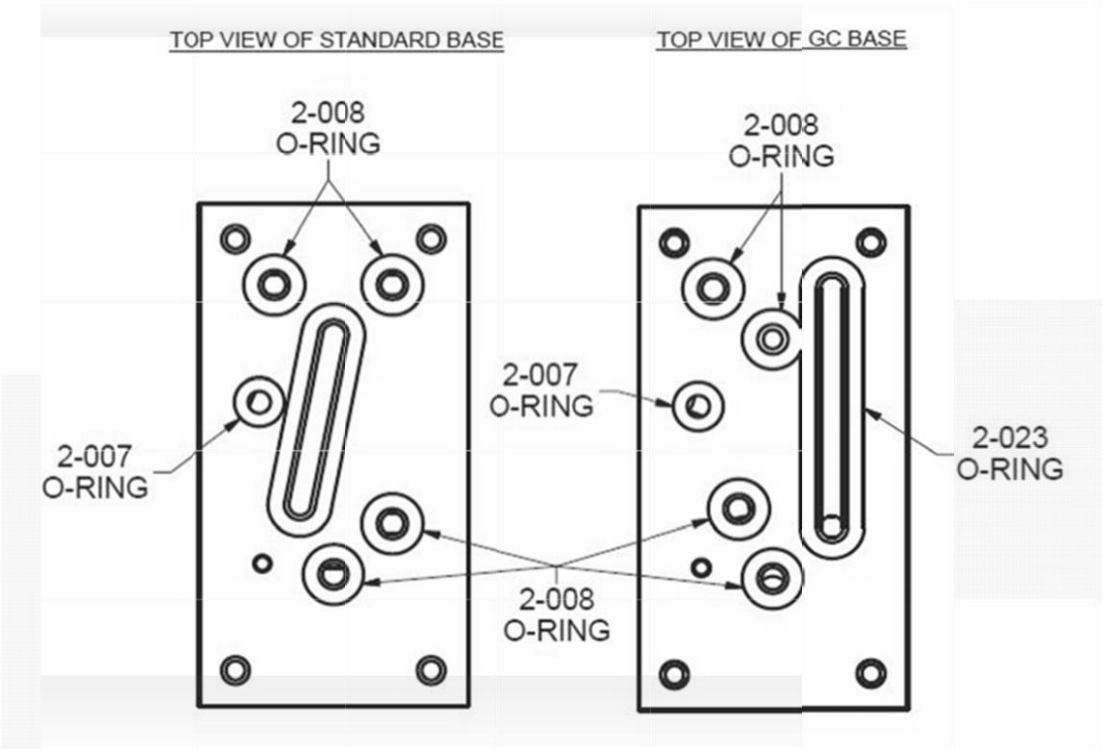
Install the Vent Plate onto the end of the Assembled System and thread two Vent Plate Bolts thru and into the previously assembled Base Bolts. Using a 1/4" wrench, torque to 60 in-lbs.
NOTE: The Vent Plate also protrudes below the Module Assembly.

GC Module

Optional modules for venting sampled media to a low pressure header are disassembled and reassembled in the same manner as the standard module.

One exception to this are the o-ring patterns in the Base (see figure 3).

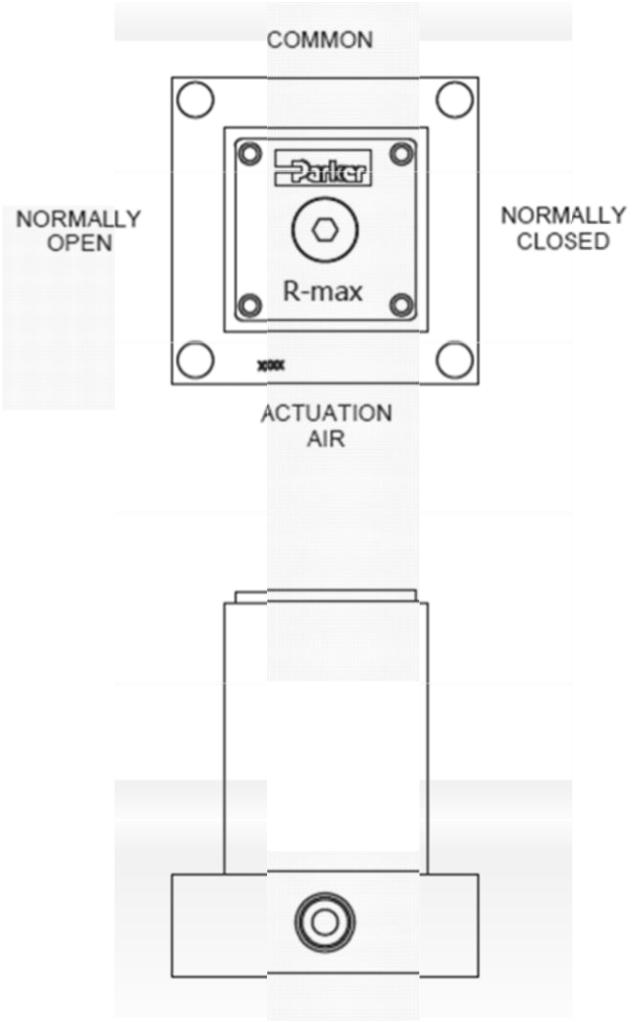
When assembling the system, the GC module is always assembled onto the End Plate. Any other manner of assembly will result in improper function of the R-Max System.

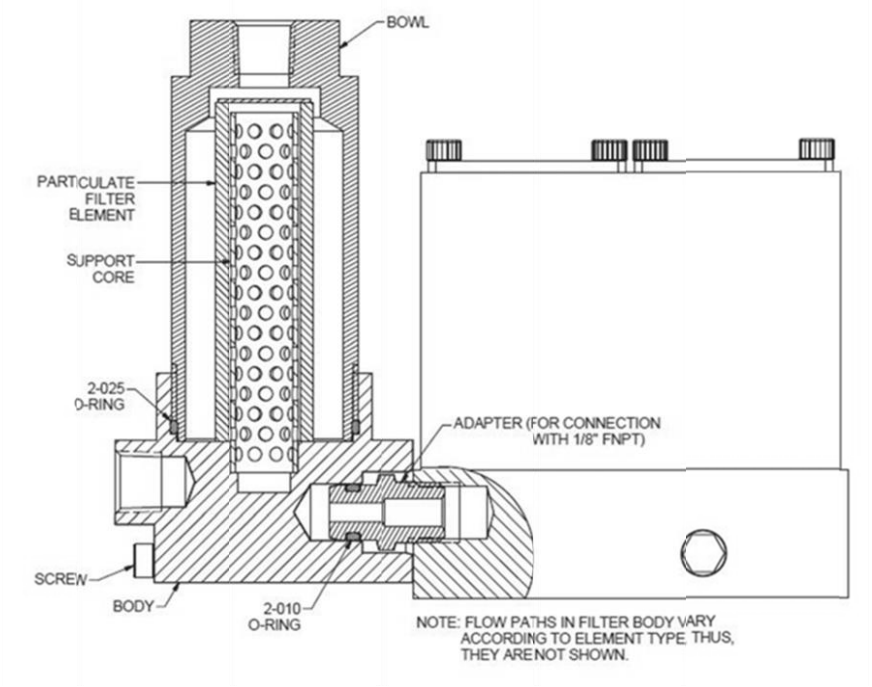


Single Valve

The Single R-Max is disassembled and reassembled in a similar manner as the standard module. The notable difference is four long screws are used to hold the valve body to the base.

Also, when assembling the valve body to the base insure the marking on the valve body is directed to the base side marked "actuation air".


COMMON
NORMALLY OPEN
NORMALLY CLOSED
Parker
R-max
ACTUATION AIR



NOTE: This filter is not meant for individual use. It can only be used in conjunction with the R-Max Stream Switching System.

Filter/R-Max Disassembly

1. Remove the two **Screws** (and **Bracket** if necessary) from the Body.
2. Gently pull the Filter from the R-Max Module.
3. If necessary, remove the **Adapter** from the R-Max Module using a 7/16 inch wrench.
4. Remove the **2-008 O-Ring** from the **Adapter**.
5. Set all components aside for later use.

Filter/R-Max Reassembly

1. Install the **2-008 O-Ring** onto the **Adapter**. Lubricate the o-ring to insure proper function.
2. Thread the **Filter Fitting** into the R-Max. Insure a proper pipe thread sealant is used on the threads.
3. Slide the Filter over the **Adapter**. Insure the Filter sits flush against the R-Max base. If not, remove the Filter, tighten the **Adapter** and repeat.
4. Insert the **Screws** (over the **Bracket** if necessary) thru the Filter and thread into the R-Max. Torque to 25 in-lbs.

Filter Disassembly (w/particulate element)

1. Using a 1" hex wrench remove the **Bowl** from the **Body.**
2. Remove the **Particulate Filter Element**.
3. Remove the **2-025 O-Ring**.
4. Set all components aside for later use.

Filter Reassembly (w/particulate element)

1. Insert the **2-025 O-Ring**. Insure it is not twisted or crinkled once within the groove. Lubricate to insure proper function.
2. Insert the **Particulate Filter Element** over the **Support Core**.
3. Apply an appropriate lubricant to the exterior threads of the **Bowl** and thread into the Body. Torque to 25 in-lbs.

Section 6.3 Valve connector make-up instructions

MALE AND FEMALE PIPE PORTS

Wrench flats are provided on the Valve Body. It is recommended a smooth- jawed wrench or vise be used to grip the Valve Body.

1. On the male threaded part of the connection, apply a high quality pipe joint compound or PTFE tape made for this purpose. When PTFE tape is used, it is recommended two full turns of tape be applied. PTFE tape should not be overhanging or covering the first thread
2. Engage the Valve and the other component part together, until hand-tight.
3. With a proper wrench, holding both the Valve and the component part, continue to tighten to achieve a leak-tight joint.

TUBE FITTING CONNECTIONS

Insert the tube into the Valve port until the tube bottoms out in the Valve Body. Care should be exercised to insure the tube is properly aligned with the Valve Body and port.

1. Normal make-up for US Customary port sizes 1 thru 3 (1/16 thru 3/16 inch) and SI port sizes 2 thru 4 (2 thru 4 mm) is 3/4 turn from finger tight. Normal make-up for US Customary port sizes 4 thru 16 (1/4 thru 1 inch) and SI port sizes 5 thru 25 (5 thru 25 mm) is 1 1/4 turn from finger tight. For larger port sizes consult Parker Ferrule Presetting Tool Instructions.

PLEASE FOLLOW THE ABOVE DIRECTIONS FOR COUNTING THE NUMBER OF TURNS FOR PROPER FITTING MAKE-UP. DO NOT MAKE-UP TUBE FITTINGS BY TORQUE OR "FEEL". VARIABLES SUCH AS TUBING AND FITTING TOLERANCES, TUBE WALL THICKNESS, AND THE LUBRICITY OF NUT LUBRICANTS CAN RESULT IN AN IMPROPERLY ASSEMBLED TUBE FITTING CONNECTION.

WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your applications and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

ALL PARKER VALVES MUST PASS A RIGID OPERATIONAL AND LEAKAGE TEST BEFORE LEAVING THE FACTORY. IT IS RECOMMENDED AFTER ANY REASSEMBLY, THE VALVE SHOULD BE TESTED BY THE USER FOR OPERATION AND LEAKAGE. IF THESE INSTRUCTIONS ARE NOT FULLY COMPLIED WITH, THE REPAIRED PRODUCT MAY FAIL AND CAUSE DAMAGE TO PROPERTY OR INJURY TO PERSONS. PARKER HANNIFIN CANNOT ASSUME RESPONSIBILITY FOR PERFORMANCE OF A CUSTOMER SERVICED VALVE.

Parker Hannifin Corporation Instrumentation Products Division
2651 Alabama Highway 21 North
Jacksonville, Alabama 36265-9681
Phone (256) 435-2130
Fax (256) 435-7718

Section 7 – Postscript

Section 7.1 ATOM Event Log

The ATOM Event Log creates and maintains a text file in the "C:\ATOM!" folder, where the alarms and critical events are logged in a chronological order. The folder and file are both named "AtomLog". The file can be viewed with Notepad or any program that can view/edit a text file. The log file or the AtomLog folder can be copied, moved or deleted at any time by the user. The Atom program will create a replacement folder and/or the file without losing data in the process. Each log entry has a date and time stamp, followed by a line of text describing the event. An "x" enclosed in brackets indicates a corresponding check box in the GUI that was checked/selected. Empty brackets indicate that the check box was un-checked/deselected. The logic state of a Digital Input is indicated in parenthesis where (*) indicates the alarm state of a Digital Input. The level of alarm is indicated by the names in parenthesis: (RED) Alarm, (YEL) Warn or (GRN) Normal.

16/07/13 09:03:02 ----------
16/07/13 09:03:02 ATOM SGA/SLA-1000 Event Log Settings SnapShot
16/07/13 09:03:02 where: (*) State = On , ( ) State = Off
16/07/13 09:03:02 where: (GRN) = NORMAL, (YEL) = Warning, (RED) = Alarm
16/07/13 09:03:02 ON OFF where: [x]=CheckedBox; [ ]= not CheckedBox
16/07/13 09:03:02 [x] Stream1 Select On
16/07/13 09:03:02 [x] Stream2 Select On
16/07/13 09:03:02 [x] DI-1 Alarm Check On
16/07/13 09:03:02 [ ] DI-1 Warn Check Off
16/07/13 09:03:02 [x] DI-2 Alarm Check On
16/07/13 09:03:02 [ ] DI-2 Warn Check Off
16/07/13 09:03:02 [x] DI-3 Alarm Check On
16/07/13 09:03:02 [ ] DI-3 Warn Check Off
16/07/13 09:03:02 [x] DI-4 Alarm Check On
16/07/13 09:03:02 [ ] DI-4 Warn Check Off
16/07/13 09:03:02 [ ] DI-5 Alarm Check Off
16/07/13 09:03:02 [ ] DI-5 Warn Check Off
16/07/13 09:03:02 [ ] DI-6 Alarm Check Off
16/07/13 09:03:02 [ ] DI-6 Warn Check Off
16/07/13 09:03:02 [ ] DI-7 Alarm Check Off
16/07/13 09:03:02 [ ] DI-7 Warn Check Off
16/07/13 09:03:02 [ ] Zero Alarm Check Off
16/07/13 09:03:02 [ ] Span Alarm Check Off
16/07/13 09:03:02 [ ] Zero Warn Check Off

16/07/13 09:03:02 [ ] Span Warn Check Off
16/07/13 09:03:02 [ ] Stream 1 Alarm State Off
16/07/13 09:03:02 [x] Stream 1 Warn State On
16/07/13 09:03:02 [ ] Stream 2 Alarm State Off
16/07/13 09:03:02 [x] Stream 2 Warn State On
16/07/13 09:03:02 (GRN) Zero Value L=0 V=3 H=4
16/07/13 09:03:02 (GRN) Span Value L=0 V=1983 H=2025
16/07/13 09:03:02 (YEL) Stream 1 Value L=1995 V=1984 H=2004
16/07/13 09:03:02 (YEL) Stream 2 Value L=1069 V=1077 H=1074
16/07/13 09:03:02 ----------

Upon log creation, a header of the current state is printed between two dashed lines. There are two blank lines to separate the block from normal event data for a visual indicator when reviewing the data..

16/07/13 09:04:59 (YEL) Stream 2 Value L=1069 V=1061 H=1074
16/07/13 09:06:20 (YEL) Stream 2 Value L=1069 V=1061 H=1074
16/07/13 09:10:24 (YEL) Stream 1 Value L=1995 V=1983 H=2004
16/07/13 09:11:45 (YEL) Stream 1 Value L=1995 V=1985 H=2004
16/07/13 09:13:06 (YEL) Stream 1 Value L=1995 V=1991 H=2004
16/07/13 09:17:10 (YEL) Stream 2 Value L=1069 V=1059 H=1074
16/07/13 09:18:32 (YEL) Stream 2 Value L=1069 V=1062 H=1074
16/07/13 09:19:52 (GRN) Stream 2 Value
16/07/13 09:23:55 (GRN) Stream 1 Value

A **(YEL) Stream 1 Value L=1995 V=1984 H=2004** indicates that the stream 1 value is in Warnings with low reading where L=lower limit, H=higher limit and V=reading. All values are expressed in ppm.

Other events include Check Calibration events as they occur.
16/07/13 09:58:22 Auto Check Time Set: 00:10:00 (DD:HH:MM)
16/07/13 09:59:09 (GRN) Stream 2 Value
16/07/13 10:00:00 Auto Check Event Initiated
16/07/13 10:00:40 Begin Zero Check cycle
16/07/13 10:03:30 End Zero Check Cycle
16/07/13 10:03:30 Begin Span Check cycle
16/07/13 10:06:19 End Span Check Cycle
16/07/13 10:06:19 Begin Validate Check cycle
16/07/13 10:09:09 End Validate Check Cycle
16/07/13 10:15:25 Calculate RF
16/07/13 10:15:28 Save Calibration

In the above example, the user has clicked on Calculate RF and Save Calibration buttons.

Setting Alarm Limits examples:

16/07/13 10:37:41 Stream 1 High set = 2050
16/07/13 10:37:41 (GRN) Stream 1 Value
16/07/13 10:37:55 Stream 2 High set = 1200
16/07/13 10:37:55 (GRN) Stream 2 Value
16/07/13 10:38:08 Stream 2 Low set = 1000

Setting Digital Inputs examples:
16/07/13 10:38:47 (*) DI-5 Alarm on (GRN)
16/07/13 10:38:48 (*) DI-6 Alarm on (GRN)
16/07/13 10:38:49 (*) DI-7 Alarm on (GRN)

External State Changes of DI-7 example:
16/07/13 10:39:43 DI-7 (RED) Alarm
16/07/13 10:40:53 DI-7 (OFF)

Section 7.2 ATOM Excel Trend Log

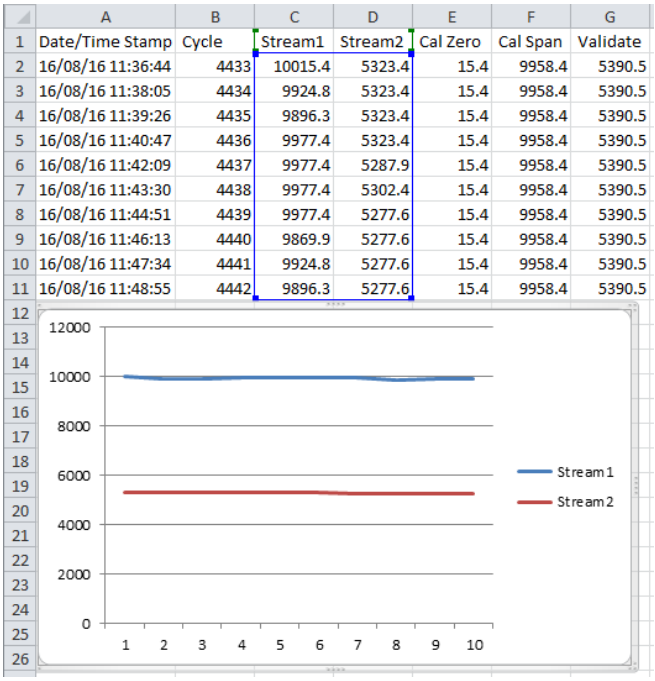
The SGA program will create and maintain a comma delimited Trend Log text file suitable for importing into EXCEL by the user.

1. The TrendLog.TXT is located in the "C:\ATOM!\AtomLog\" directory
2. The easiest way to import the TrendLog.TXT into Microsoft EXCEL, is to rename the file as TrendLog.CSV. Then double-clicking this file will open it in EXCEL, importing the data to the spreadsheet.

Following is an example of the ATOM Trend log file:

Date/Time Stamp, Cycle, Stream1, Stream2, Cal Zero, Cal Span, Validate
16/08/16 11:36:44 ,4433, 10015.4, 5323.4, 15.4, 9958.4, 5390.5
16/08/16 11:38:05 ,4434, 9924.8, 5323.4, 15.4, 9958.4, 5390.5
16/08/16 11:39:26 ,4435, 9896.3, 5323.4, 15.4, 9958.4, 5390.5
16/08/16 11:40:47 ,4436, 9977.4, 5323.4, 15.4, 9958.4, 5390.5
16/08/16 11:42:09 ,4437, 9977.4, 5287.9, 15.4, 9958.4, 5390.5
16/08/16 11:43:30 ,4438, 9977.4, 5302.4, 15.4, 9958.4, 5390.5
16/08/16 11:44:51 ,4439, 9977.4, 5277.6, 15.4, 9958.4, 5390.5
16/08/16 11:46:13 ,4440, 9869.9, 5277.6, 15.4, 9958.4, 5390.5
16/08/16 11:47:34 ,4441, 9924.8, 5277.6, 15.4, 9958.4, 5390.5

As mentioned earlier, if the above file is saved as TrendLog.CSV, and opened in Microsoft Excel, it will appear as below:



	A	B	C	D	E	F	G
1	Date/Time Stamp	Cycle	Stream1	Stream2	Cal Zero	Cal Span	Validate
2	16/08/16 11:36:44	4433	10015.4	5323.4	15.4	9958.4	5390.5
3	16/08/16 11:38:05	4434	9924.8	5323.4	15.4	9958.4	5390.5
4	16/08/16 11:39:26	4435	9896.3	5323.4	15.4	9958.4	5390.5
5	16/08/16 11:40:47	4436	9977.4	5323.4	15.4	9958.4	5390.5
6	16/08/16 11:42:09	4437	9977.4	5287.9	15.4	9958.4	5390.5
7	16/08/16 11:43:30	4438	9977.4	5302.4	15.4	9958.4	5390.5
8	16/08/16 11:44:51	4439	9977.4	5277.6	15.4	9958.4	5390.5
9	16/08/16 11:46:13	4440	9869.9	5277.6	15.4	9958.4	5390.5
10	16/08/16 11:47:34	4441	9924.8	5277.6	15.4	9958.4	5390.5
11	16/08/16 11:48:55	4442	9896.3	5277.6	15.4	9958.4	5390.5

Section 7.3 ATOM DCS Log

The SGA program will create and maintain a comma delimited DCS communication text file suitable for importing into EXCEL by the user.

1. The DCSLog.TXT maintains a running log of commands received by the ATOM from the DCS, i.e. the log records the status of Modbus Control Registers in the range R1 through R64.
2. The DCSLog.TXT is located in the "C:\ATOM!\AtomLog\" directory.

Following is an example of the ATOM DCS Log file:

" DCS: R2 Run = ON"
" DCS: R2 Run = OFF"
" DCS: R3 Calibrate Check Zero = ON"
" DCS: R3 Calibrate Check Zero = OFF"
" DCS: R4 Calibrate Check Span = ON"
" DCS: R4 Calibrate Check Span = OFF"
" DCS: R5 Calibrate Check Validate = ON"
" DCS: R5 Calibrate Check Validate = OFF"
" DCS: R6 Manual Zero Pulsed when Set = ON"
" DCS: R7 Analyzer = ONLINE"
" DCS: R7 Analyzer = OFFLINE"
" DCS: R9 Calculate RF = ON"
" DCS: R9 Calculate RF = OFF"
" DCS: R10 Purge Override = ON"
" DCS: R10 Purge Override = OFF"
" DCS: R11 Base Line Set = ON"
" DCS: R11 Base Line Set = OFF"
" DCS: R12 BL Enable = ON"
" DCS: R12 BL Enable = OFF"
" DCS: R13 Lamp State = ON"
" DCS: R13 Lamp State = OFF"
" DCS: R14 PMT State = ON"
" DCS: R14 PMT State = OFF"
" DCS: R15 AutoCheck State = ON"
" DCS: R15 AutoCheck State = OFF"
" DCS: R17 Inject Valve = INJECT State"
" DCS: R17 Inject Valve = VENT State"
" DCS: R18 Sample Valve = Shut Off State"
" DCS: R18 Sample Valve = Vent State "
" DCS: R19 Stream 1 State DO = On"
" DCS: R19 Stream 1 State DO = Off"

Section 7.4 Procedure To Auto-Tune Temperature Controller

Whenever the thermocouple is replaced, the Temperature Controller needs to be "Auto-Tuned" for optimal performance. This is an automatic procedure which sets the PID control parameters that the Temperature Controller uses to maintain the "set" temperature value.

Before beginning the Auto-Tuning procedure:

- Install the new thermocouple (verify that the polarity is correct)
- For proper Auto-Tuning, the furnace temperature must be cooled to less than 90% of the set point value (for a Set Point of 1050°C, less than 940 °C)
- Verify that the Furnace breaker is switched ON
- Verify that the Analyzer is in "Purge Override" (otherwise power to the furnace will remain disabled)

Begin:

Press the key while holding down the key and the Temperature Controller reads "AT" and the first line and "----" on the second line.

Press the key and both the top and bottom line on the Temperature Controller will read "AT".

Press the key to start the "Auto-Tune" procedure. The "**AT**" indicator will begin to flash ON and OFF, and the furnace temperature will begin to increase indicating that the Auto-Tune procedure is in progress.

Once the procedure is complete, the "AT" indicator will automatically turn OFF, and the optimized PID values should maintain the furnace at its set temperature.

***Note :** **During the Auto-tuning procedure it is normal for the furnace temperature to briefly over-shoot the set temperature value.**

Section 7.5 Calibration/Validation Procedure

The Calibrate settings screen *(Figure 1.1)* is where all information regarding instrument calibration and associated calibration results are displayed.

To access this screen press **Settings > Calibrate Settings**

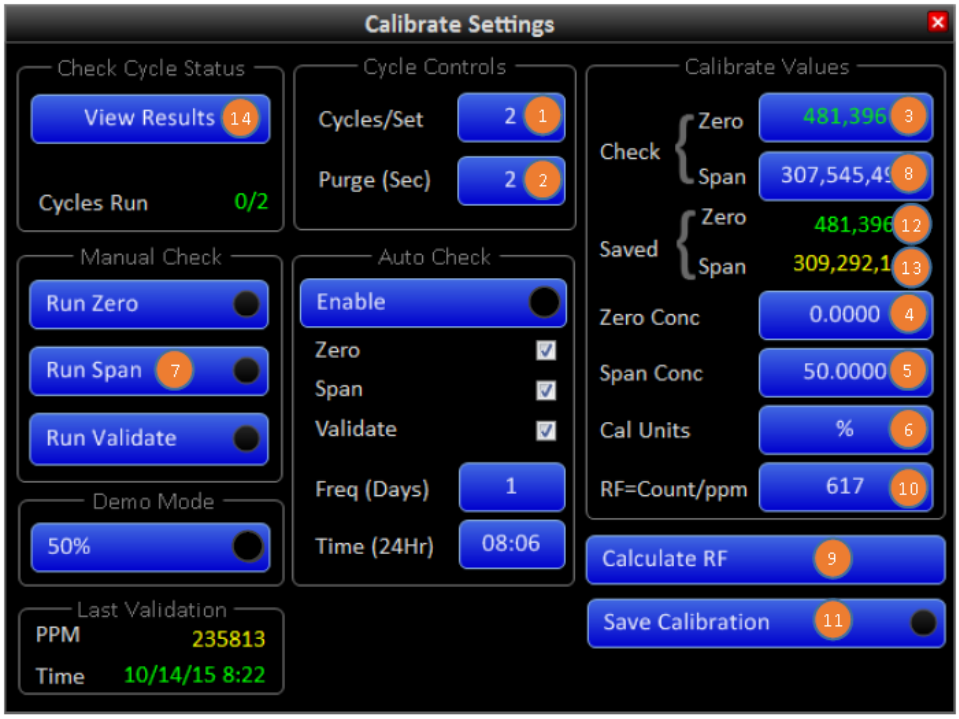


Figure 1.1 – Calibrate Settings Screen

Manual Calibration:

Settings

1. **Cycles/set** ①**:** Set this to 5.
2. **Purge (Sec)** ②: Set this to 60.
3. **Check Zero** ③: Set this to 0 (zero).
4. **Zero Conc** ④: Set this to 0 (Zero).
5. **Span Conc** ⑤: Set this to SO2 concentration in the span/cal standard.
6. **Cal Units** ⑥: Select unit based on the format of the value entered in **Span Conc**.

Procedure

1. Select **Run Span** ⑦. After 5 cycles of Span is completed, value in **Check Span** ⑧ will get updated.

2. Select **Calculate RF** ⑨. Wait for the value to get updated in **RF=Count/ppm** ⑩.
3. Select **Save Calibration** ⑪ after the indicator on this button turns green.
4. Values in **Saved Zero** ⑫ and **Saved Span** ⑬ will get updated and will be same as ③ & ⑧.

Manual Validation:

Settings

1. Keep all the settings same as in Manual calibration.

Procedure

1. Select **Run Span** ⑦.
2. Select **View Results** ⑭. Screen **Check Calibration Results** will open *(Figure 1.2).*

Check Calibration Results

Run	Zero		Span	
	Area	Conc %	Area	Conc %
1	0	0.00	309,236,128	50.36
2	0	0.00	308,633,134	50.26
3	0	0.00	306,712,151	49.95
4	0	0.00	304,737,106	49.63
5	0	0.00	306,421,694	49.90
6		0.00		0.00
7		0.00		0.00
8		0.00		0.00
9		0.00		0.00
10		0.00		0.00
Average	0	0.00	307,148,042	50.02

Figure 1.2 – Check Calibration Results Screen

3. After 5 cycles are completed the value at ⑮ should be value of SO2 concentration in span/cal standard.

Field Certification
Certificate of Compliance

Certificate: 2744021

Project: 2744021 **Date Issued:** 2014-08-29

Issued to: **ATOM Instrument, LLC.**
1656 Townhurst Dr.
Houston, TX. 77043
USA

Attention: Franek Oltowski

The products listed below are eligible to bear CSA Field Certification Labels, bearing the CSA Mark shown with adjacent indicators 'C' and 'US'.

C US

Issued by: Tony DeSousa CET

PRODUCTS

CLASS – 2258 02 – PROCESS CONTROL EQUIPMENT - For Hazardous Locations
CLASS – 2258 82 – PROCESS CONTROL EQUIPMENT - For Hazardous Locations - US requirements.

Class I Division 2 Groups B, C and D. T3, Purge type "Z".

Model ATOM TraceS-1000 rated; 120 Vac@25.0 Amps, 60 Hz.

CSA Field Certification Label(s) issued: FC 249403 to FC 249407.

APPLICABLE REQUIREMENTS

CSA Standard C22.2 No 0-10 - General Requirements - Canadian Electrical Code, Part II
CSA Standard C22.2 No 0.4-04 - Bonding of Electrical Equipment
CSA Standard C22.2 No 142-M1987 - Process Control Equipment

Certificate: 2744021

LTR 10E-2005	-	Purged and Pressurized equipment for use in Class I Hazardous Locations – North American (Division System) Purging based on NFPA- 496
UL 508 17th Ed.	-	Electric Industrial Control Equipment.
NFPA 496:2013	-	Purged and Pressurized Electrical Equipment.

MARKINGS

Y Submittor's name. Y
Model designation. Y
Electrical ratings. Y
Serial number.
Y Hazardous Location designation
Y Temperature code
Y Purge type
Y The following statement:

"WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CASS I, DIVISION. 2. Or equivalent

Y WARNING; Enclosure shall not be opened unless the area is known to be Non-hazardous, or unless all devices within the enclosure have been de-energised. Power must not be restored after enclosure has been opened until enclosure has been purged for 10 Minutes at 30 PSIG Note; Read all labels before operating this purged system.

Y "Type Z Purge System."

Y "WARNING; Hot internal components, wait 3 hours prior opening enclosure prior to work." Or equivalent.