SOLA II

Sulfur Online Analyzer
User Guide
P/N 90-1307-0

Revision AB

Part of Thermo Fisher Scientific

Thermo
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Revision History

Revision Level	Date	Comments
A	02-2004	Initial release.
B	04-2005	Applied standardized formatting, changes to analyzer menu, stream setup, autocal setup menus; added “At Line Grab Sample” menu and related items; edited Modbus register for software v. 1.20.
C	04-2006	Address change.
D	01-2007	Company name change (ECO 5457).
E	04-2007	Revised per ECO 5625.
F	08-2007	Revised per ECO 5921.
G	10-2007	Revised per ECO 6018.
H	03-2008	Revised per ECO 6230.
J	04-2008	Revised per ECO 6320.
K	06-2008	Revised per ECO 6419.
M	04-2009	Revised per ECO 6903.
N	05-2009	Revised per ECO 6915.
P	06-2009	Revised per ECO 6968.
R	04-2010	Revised per ECO 7351.
S	11-2010	Revised per ECO 7578.
T	01-2011	Revised per ECO 7627.
U	04-2011	Revised per ECO 7694.
V	01-2012	Revised per ECO 7897.
W	02-2013	Revised per ECO 8126.
X	01-2014	Revised per ECO 8332.
Y	11-2014	Revised per ECO 8545.
Z	06-2016	Revised per ECO 8659.
AA	06-2016	Revised per ECO 8667.
AB	01-2017	Revised per ECO 8995.

Contents

Chapter 1
Safety Information & Guidelines

This chapter contains information that must be read and understood by all persons installing, using, or maintaining this equipment.

Safety Considerations

Failure to follow appropriate safety procedures or inappropriate use of the equipment described in this manual can lead to equipment damage or injury to personnel.

Any person working with or on the equipment described in this manual is required to evaluate all functions and operations for potential safety hazards before commencing work. Appropriate precautions must be taken as necessary to prevent potential damage to equipment or injury to personnel.

The information in this manual is designed to aid personnel to correctly and safely install, operate, and maintain the system described; however, personnel are still responsible for considering all actions and procedures for potential hazards or conditions that may not have been anticipated in the written procedures. If a procedure cannot be performed safely, it must not be performed until appropriate actions can be taken to ensure the safety of the equipment and personnel. The procedures in this manual are not designed to replace or supersede required or common sense safety practices. All safety warnings listed in any documentation applicable to equipment and parts used in or with the system described in this manual must be read and understood prior to working on or with any part of the system.

Failure to perform the instructions and procedures in this manual or other documents pertaining to this system correctly can result in equipment malfunction, equipment damage, and/or injury to personnel.

Safety Summary

The following admonitions are used throughout this manual to alert users to potential hazards or important information. Failure to heed the warnings and cautions in this manual can lead to injury or equipment damage.

Warning Warnings notify users of procedures, practices, conditions, etc. which may result in injury or death if not carefully observed or followed. The triangular icons with warnings vary depending on the hazard. σ

Caution Cautions notify users of operating procedures, practices, conditions, etc. which may result in equipment damage if not carefully observed or followed. σ

Caution Static sensitive component. Appropriate handling precautions required to prevent damage. σ

Note Notes emphasize important or essential information or a statement of company policy regarding an operating procedure, practice, condition, etc. σ

Safety Operating Information

This section contains general safety and operating information applicable to analytical systems, which must be understood by all persons installing, using, or maintaining the analyzer system. This information is designed to aid personnel in the safe installation, operation, and service of the analyzer and sample systems. It is not designed to replace or limit appropriate safety measures applicable to work performed by personnel. Any additional safety and operating measures that are required must be determined by and followed by personnel performing work on the system.

Caution Failure to heed the following information may lead to equipment damage or injury to personnel. σ

Protective eyewear (glasses with side shields or goggles as appropriate) must be worn when servicing any part of the analyzer or sample system. When servicing the sample system, chemical resistant gloves appropriate for the materials in the system must be worn. When servicing the hot analyzer oven, internal components (e.g., detectors), or hot sample system components, appropriate gloves must be worn. Heated components should be allowed to cool before servicing if possible. Other appropriate equipment or clothing must be used as required by the type of work performed.

Caution Ovens, internal components, and sample systems may be hot even when power is not applied to the unit. Take appropriate precautions to prevent injury resulting from contact with hot items. σ

All applicable regulations and procedures must be followed for the work performed. Before beginning any work on the system, carefully consider all the potential hazards and ensure that appropriate measures are taken to prevent injury to personnel and damage to equipment.

Electrical Power

The system uses AC power at 110 Vac (an optional step-down transformer is available for 220 Vac). The AC power is converted to DC at several voltage levels. Appropriate precautions must be taken to prevent sparks present in the analyzer environment that may ignite combustible materials. Precautions must also be taken to prevent electrical shock if the analyzer or sample system enclosures are opened.

The AC power to the system must be free from noise, surges, sags, and spikes for proper system operation. AC power circuit breakers and wiring must be sized properly for the required current. All wiring installations must meet applicable electrical codes.

The fuse is located on the analyzer terminal block.

Caution If it becomes necessary to replace the fuse, it must be replaced with one of the same rating: Fuse, 3 A S/B (p/n TE-4510). σ

Warning Remove power prior to performing any work internal to the instrument. An override is available for use in non-hazardous areas; however, removal of components while the instrument is energized is not permitted. σ

Chapter 2
Product Overview

The Thermo Scientific SOLA II sulfur online analyzer combines proven detection technology, easy-to-use, menu-driven software, and advanced diagnostics to offer unsurpassed flexibility and reliability. The instrument offers field programmable ranges, high sensitivity, total sulfur measurement, fast response time, linearity through all ranges, and low consumables.

Function

Major components of the SOLA II include a sample injection valve, carrier gas flow control system, mixing chamber, pyrolyzer, optional dryer, and a pulsed ultraviolet fluorescence (PUVF) detector. Unlike the original SOLA instrument, the PUVF is not a subassembly. The SOLA II is a single assembly with one software program and one user interface.

The sample injection valve periodically transfers a small amount of sample (approximately 1.0 µL) into an air carrier gas. The air/sample mixture passes through the mixing chamber to ensure complete mixing and then flows to the pyrolyzer. The pyrolyzer combusts all sample components to SO_2, CO_2, and H_2O at approximately 1100°C (2012°F). The optional dryer (application dependent) removes water from the sample that is produced during combustion. The PUVF detector accurately measures the amount of SO_2 produced during combustion of the sample.

An appropriate sample conditioning system is mandatory for proper functioning. The sample conditioning system should:

- Regulate sample pressure and temperature.
- Provide filtration to at least a 0.5-micron particle size. Staged filtration is recommended (e.g. going from 10 micron to 5 micron to 0.5 micron). The final filter should contain a hydrophobic element to remove undissolved water.
- Ensure that a representative sample is transported to the analyzer in the desired time.
- Maintain the sample in a single phase.

Note Liquid samples with high vapor temperatures such as naphthas and gasolines will require sample backpressure regulation +0 25–35 psig. σ

λ Remove undissolved water.

Sample should be delivered to the sample conditioning system using a sample probe. The sample probe should be designed and fabricated so that sample is extracted from near the center of the process pipe, preventing the unnecessary introduction of pipe scale and other particulate that tend to accumulate along the process pipe walls.

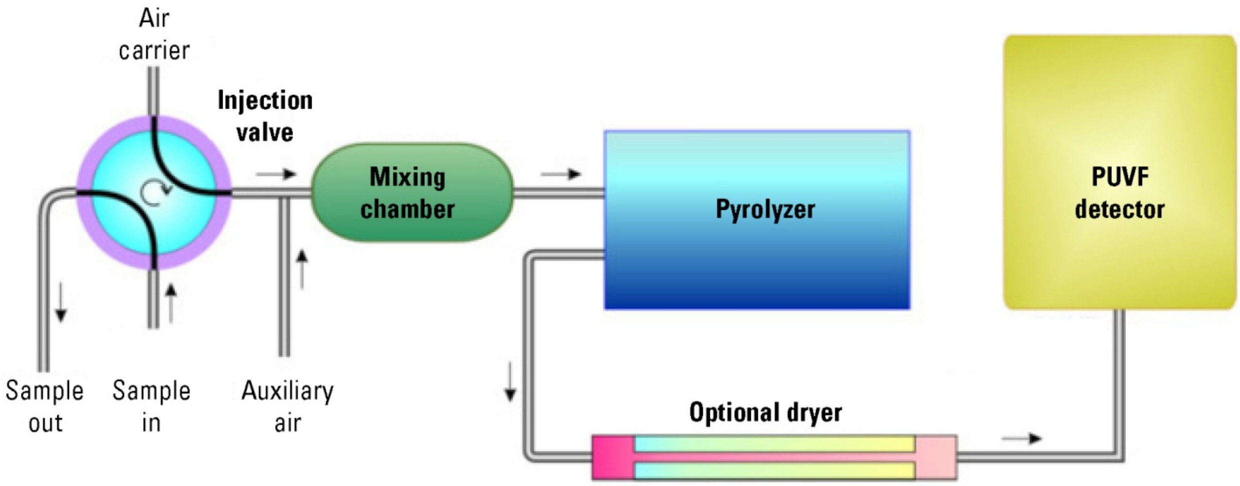

Figure 2–1. Functional block diagram

Total Sulfur Measurement

Total sulfur measurement is based upon the precise measurement of the SO_2 concentration produced from a wide variety of compounds containing sulfur, such as H_2S, COS, methyl mercaptan, benzothiophenes, dibenzothiophenes, sulfides, disulfides, and thiols. Consider the measurement of a sample of diesel, gasoline, or another common petroleum fraction such as naphtha for liquid phase samples. For liquid phase samples, the analyzer periodically injects a very small quantity of sample (1.0 µL) of the petroleum fraction into a hot oven (110°C to 220°C / 230°F to 428°F) where it is vaporized and mixed with air. Analysis of gas phase samples requires sample sizes of 0.1 to 1.0 cm^3. After thoroughly mixing with air, the sample enters the pyrolyzer, where all components of the sample are combusted at 1100°C (2012°F) to CO_2, H_2O, or SO_2. The quantity of SO_2 formed during the combustion process is directly proportional to the total sulfur content of the petroleum fraction.

The analyzer is equipped with a PUVF detector that accurately measures the quantity of SO_2 formed during the combustion process. The SO_2 molecules enter the cell of the PUVF detector where they are exposed to ultraviolet (UV) light. Absorption of UV light by SO_2 molecules results in an excited state of the SO_2 molecules. The excited state SO_2 molecules exist at a higher energy state (due to absorption of energy in the form of UV light) and rapidly relax to their original energy level or ground state through the emission of light. This process is called fluorescence. The intensity of the light emitted by SO_2 fluorescence is directly proportional to the SO_2 concentration. Pulsing the UV light allows more energy (UV light) to be delivered to the sample, increasing the fluorescence intensity for a given SO_2 concentration. This results in increased overall sensitivity of the instrument.

At the PUVF detector, it is important to ensure that the measured light is representative of only the SO_2 concentration and not some other species. SO_2 molecules emit light through fluorescence at a specific wavelength, and the PUVF detector utilizes bandpass filters to ensure that only light from SO_2 is measured. Once the proper wavelength of light is selected, its intensity is measure by a photomultiplier tube (PMT). The PMT converts light energy to electrical energy through manipulation of the photoelectric effect. The electrical signal generated by the PMT is finally processed by the analyzer electronics and software to determine and report the concentration of total sulfur in the liquid petroleum fraction or gas sample.

The analyzer can be configured to report total sulfur in parts per million (ppm), parts per billion (ppb), or milligrams per liter (mg/L).

- When using the ppm or ppb units of measure, you can choose to calibrate the analyzer in terms of ppm (w/w), ppm (v/v), ppm (w/v), ppb (w/w), ppb (v/v), or ppb (w/v).
- When using density compensation and the ppm or ppb units are selected, the display shows ppm/weight or ppb/weight.

Units of concentration calculated on a weight/weight basis are sensitive to sample density. If the density of the calibration standard is significantly different from the density of the sample, a density correction should be applied.

- If the sample density varies significantly, a density correction is also necessary when using concentration units of ppm (w/w) or ppb (w/w).
- If using mg/L, ppm (w/v), ppm (v/v), ppb (w/v), or ppb (v/v), a density correction is not required.

Principle of Operation

The detector is based on the principle that SO_2 molecules absorb UV light and become excited at one wavelength, then decay to a lower energy state emitting UV light at a different wavelength. Specifically,

$$SO_2 + hv_1 \longrightarrow SO_2^* \longrightarrow SO_2 + hv_2$$

* = Excited state
hv_1 = Exposure light at excitation wavelength
hv_2 = Emitted light at emission wavelength

The sample inlet bulkhead draws the sample into the analyzer. The sample is mixed with air and passes through a pyrolyzer furnace that oxidizes the sulfur molecules in the sample to produce SO_2. The sample then flows into the fluorescence chamber where pulsating UV light excites the SO_2 molecules. The condensing lens focuses the pulsating UV light onto a mirror assembly. The mirror assembly contains four selective mirrors that reflect only the wavelengths that excite SO_2 molecules.

As the excited SO_2 molecules decay to lower energy states, they emit UV light that is proportional to the total sulfur concentration in the sample. The bandpass filter allows only the wavelengths emitted by the excited SO_2 molecules to reach the PMT, which detects the UV light emission. The photo detector, located at the back of the fluorescence chamber, continuously monitors the pulsating UV light source to provide compensation for fluctuations in the UV light source. The measured SO_2 concentration (representing total sulfur in the sample) is processed, displayed on the front panel display, and sent to the analog outputs.

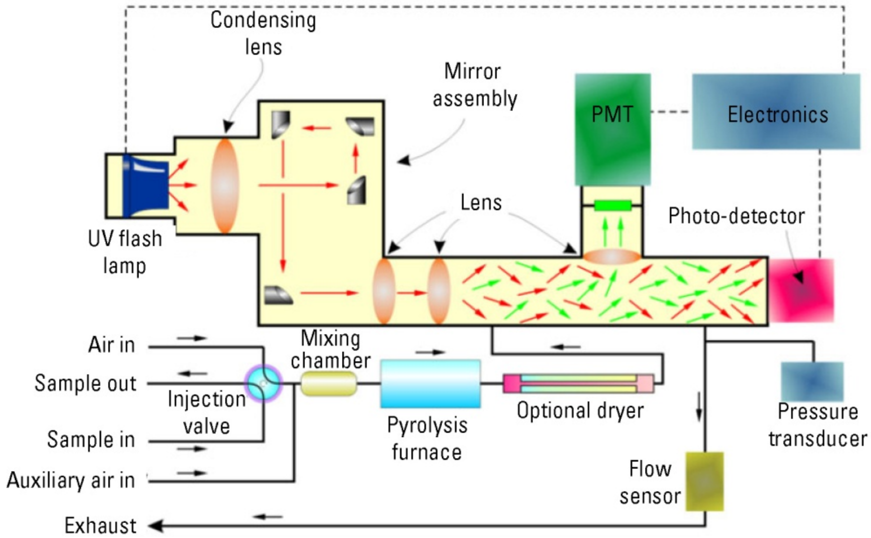

Figure 2–2. Typical functional flow diagram

PUVF Detector

The PUVF detector includes and controls the following:

- UV pulsed light and associated systems
- Reaction chamber temperature control
- Digitizing of PMT signal
- Smoothing of measurement signal using moving average

Pyrolyzer

Measuring total sulfur with the PUVF detection method requires the conversion of all sulfur compounds in the sample to SO_2. This is typically accomplished with the pyrolyzer, an electrically heated furnace designed by Thermo Fisher Scientific. The pyrolyzer typically operates at a temperature of 1100°C (2012°F) to oxidize sulfur without need for a catalyst.

Figure 2–3. Pyrolyzer

Dryer

The optional Perma Pure dryer removes moisture from the sample prior to its entry into the PUVF detector. A filter is positioned before the dryer to protect it from impurities. Dryer tubing consists of multiple small tubes encased in a large outer tube. Air circulates through the outer tube with sample passing through the inner tube. Moisture passes from the sample through the tubing where it is carried to the condensate drain by the airflow in the outer tube.

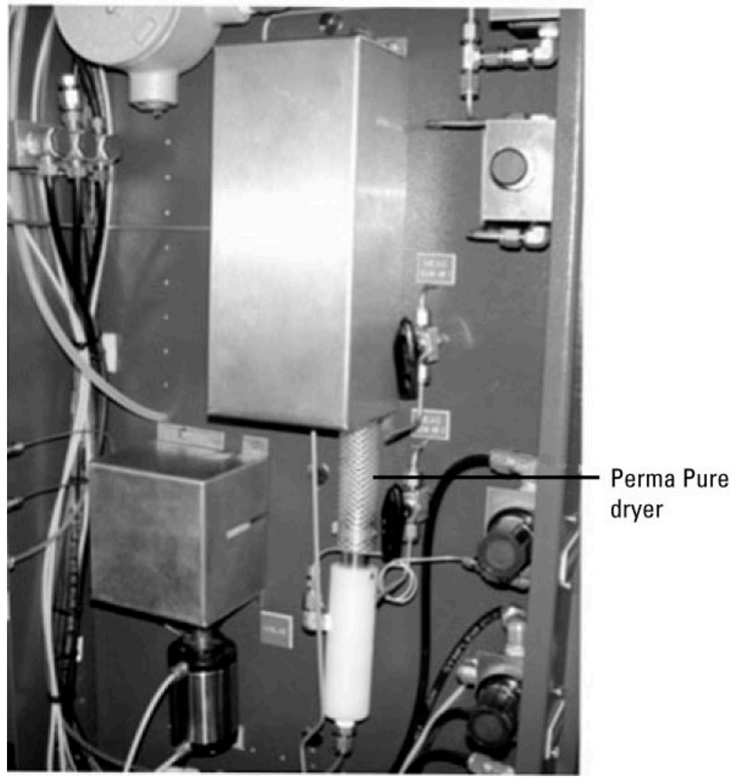

Figure 2–4. Optional dryer

Mixing Chamber

The mixing chamber mixes the gases and permits the sample to vaporize to a gaseous state before entering the pyrolyzer.

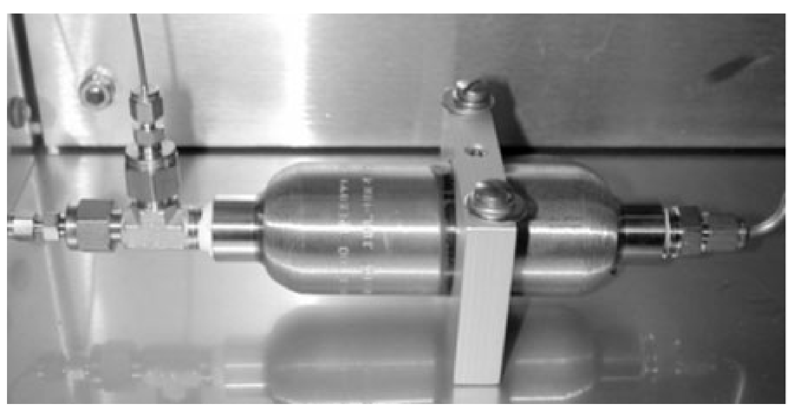

Figure 2–5. Typical mixing chamber

Injection Valve

The injection valve periodically injects precisely measured quantities of the sample stream into a controlled carrier airflow. An auxiliary airflow is added to this sample and air mixture. The sample then passes to the mixing chamber where it vaporizes (if necessary) and is thoroughly mixed with the air. See Appendix B for rotary injection valve service.

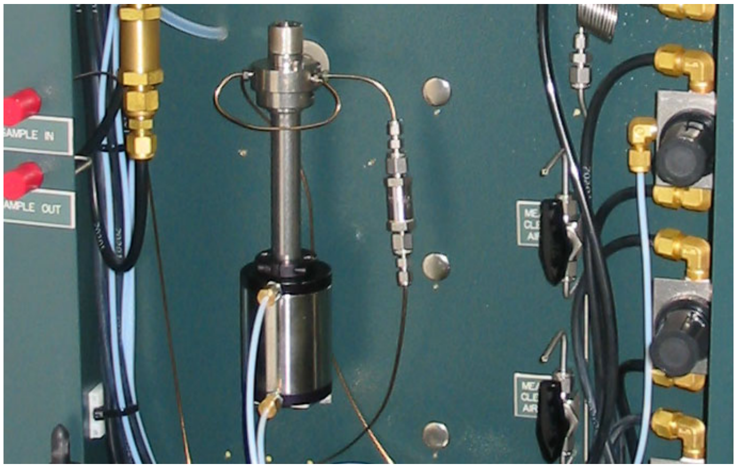

Figure 2–6. Injection valve

Specifications

Results may vary under different operating conditions.

Table 2–1. Mechanical specifications

Mechanical specifications	
Dimensions, H x W x D	40 x 24 x 18 in (102 x 61 x 46 cm)
Weight	Approximately 200 lb (91 kg)
Mounting	Wall or rack mount
Ambient temperature	12ºC to 40ºC (54ºF to 104ºF)
Incoming purge air temperature	12ºC to 40ºC (54ºF to 104ºF)
Area classification	CSA: Class 1, Div. 2, Groups B, C, D, T2, or T3 (T3 optional with back-up purge system) Class 1, Div. 1, Groups B, C, D, T2, or T3 (optional, X-Purge system; T3 optional with back-up purge system) ATEX: Zone 1, G Ex pxb IIC T Gb (optional, X-Purge system; T3 and T4 optional with back-up purge system) II 3 G Ex pz IIC T3 Gc, SOLA II Flare or CV. T3 or T4 optional with back-up purge system, standard SOLA II IECEx: G Ex pz IIC T Gc (T3 and T4 with back-up purge system) Zone 1, G Ex px IIC T Gb (X-Purge system); T3 and T4 with back-up purge system)

Table 2–2. Analytical specifications

Analytical specifications	
Detector	Pulsed UV fluorescence with pyrolyzer for total sulfur measurement
Full scale range	Ranges from 0–5 ppm (w/w) to 0–50,000 ppm (w/w) (consult factory for other ranges). Unique ranges may be assigned to Streams 1 and 2. Trace option enables 0–2 ppm (w/w) measuring range with LDL of 25 ppb (consult factory for other ranges).
Repeatability	Calculated at 1 standard deviation ±1% of full scale at 2x injections per minute ±2% of full scale at 1x injection per minute Standard SOLA II (not Trace level) for full scale ranges of 10ppm or lower, the repeatability is ±2% of full scale at 2x injections per minute.
Linearity	Equal to repeatability, for ranges >1% full scale, consult factory for linearity specification.

Response time	Programmable. Analyzer is semi-continuous; initial response occurs at each injection
Calibration	Automatic or Manual, with ability for Distributed Control System (DCS) to force an autocal (via contact inputs or Modbus)
Calibration method	External standard(s), 2-point calibration

Table 2–3. Controller specifications

Controller specifications	
Display	4-line x 20-character, vacuum fluorescent display, indicating stream selected, range selected, or off-line
User interface	4 buttons with context-sensitive functions
Streams	Dual streams optional with autostream select or DCS control of stream selection
Alarms	Standard: I/O board time-out, oven/pyrolyzer temperature, valve fault (lamp rate of change), chamber flow, chamber temperature, lamp voltage, autocal fail, HIGH and HIGH HIGH concentration Optional: Sample flow, analog input board time-out
Alarm relays/indicators	SPST, 2 A at 240 Vac or 10 A at 24 Vdc; 8 total
Analog signal output	Isolated, 4–20 mA; 2 total
Analog signal load	$\leq$ 600 ohms
Inputs	Dry contact; remote suspend, remote calibration, remote range select, remote stream select
I/O ports	Standard: RS485 Modbus RTU; RS485/RS232 Modbus RTU Optional: TCP/IP encapsulated Modbus, browser-enabled interface

Table 2–4. Other specifications

Other specifications	
AC power	Standard: 110 Vac, 50/60 Hz at 2000 W Optional: 220 Vac, 50/60 Hz
Oven and purge air	Instrument air: 55–100 psig, water and oil free; -40ºC (-40ºF) dew point, particles ≤ 5 m, ISA grade hydrocarbon free, 8 SCFM (maximum)
Carrier and auxiliary air	Zero grade air: 80 psig, 300 sccm (maximum) Heliox (79% helium, 21% oxygen): 80 psig, 200 sccm (maximum), for trace option
Sample tubing	316 stainless steel, cleaned and free from oils, moisture, and debris
Sample wetted components	316 stainless steel, Teflon®, and graphite-filled Teflon; others application dependent (Kalrez, Viton)

Parts List

The following table lists the SOLA II / SOLA II Trace parts.

Note Unless otherwise specified, the parts listed below are for the SOLA II and the SOLA II Trace units. σ

Table 2–5. SOLA II / SOLA II Trace parts list

P/N	Description
75-1350-0	Actuator, standard temperature, air, 36 deg, 10-port
75-1348-0	Actuator, standard temperature, air, 90 deg, 6-port
89-2913-0	Assembly, Lookout Software
TE-8812	Attenuator, photo cell
TE-8887	Base assembly, PMT
TE-57P713-1	Bench assembly, SOLA II standard unit
TE-57P7125-1	Bench assembly, SOLA II Trace unit
88-1216-0	Cable, DB9 for RS232 Modbus
TE-6279	Cable, RS232, assembly 6'
88-1217-0	Cable, TCP/IP to CPU
00-1010-S	Cal standard for liquid units (specify volume, S concentration, and fluid, i.e. liter, 6 ppm wt/wt thiophene in #2 diesel)
TE-5365	Connector pins, male, bench

P/N	Description
TE-4609	Connector, housing, male pin, bench
97-1592-1	Critical operation spare parts kit, Dinfa valve, liquid applications
97-1592-2	Critical operation spare parts kit, Valco valve, gas applications
97-1592-0	Critical operation spare parts kit, Valco valve, liquid applications
TE-8719	Detector filter
TE-8335	Detector lens
TE-8851	Diffuser, photo cell
75-1334-0	Dinfa valve slider 1.2 µl
19-1182-0	Discs, thermal, T2
19-1183-0	Discs, thermal, T3
TE-8544	Feet, rubber, shock mounts, optical bench
32-5000	Ferrule, Vespel, graphite, 1/16", for fitting to mixer
TE-8852	Filter, detector
HA-100153	Filter, disposable, PUVF inlet, not used with Perm-A-Pure
47-1362-0	Filter, inlet, 2 micron (used for sample and air inlet)
HA-101291	Filter, Perm-A-Pure Dryer
25-1352-0	Flow switch, SS, explosion proof, 1/8” FNPT, SPDT
89-2839-0	Furnace, pyrolyzer, complete assembly
TE-4510	Fuse, 3 amp S/B (PK/5)
18-1579-0	Gauge, 0-100 psi, 1.5 DL, 1/8 CBM
18-1576-0	Gauge, 0-15 psi, 1/5 DL, 1/8 CBM
18-1577-0	Gauge, 0-30 psi, 1/5 DL, 1/8 CBM
HA-101812	Graphite ferrules, reaction tube, furnace
25-6005	Heater, 1000 W, oven
29-1230-0	Heater, fiber insulated, pyrolyzer
64-1301-0	Heater, wire sleeve, flameless burner
TE-9886	Instrument cover
27-1068-0	Key
49-1161-0	Keypad, numeric, 4-position
97-1580-0	Kit, TCP/IP Ethernet, Modbus
97-1403-0	Kit, valve inject
TE-8666	Lamp, xenon, PUVF flash
TE-8892	Lens assembly, detector, complete

P/N	Description
TE-8703	Lens, bi-convex
TE-8333	Lens, condensor
TE-8076	Lens, convex plano-aci
TE-8739	Lens, plano convex- aci
TE-8850	Lens, relay
97-1626-0A	Malema flow switch kit
31-1354-0	Manifold assembly, 4-position with solenoid
TE-8888	Mirror assembly, complete, SOLA II standard unit
TE-57P746	Mirror assembly, dual, complete, SOLA II Trace unit
TE-87420	Mirror, entrance
35-1527-0	Mounting bracket, TCP/IP PCB
97-1590-1	One-year spare parts kit, Dinfa valve, liquid phase applications
97-1590-2	One-year spare parts kit, Valco valve, gas phase applications
97-1590-0	One-year spare parts kit, Valco valve, liquid phase applications
TE-4811	O-ring
TE-4808	O-ring (between reaction chamber)
63-1150-0	O-ring kit, Dinfa valve actuator
63-1143-0	O-ring kit, low temperature for Valco valve actuator
TE-4829	O-ring, chamber entrance
TE-4831	O-ring, detector filter
TE-4820	O-ring, lens relay
TE-4830	O-ring, photo cell
TE-4808	O-ring, photo cell conic
63-1135-0	O-ring, pyrolyzer furnace
89-2896-0	PCB, 4-20 mA input
TE-8943	PCB, A/D
TE-8884	PCB, flasher intensity (photo detector)
TE-9681	PCB, flasher supply
TE-8951	PCB, input, PMT signal
89-2899-0	PCB, Modbus RS485, dual channel
TE-9829	PCB, motherboard
55-1228-0	PCB, Netburner TCP/IP Ethernet 10/100
TE-8949	PCB, PUVF DC power supply

P/N	Description
TE-8765	PCB, PUVF temperature control
89-2897-0	PCB, CPU
89-2803-0	PCB, stream relay
89-2898-0	PCB, digital I/O
TE-8684	Plate, filter lens
TE-8868	PMT, SOLA II standard unit
TE-8391	PMT, SOLA II Trace unit
TE-8165	Power cord, 115 V
85-1173-0	Power supply, 110/220 Vac +5 V, ±12 V, for PCB, input option
85-1164-0	Power supply, 24 VDC , DIN rail mount
TE-9901	Power supply, PMT
32-0024	Reducing union, 316 SS 1/8 tube x 1/16 tube
14-1435-0	Regulator, pressure, 0-100 psi, SS case
30-2009	Regulator, pressure, 0-25 psi, 4-way mini
HA-100645	Relay, solid state
25-1001	RTD, used for oven heater
TE-8869	Socket assembly, PMT
97-1646-0	Quick repair kit
97-1644-0	N_2, addition, field installation
97-1651-0	Solenoid manifold adapter kit
31-0030	Solenoid, 24 Vdc, 5-port, 4-way, 2-position, manifold mount
31-1367-0	Solenoid, 24 Vdc, 5-port, 4-way, 2-position, manifold mount
97-1589-1	Startup spare parts kit, Dinfa valve, liquid phase applications
97-1589-2	Startup spare parts kit, Valco valve, gas phase applications
97-1589-0	Startup spare parts kit, Valco valve, liquid phase applications
25-1189-0	Switch, differential pressure, 0.2 inH_2O
25-1137-0	Switch, pressure sensor, 0-15 psi adj, oven and burner
68-2139-2	Tee, 1/4" x 1/8", Sulfinert
68-2138-2	Tee, 1/8", Sulfinert
89-2650-G	Temperature controller, furnace, Watlow, complete Centalac
89-2089-G	Temperature controller, oven, Watlow, complete Centalac
29-1113-0	Temperature controller, Watlow
56-1150-0	Terminal block, two pole, ceramic, SS connectors

P/N	Description
5382	Thermistor IM-1002-A5
27-1108-0	Thermocouple, S type
TE-9934	Transducer, flow
TE-9877	Transducer, pressure assembly
TE-8774	Trigger pak for SOLA II bench, standard unit
TE-8392	Trigger pak for SOLA II bench, Trace unit
30-1025-0	Tube, quartz pyrolyzer furnace, looped
64-1304-0	Tubing, 1/16”, Sulfinert
64-1051-0	Tubing, 1/16" OD x 0.02” ID SS
40-0614	Tubing, 1/16" OD x 0.01" ID, SS, capillary
64-1305-0	Tubing, 1/4", Sulfinert
64-1303-0	Tubing, 1/8”, Sulfinert
40-0611	Tubing, black nylon, 1/4" OD x 0.035” wall
40-0609	Tubing, FEP, 0.125” OD x 0.062” ID, high temperature
40-0600	Tubing,1/8” OD x 0.085” ID, 0.020, 304SS
97-1591-1	Two-year spare parts kit, Dinfa valve, liquid phase applications
97-1591-2	Two-year spare parts kit, Valco valve, gas phase applications
97-1591-0	Two-year spare parts kit, Valco valve, liquid phase applications
75-1343-0	Valve head, Valco, 10-port
75-1333-0	Valve head, Valco, 6-port
45-1837-0	Valve, 3-way, air operated
75-1335-0	Valve, Dinfa, 8-port, 1.2 µl, complete assembly
45-1823-0	Valve, Valco rotor 1.0 µl, 6-port
45-1835-0	Valve, Valco rotor, 10-port
75-1340-0	Valve, Valco, 10-port, complete assembly
75-1332-0	Valve, Valco, 6-port, 1µl, complete assembly with rotor
45-1235-0	Valve, 3-way ball, tube to tube, 316SS, TFE seat, 1/8” port size

Spare Parts

Table 2–6. SOLA II spare part kits

P/N	Description	
97-1589-0	Startup spare parts kit, Valco valve, liquid phase applications	
	Qty.	Includes
	4	Ferrules for pyrolyzer tube fittings, graphite
	2	Pyrolyzer tube, looped
	2	Pyrolyzer, O-ring 5 5/8” ID x 5 7/8” OD, 1/8” width
	2	Rotor, liquid sample valve, 1.0 µl, 4-port or 6-port
97-1590-0	One-year spare parts kit, Valco valve, liquid phase applications	
	Qty.	Includes
	1	Heater for pyrolyzer assembly
	4	Ferrules for pyrolyzer tube fittings, graphite
	2	Pyrolyzer tube, looped
	2	Pyrolyzer, O-ring 5 5/8” ID x 5 7/8” OD, 1/8” width
	1	Thermocouple, pyrolyzer S type
	4	Rotor, liquid sample valve, 1.0 µl, 4-port or 6-port
	1	O-ring kit for liquid injection valve actuator
	1	Filter, inline, 2 micron, 1/8” tube
	1	Filter, inline, 0.5 micron, 1/8” tube
97-1591-0	Two-year spare parts kit, Valco valve, liquid phase applications	
	Qty.	Includes
	2	Heater for pyrolyzer assembly
	8	Ferrules for pyrolyzer tube fittings, graphite
	3	Pyrolyzer tube, looped
	4	Pyrolyzer, O-ring 5 5/8” ID x 5 7/8” OD, 1/8” width
	1	Filter, inline 2 micron, 1/8” tube connections
	1	Thermocouple, pyrolyzer S type
	1	6-port liquid valve head with internal sample loop
	8	Rotor, liquid sample valve, 1.0 µl, 4-port or 6-port
	2	O-ring kit for liquid injection valve actuator
	1	UV flash lamp
	2	Filter, inline 0.5 micron, 1/8” tube
	1	Injection valve assembly, complete

P/N	Description	
97-1592-0	Critical operation spare parts kit, Valco valve, liquid phase applications	
	Qty.	Includes
	1	Optical bench assembly
	1	Valve, complete 6-port for liquid
	1	Pyrolyzer assembly
	1	Power supply board for SO_2 bench
	1	Trigger pak
	1	Flasher supply board
	1	I/O PCB
97-1589-2	Startup spare parts kit, Valco valve, gas phase applications	
	Qty.	Includes
	4	Ferrules for pyrolyzer tube fittings, graphite
	2	Pyrolyzer tube, looped
	2	Pyrolyzer, O-ring 5 5/8” ID x 5 7/8” OD, 1/8” width
	2	Rotor, 10-port, gas
97-1591-2	Two-year spare parts kit, Valco valve, gas phase applications	
	Qty.	Includes
	2	Heater for pyrolyzer assembly
	8	Ferrules for pyrolyzer tube fittings, graphite
	3	Pyrolyzer tube, looped
	4	Pyrolyzer, O-ring 5 5/8” ID x 5 7/8” OD, 1/8” width
	1	Filter, inline, 2 micron, 1/8” tube connections
	1	Thermocouple, pyrolyzer S type
	1	10-port valve head, gas
	4	Rotor, 10-port, gas
	2	O-ring kit for liquid injection valve actuator
	1	UV flash lamp
	2	Filter, inline, 0.5 micron, 1/8” tube
	1	Valve, complete 10-port for gas

P/N	Description	
97-1592-2	Critical operation spare parts kit, Valco valve, gas phase applications	
	Qty.	Includes
	1	Optical bench assembly
	1	Valve, complete 10-port for gas
	1	Pyrolyzer assembly
	1	Power supply board for SO_2 bench
	1	Flash intensity board assembly
	1	I/O PCB
	1	Trigger pack
	1	Flasher supply board
97-1589-1	Startup spare parts kit, Dinfa valve, liquid phase applications	
	Qty.	Includes
	4	Ferrules for pyrolyzer tube fittings, graphite
	2	Pyrolyzer tube, looped
	2	Pyrolyzer, O-ring 5 5/8” ID x 5 7/8” OD, 1/8” width
	1	Slider block, 1.2 μl
97-1590-1	One-year spare parts kit, Dinfa valve, liquid phase applications	
	Qty.	Includes
	1	Heater for pyrolyzer assembly
	4	Ferrules for pyrolyzer tube fittings, graphite
	2	Pyrolyzer tube, looped
	2	Pyrolyzer, O-ring 5 5/8” ID x 5 7/8” OD, 1/8” width
	1	Thermocouple, pyrolyzer S type
	1	Slider block, 1.2 μl
	1	Filter, inline, 2 micron, 1/8” tube
	1	Filter, inline, 0.5 micron, 1/8” tube

97-1591-1	Two-year spare parts kit, Dinfa valve, liquid phase applications	
	Qty.	Includes
	2	Heater for pyrolyzer assembly
	8	Ferrules for pyrolyzer tube fittings, graphite
	3	Pyrolyzer tube, looped
	4	Pyrolyzer, O-ring 5 5/8” ID x 5 7/8” OD, 1/8” width
	1	Filter, inline, 2 micron, 1/8” tube connections
	1	Thermocouple, pyrolyzer S type
97-1591-1	Two-year spare parts kit, Dinfa valve, liquid phase applications	
	1	Slider block, 1.2 μl
	1	UV flash lamp
	2	Filter, inline, 0.5 micron, 1/8” tube
97-1592-1	Critical operation spare parts kit, Dinfa valve, liquid phase applications	
	Qty.	Includes
	1	Solenoid relay PCB
	1	Valve, complete 8-port, 1.2 μl
	1	Optical bench assembly
	1	Pyrolyzer assembly
	1	Power supply board for SO_2 bench
	1	Trigger pak
	1	Flasher supply board
	1	I/O PCB

Table 2–7. SOLA II Trace spare parts kits

97-1592-3	Critical operation spare parts kit, Valco valve, liquid phase applications	
	Qty.	Includes
	1	Valve, inject, 1/16 6-port 1µl, 150 psi, 175°C
	1	Optical bench assembly
	1	Trigger pak, for SO_2 bench
	1	Pyrolyzer assembly
	1	Board, power supply for SO_2 bench
	1	Board, flasher supply for SO_2 bench
	1	PCA, SOLA II I/O circuit PCBA
97-1592-4	Critical operation spare parts kit, Valco valve, gas phase applications	
	Qty.	Includes
	1	Valve, 10-port, 1/16", 150 psi, 175°C
	1	Optical bench assembly
	1	Trigger pak, for SO_2 bench
	1	Pyrolyzer assembly
	1	Board, power supply for SO_2 bench
	1	Board, flasher supply for SO_2 bench
	1	PCA, SOLA II I/O circuit PCBA

Table 2–8. Valco injection valve replacement parts

P/N	Description
89-2803-0	Solenoid relay PCB
29-1230-0	Heater for pyrolyzer assembly
HA-101812	Ferrules for pyrolyzer tube fittings, graphite
30-1025-0	Pyrolyzer tube, looped
63-1135-0	Pyrolyzer chamber O-ring seal
47-1362-0	Inline micron filter for orifice flow
27-1108-0	Thermocouple
75-1332-0	Injection valve assembly, 6-port, 1.0 µl
75-1333-0	Injection valve head
45-1823-0	Injection valve rotor, 1.0 µl
63-1143-0	Injection valve O-rings (actuator, low temperature)
TE-9934	Flow transducer assembly

P/N	Description
TE-8868	PUVF PMT
TE-8943	A/D PCB
TE-8949	PUVF DC power supply board
TE-8774	PUVF lamp trigger pak (consult factory for SOLA II Trace)
TE-8884	PUVF flash intensity board (consult factory for SOLA II Trace)
TE-9681	Flasher supply board (consult factory for SOLA II Trace)
TE-8951	Input board
TE-8765	PUVF temperature control board
TE-8666	PUVF flash lamp
89-2897-0	CPU
89-2898-0	I/O PCB
85-1164-0	Power supply, 24 Vdc, DIN rail mount

Table 2–9. Dinfa injection valve replacement parts

P/N	Description
89-2803-0	Solenoid relay PCB
29-1230-0	Heater for pyrolyzer assembly
HA-101812	Ferrules for pyrolyzer tube fittings, graphite
30-1025-0	Pyrolyzer tube, looped
63-1135-0	Pyrolyzer chamber O-ring seal
47-1362-0	Inline micron filter for orifice flow
27-1108-0	Thermocouple
75-1335-0	Injection valve assembly, 8-port, 1.2 µl
75-1334-0	Injection valve slider, 1.2 µl
TE-9934	Flow transducer assembly
TE-8868	PUVF PMT
TE-8943	A/D PCB
TE-8949	PUVF DC power supply board
TE-8774	PUVF lamp trigger pak (consult factory for SOLA II Trace)
TE-8884	PUVF flash intensity board (consult factory for SOLA II Trace)
TE-9681	Flasher supply board (consult factory for SOLA II Trace)
TE-8951	Input board
TE-8765	PUVF temperature control board

P/N	Description
TE-8666	PUVF flash lamp
89-2897-0	CPU
89-2898-0	I/O PCB
85-1164-0	Power supply, 24 Vdc, DIN rail mount

Storage

If storing the instrument, the storage environment should be protected and free from extremes of temperatures and high humidity.

Chapter 3
Installation

Requirements

- Material and power: Consult the specifications for information required for installation.
- Operating environment: For optimum reliability and equipment life, we recommend that the analyzer be installed in a location protected from extremes in temperature and weather. The analyzer operates best in a controlled environment. Ambient temperature and purge air must not exceed the limits listed in the specifications.
- Mounting requirements: The mounting site must be as close as possible to the sampling point. The analyzer must be sheltered from extreme weather conditions. Avoid mounting the analyzer in high vibration areas. Mount the analyzer in an accessible location.
- Cable glands used to supply electrical power must be IP40 rated metallic cable glands.
- Blanking elements or plugs used shall be in accordance with national standards.

Caution This product is extremely heavy. Care must be taken at all times to avoid injury. Never attempt to move this product alone or without the use of lift gear. When handling the analyzer, ensure that all four corners are supported. σ

Sample Line Installation

Note Pressure buildup or liquid accumulation in the analyzer vents degrades performance. Vent lines must be as short as possible and routed in a manner that prevents accumulation of liquids. σ

There must be no back pressure on the vent or drain lines. All vents must be referenced to atmospheric pressure. If the analyzer is installed in a pressurized analyzer shelter, route all vents from the purge controllers and the PUVF detector to the exterior of the shelter. All sample lines must be as short as possible. Sample lines must use new 316 stainless steel that has been prepared as described in the following section "Sample Tubing Preparation."

The analyzer will produce erratic readings if backpressure is created or varied by an obstructed or improperly routed vent.

Sample Tubing Preparation

Review the following cautions prior to performing this procedure.

Caution Isopropyl alcohol is extremely flammable, hazardous if breathed, and dries skin on contact. When using isopropyl alcohol, avoid breathing the vapors and contact with the skin. Appropriate measures must be taken to prevent ignition of the isopropyl alcohol vapors. Use isopropyl alcohol only where there is adequate ventilation and no ignition sources are present. Refer to a Material Safety Data Sheet (MSDS) for isopropyl alcohol for additional important information. σ

Caution Acetone is extremely flammable, hazardous if breathed, and dries skin on contact. When using acetone, avoid breathing the vapors and contact with the skin. Appropriate measures must be taken to prevent the acetone vapors from igniting. Use acetone only where there is adequate ventilation and no ignition sources are present. Refer to a MSDS for acetone for additional important information. σ

Caution Acetone dissolves many plastics. Use caution to prevent the acetone from contacting materials that may be marred or damaged. σ

Caution Take necessary precautions to prevent exposure to hazardous materials when conditioning the sample tubing with sample. σ

Proper preparation of sample tubing prior to installation is very important. Prepare the sample tubing as follows.

1. Thoroughly rinse the tubing inside with isopropyl alcohol (isopropanol) or acetone to remove any oils that may be present.

2. Flush the inside of the tubing with deionized water.

3. Rinse the inside of the tubing again with isopropyl alcohol (isopropanol) or acetone.

4. Thoroughly blow-dry the tubing with clean air (free of oil and moisture).

Electrical Connections

Refer to the following AC power information and wire information when planning and connecting power for the analyzer.

Power source specification: 110 or 220 Vac, 50/60 Hz, 2000 W

Power wiring specification: Use stranded, 3-wire copper or tin-plated copper power wire rated for at least 600 Vac and 20 A at the required length.

Warning This apparatus must be earth grounded! σ

Warning Installation of this instrument requires an external, lockable electrical power isolation switch supplied by the customer. σ

If the optional X-Purge unit is installed, refer to Appendix G for important installation and operation information.

Wiring to the relay contacts should be sized according to the load imposed by the alarm systems installed by the user. Maximum current capability of the alarm contacts is 2 A at 240 Vac or 10 A at 24 Vdc. Voltage is not supplied to the relay contacts by the analyzer.

DCS & External Connections

The following inputs and outputs can be connected to a Distributed Control System (DCS) or other devices as desired.

Digital Inputs

The following inputs are available for controlling the analyzer from a DCS or other external source. Refer to the wiring diagrams shipped with your instrument.

- Remote Stream Control: A manual switch or DCS output signal can be used to select the following stream operation when the multiple stream option is installed. For this control to function, enable the Remote Control function the Analyzer Setup parameters (Chapter 6).

Table 3–1.

Stream Select 0	Stream Select 1	Action
Close*	Open	Analyzes only stream 1
Open	Close*	Analyzes only stream 2
Close*	Close*	Analyzer alternates between stream 1 and stream 2 at the time intervals specified in the Stream 1 Dwell Time and Stream 2 Dwell Time parameters (Chapter 6)
Open	Open	Analyzer operation for streams is performed as specified in the Stream Setup parameters (Chapter 6)

*Close = Shorted to associated ground terminal

- Remote Measurement Range Control: To switch to high measurement range, short the Remote Range connection to the Remote Range common terminal. To switch to low measurement range, open the connection across the Remote Suspend connectors. The Remote Control function must be enabled ("Analyzer Setup", Chapter 6).

- Remote:

  Autocal/Validation: The Autocal/Validation function can be initiated by closing the contact.

  Remote Suspend: To suspend analysis, short the Remote Suspend connection to the Remote Suspend common terminal. To restart analysis, open the connection across the Remote Suspend connectors. The Remote Control function must be enabled ("Analyzer Setup", Chapter 6).

Optional Analog Inputs

Analog inputs are available for connecting densitometers used to correct each stream measurement based on the density of the sample.

- Density Input Stream 1: This 4–20 mA DC input signal represents the density of the Stream 1 sample. The measured densities at 4 mA and at 20 mA can be programmed into the analyzer using the Density Compensation Setup menu (Chapter 6).

Density Input Stream 2: This 4–20 mA DC input signal represents the density of the Stream 2 sample. The measured densities at 4 mA and at 20 mA can be programmed into the analyzer using the Density Compensation Setup menu (Chapter 6).

Analog Outputs

The following outputs are available with the analyzer. Refer to the wiring diagrams shipped with your instrument for wiring details.

- Analog Output 1: This 4–20 mA DC signal represents the measured concentration of Stream 1. The zero value (4 mA DC) represents zero measured concentration in the sample. Full scale (20 mA DC) represents the measured concentration specified in High Range or Low Range (depending on range selected).
- Analog Output 2: This 4-20 mA DC signal represents the measured concentration of Stream 2. It is available only if the dual-stream option is installed. The zero value (4 mA DC) represents zero measured concentration in the sample. Full scale (20 mA DC) represents the measured concentration specified in High Range or Low Range (depending on range selected).

Other Outputs

The following outputs are also provided: High/High Alarm Relay, High Alarm Relay, Off Line Status Relay (fail-safe), Malfunction Alarm Relay (fail-safe, normally closed), Range Selected, Stream Selected, Purge Alarm (fail-safe).

Installation Checklist

The following checklist may be copied for use during system installation. Details for the installation and various specification requirements are contained in this manual, application specific drawings, and information supplied with the instrument.

Installation Checklist

- ☐ Materials used meet specifications defined in Chapter 2.
- ☐ Operating environment meets requirements defined in Chapter 3.
- ☐ Mounting meets requirements defined in Chapter 3.
- ☐ Analyzer condition inspected as follows:
  - ☐ No physical damage, broken parts, or observable defects.
  - ☐ All electronic boards are securely seated.
  - ☐ All cables and wiring connectors are in place and fully seated.
  - ☐ No loose parts (wires, nuts, screws, cables, debris, etc.).
  - ☐ All tubing is properly connected and fittings are tight.
- ☐ Installation and flow connections adhere to the following:
  - ☐ Sample system properly designed to condition (control pressure, flow, temperature, and particulate) sample as required by system.
  - ☐ Sample system fast loop panel is installed as close as possible to analyzer for fastest response time.
  - ☐ System gases meet quality and quantity (pressure and flow) specifications according to Chapter 2.
  - ☐ PUVF vent is vented to atmospheric pressure.
  - ☐ PUVF vent is **NOT** connected to headers with varying pressure or that may accumulate liquids.
  - ☐ Inject purge vent will contain instrument air plus 5–10 cm^3 of hydrocarbon liquid or gas during suspension of analyzer, loss of combustion air, or inject valve fault. Inject purge vent is routed to accommodate disposal of hydrocarbon.
  - ☐ All tubing supply lines to analyzer are sized to match or exceed connector size on the analyzer.
  - ☐ All internal and external tubing fittings are physically checked for tightness and tested for leaks.
- ☐ Installation and electrical connections adhere to the following:
  - ☐ AC power wiring meets requirements.
  - ☐ AC power wiring is properly connected to the instrument with proper earth grounding.
  - ☐ Signal wiring (DC signals, communications, etc.) meets requirements.
  - ☐ Signal wires properly connected to the instrument.
  - ☐ All electrical conduit seals poured with sealing compound such as Chico A5r or equivalent.

Chapter 4
Startup & Shutdown

Initial Startup

Perform this procedure when starting up a new installation or when major service work is performed. Otherwise, perform the procedure according to the section titled "Startup after Short-Term Shutdown."

See the application data that shipped with the instrument, the specifications in Chapter 2, and the installation instructions in Chapter 3 in this manual for information necessary in performing the following procedure.

1. Verify proper electrical power and connections:
   a. Ensure the instrument electrical power wiring is properly sized and connected.
   b. Ensure the power voltage and frequency matches the instrument requirements.
   c. Ensure a suitable circuit breaker and power switch is installed.
   d. Ensure the instrument is properly grounded.
   e. Inspect all electrical connections. Terminals must be snug; wire and cable plugs must be fully seated. Perform a visual check for electrical shorts.
   f. Inspect the plug-in cards; ensure they are properly seated in their connectors.
   g. Ensure the signal wiring is properly sized and connected.

2. Verify proper plumbing:
   a. Ensure the correct supply tubing is properly connected to the instrument.
   b. All sample lines to the analyzer MUST be cleaned and dried before initial use.
   c. Check all tubing connections to ensure they are tight and free of leaks. Pressure test the lines to check for leaks or use a liquid leak detector.

3. Apply instrument/purge air to the instrument for at least 15 minutes, and set the pressure. See application data sent with instrument for proper settings.

Warning For Zone II areas, initial purge must be carried out only when the area is known to be non-hazardous. σ

4. Apply power to the instrument.

Note If the X-Purge option is installed, you must follow the instructions included in Appendix G. σ

   a. Verify that temperature controllers are set as specified in the application notes shipped with the instrument or as recorded in the system logbook. Note that the pyrolyzer and oven do not begin heating immediately due to the safety interlocks.

Note The pyrolyzer temperature controller does not accurately read low temperatures near ambient; however, it does read accurately at normal operating temperatures. σ

   b. Verify that the display is functioning. The screen in Figure 4–1 appears, which displays the version and whether a valid configuration is loaded.

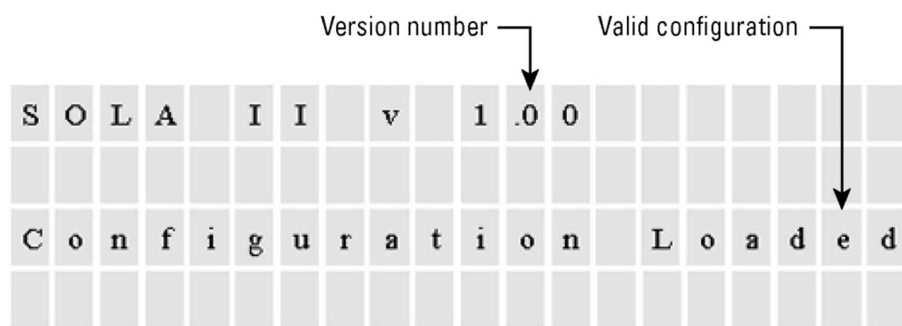

Figure 4–1.

   c. Verify that the configuration settings in the menus match the application data sheet or system logbook.

   d. Suspend the analyzer (Chapter 5) to prevent accidental injection of sample while setting up the instrument.

5. Apply carrier air to the instrument, and set the flows. See application data sent with the instrument for proper settings.

   a. Verify that the pyrolyzer and oven heater temperature come up to temperature and stabilize at the control point.

   b. Adjust the zero/carrier air pressure and flow again after the pyrolyzer and oven stabilize at the correct temperature.

6. Turn on the sample flow to the instrument, and adjust it to the correct pressure and flow. Note that this procedure varies depending on the installed sampling system. Consult the application notes and drawings provided with the instrument for more information.

7. Enable analysis of the sample by taking the instrument out of the suspend mode (Chapter 5). The unit begins injecting and analyzing sample when the instrument temperatures reach operating levels.

8. Allow the analyzer system to stabilize. Monitor the measured values on the front panel for consistent analysis readings to determine when the analyzer system has stabilized.

9. Calibrate the analyzer according to "Calibration" in Chapter 6. Allow ample time for this initial calibration to stabilize. Subsequent calibrations proceed more quickly than this initial calibration.

Startup after Short-Term Shutdown

If starting the analyzer for the first time or if major service has been performed, use the initial startup procedure detailed in the previous section "Initial Startup."

When starting the analyzer after a short-term shutdown, perform the following:

1. Open the instrument/purge air and carrier air to the instrument. Refer to the applications information, manuals, and drawings shipped with the instrument, and adjust the pressure regulators to the appropriate settings.

2. Apply power to the analyzer.

Note If the X-Purge option is installed, you must follow the instructions included in Appendix G. σ

3. Allow the analyzer to warm up until the instrument stabilizes.

4. Adjust the flow rates.

5. Turn on sample to the instrument.

6. If necessary, calibrate the analyzer (“Calibration,” Chapter 6).

The analyzer includes an interlock system that prevents the injection valve from operating until the pyrolyzer and oven temperatures reach the operating value.

Short-Term Shutdown

Follow this procedure when temporarily shutting down the analyzer. To shut down the analyzer for maintenance purposes or for a long-term shutdown, refer to the following section “Maintenance Shutdown.”

1. Turn the solenoid manifold regulator to 0 psig. Doing so blocks sample flow to the injection valve and purges sample from the injection valve.

2. Observe reported sulfur value.

3. Do not interrupt power, instrument air, carrier or auxiliary air, or open oven doors until reported sulfur value is less than 0.5 ppm or reported sulfur value has not changed by more than 2% for 15 minutes.

Note Sample is purged automatically by 3-way diverter valves when power is removed from the instrument. σ

Maintenance Shutdown

The analyzer system must be fully shut down and the sample system decontaminated as appropriate PRIOR to performing maintenance. Follow this procedure when shutting down the analyzer for maintenance or a long-term outage.

1. Close the sample flow to the instrument and purge sample from the unit using air.

2. Turn off power to the analyzer.

3. Allow the instrument to cool.

    a. If the analyzer is used in an ATEX hazardous area with a T3 rating, do not open the oven door for 45 minutes, 50 minutes for Zone 2 unit.

    b. If the analyzer is used in an ATEX hazardous area with a T4 rating, do not open the oven door for 140 minutes.

Caution Failure to allow adequate cooling time before opening the oven can lead to equipment damage or injury to personnel. σ

4. Turn off all air supplies.

Caution Parts of the instrument may be hot even after power is removed. Allow the system to cool completely before performing maintenance. σ

Emergency Shutdown

1. Close the sample supply to the system.

2. Turn off the main power to the system.

Chapter 5
Operation

The Interface

The analyzer utilizes a 4-line x 20-character, vacuum fluorescent display and 4 push buttons as the user interface. All programming and adjustments are accomplished using the push buttons. Following is an example of how to use the interface to enter the passcode.

1. Press any button, and you are prompted to enter the passcode, as seen in Figure 5–1.

2. Press the button below Ent (Enter) and Figure 5–2 appears.

3. To increase the first digit's value press the button below the up arrow (∧). Decrease the value by pressing the button below the down arrow (∨). When the correct number is displayed, press the button below the right arrow (>) to enter the next digit.

4. Repeat the process used to enter the first digit for the remaining digits.

5. When you have completed this, press the button below Done.

You can access all program features and edit parameters by following these steps.

V	e	r	s	i	o	n		1	.	0	0								
E	n	t	e	r		P	a	s	s	c	o	d	e						
											E	n	t			E	x	i	t

Figure 5–1.

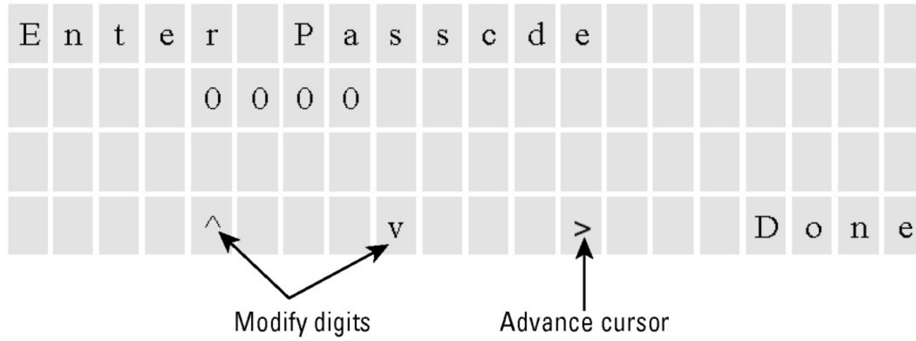

Figure 5–2.

Begin Analyzing

1. If the analyzer is shut down, start up the instrument by following the appropriate set of instructions in Chapter 4.

2. If the system power is off, open the instrument and carrier air flows to the analyzer, and adjust the pressures to the appropriate settings (refer to application data that shipped with the analyzer).

3. Open sample flow to the analyzer.

4. Apply power to the instrument.

5. Analysis begins automatically when the pyrolyzer reaches operating temperature. If you need to change the configuration, press any button, and enter the passcode.

Suspending an Analysis

Follow these steps to suspend an analysis.

1. Enter the Analyzer Mode top-level menu (Figure 5–3).

2. Select **Suspended** to suspend the analysis. In suspended mode, the analyzer stops injecting, and the sample diverter valve allows only air to run through the burner and mixing chamber.

3. To resume the analysis, go to the Analyzer Mode menu, and select **Active**.

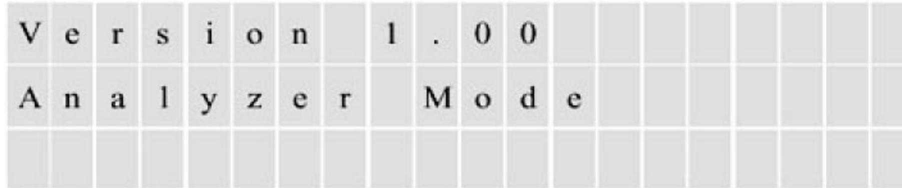

Figure 5–3.

Injection Valve Failure Alarm

Over time, the injection valve begins to wear, resulting in an increased potential for port-to-port leakage of sample. Such leakage can cause erroneous measurement and materials buildup in the system. When the analyzer detects sample leakage through the injection valve, it triggers the Injection Valve Failure alarm and switches the sample diverter valves to flow air through the injection valve rather than sample.

Note The Injection Valve Failure alarm must be acknowledged after valve repair or replacement. σ

If an injection valve begins leaking due to damage or wear, excess sample begins flowing to the pyrolyzer. This extra load of sample in the pyrolyzer exceeds the ability to fully combust the materials in the sample. When these incompletely combusted materials enter the PUVF optical bench, they absorb UV light.

The PUVF includes a system to monitor and compensate for decreases in the UV light output as the bulb ages. However, in the case of injection valve failure, the PUVF system begins rapidly increasing the UV lamp output in an effort to compensate for the absorption of UV by incompletely combusted sample products. The user can enter the rate of change that triggers this alarm. The programmable range is from 1 to 50 V/30 seconds. If the analyzer detects the programmed rate of change in UV lamp voltage, it triggers the Injection Valve Failure alarm to protect the system and reduce the stabilization time for the PUVF bench on system restart.

When the Injection Valve Failure or Chamber Flow alarm activates, a pair of sample diverter valves switches to flow air through the injection valve instead of sample. This prevents excess sample and incomplete combustion products from further contaminating the system. The diverter valves switch air to the injection valves under the following conditions:

- Injection Failure alarm
- Instrument power loss
- Instrument air loss
- Analysis suspension

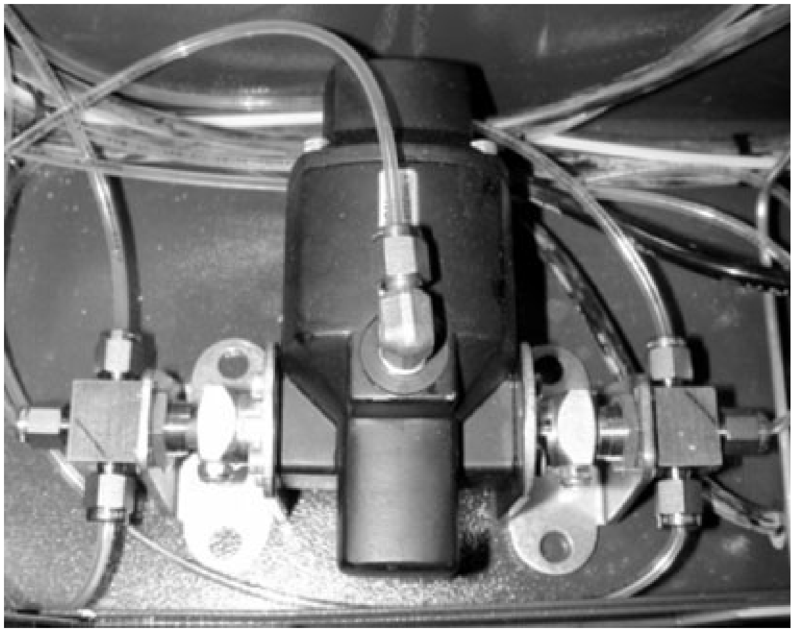

Figure 5–4. Sample diverter valves

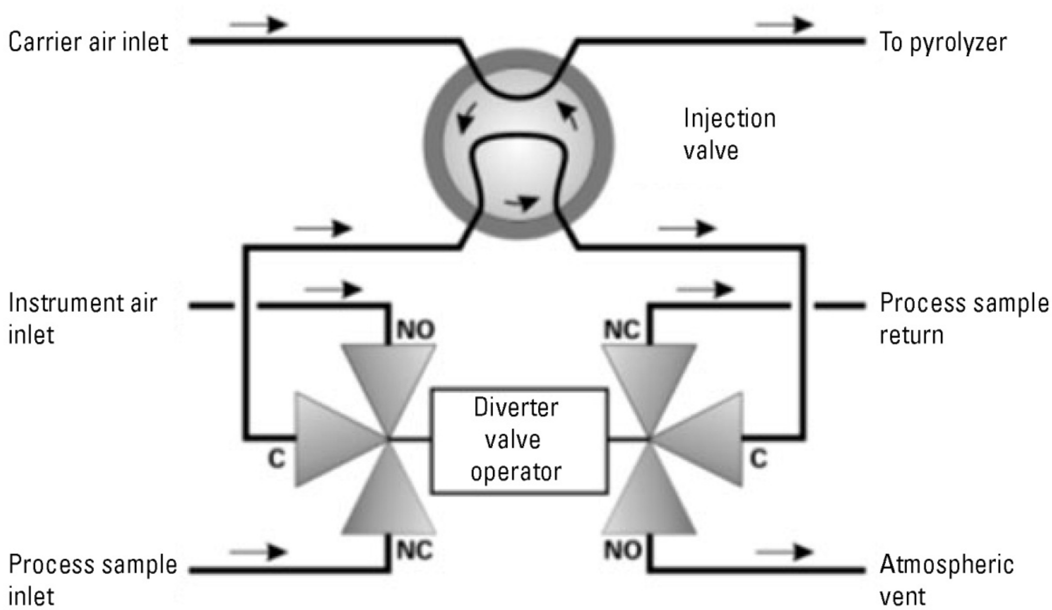

Figure 5–5. Sample diverter valves functional diagram

Chapter 6
Configuration

There are five top-level menus; this chapter addresses the Configuration menu (Figure 6–1). The Configuration menu contains 10 setup menus: Analyzer Setup, Stream Setup, Clock Setup, Modbus Setup, Dual Range Setup, Inject Setup, Autocal Setup, Alarms Setup, Calibration Setup, and Density Compensation Setup.

V	e	r	s	i	o	n		1	.	0	0								
C	o	n	f	i	g	u	r	a	t	i	o	n							
		v					^			E	n	t			E	x	i	t	

Figure 6–1. Top-level configuration menu

Analyzer Setup

1. Access the submenus within the Analyzer Setup menu by pressing **Enter**.

C	o	n	f	i	g	u	r	a	t	i	o	n							
A	n	a	l	y	z	e	r		S	e	t	u	p						
		v					^			E	n	t			E	x	i	t	

Figure 6–2.

2. The first submenu is Program Passcode. The factory default is 0000. If the passcode remains 0000, you are not required to enter the passcode to

access the menus. Change the passcode to prevent unauthorized access to the menus.

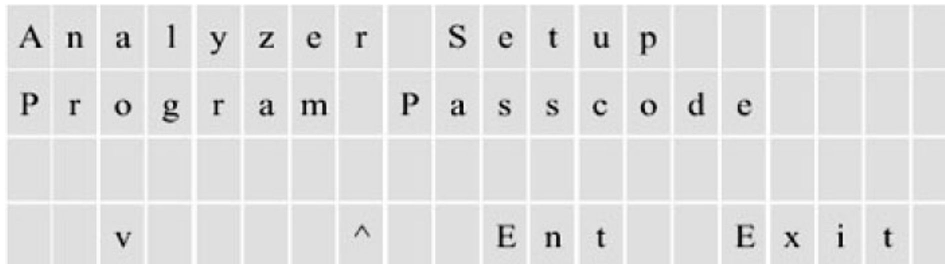

Figure 6–3.

3. Return to the Analyzer Setup menu. Press the down arrow until the Remote Control submenu appears (Figure 6–4), allowing you to enable/disable the remote control function. "DCS & External Connections" in Chapter 3 addresses which functions may be operated remotely.

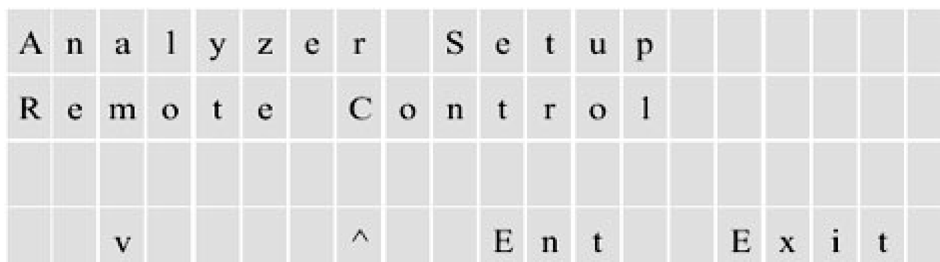

Figure 6–4.

4. The Average Time submenu allows you to set the averaging time. The average time is a period (1–240 seconds) during which the analyzer takes SO_2 measurements used to determine a moving average of the results. For example, if you set the averaging time to 10 seconds, the average concentration of the last 10 seconds is output at each update. If you set the averaging time to 60 seconds, the average concentration of the last 60 seconds is output at each update. Thus, lower averaging time means faster response to concentration changes. Longer averaging times are typically used to smooth output data.

   See the figure below.

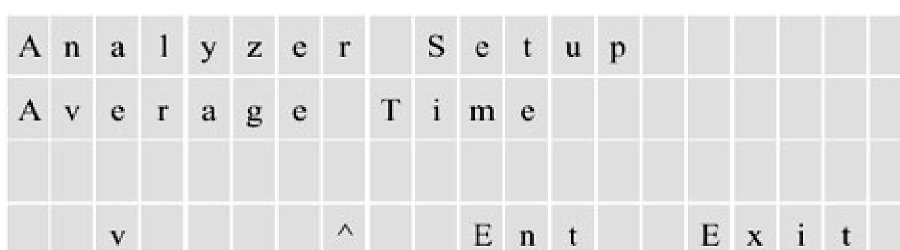

Figure 6–5.

5. The average override is expressed as a percentage of change and determines when the unit switches to the fast average. As the reading stabilizes at the new level, the analyzer progressively increases the average used until it reaches the programmed average time.

```
Analyzer Setup
Average Override

  v    ^  Ent  Exit
```

Figure 6–6.

6. The fast average time provides the ability to respond to changes faster without sacrificing stability achieved using a longer average time.

Note Both the regular and fast average times need to be set at multiples of the injection rate. For example, if the rate is two injections per minute, averages should be set to 30, 60, 90, 120, 150, 180, 210, or 240 seconds. σ

```
Analyzer Setup
Fast Average Time

  v    ^  Ent  Exit
```

Figure 6–7.

7. There are three selections within this submenu: NONE, 4 to 20 mA, and Flow Switch.

A	n	a	l	y	z	e	r		S	e	t	u	p						
F	l	o	w		M	o	n	i	t	o	r		T	y	p	e			
		v					^			E	n	t			E	x	i	t	

Figure 6–8.

Stream Setup

This section steps through the menu items in the Stream Setup menu.

1. Access the submenus within the Stream Setup menu by pressing **Enter**.

C	o	n	f	i	g	u	r	a	t	i	o	n							
S	t	r	e	a	m		S	e	t	u	p								
		v					^			E	n	t			E	x	i	t	

Figure 6–9.

2. The Stream Mode submenu allows you to configure the analyzer to continuously monitor stream 1 (Stream 1), continuously monitor stream 2 (Stream 2), or to alternate between the streams (Timed Stream).

S	t	r	e	a	m		S	e	t	u	p								
S	t	r	e	a	m		M	o	d	e									
		v					^			E	n	t			E	x	i	t	

Figure 6–10.

3. If you select the Timed Stream option as the mode, you must determine the dwell time. Dwell time is the period of time the analyzer monitors one stream before it begins monitoring the other. Figure 6–11 displays the

submenu that allows you to program the dwell time for stream 1 (the length of time the analyzer stays on stream 1 before it begins monitoring stream 2). You can then program the dwell time for stream 2 (the length of time the analyzer stays on stream 2 before returning to stream 1). Dwell time may be from 1 to 1440 minutes (24 hours).

S	t	r	e	a	m		S	e	t	u	p								
S	t	r	e	a	m		1		D	w	e	l	l		t	i	m	e	
		v					^			E	n	t			E	x	i	t	

Figure 6–11.

4. When using the second stream for validation or during the calibration cycles, it might be desirable to reduce the flow in order to conserve calibration/validation standards. You can program each stream for high or low flows. If equipped with the second stream option, the analyzer has NO and NC pneumatic outputs to control the flow in the sampling system. The calibration and validation routines always select the low flow.

S	t	r	e	a	m		S	e	t	u	p								
S	t	r	e	a	m		1		F	l	o	w							
		v					^			E	n	t			E	x	i	t	

Figure 6–12.

5. If you select the Timed Stream option, you must also determine how long the analyzer purges the line before it begins analyzing the other stream. This period is called the purge time. In respect to calibration, purge time is how long the analyzer purges the line before it begins analyzing the calibration stream. You can set the purge time between 1 and 9999 seconds.

   See the figure below.

S	t	r	e	a	m		S	e	t	u	p								
P	u	r	g	e		T	i	m	e										
		v					^			E	n	t			E	x	i	t	

Figure 6–13.

Clock Setup

1. Access the Clock Setup menu to change the time and date.

C	o	n	f	i	g	u	r	a	t	i	o	n							
C	l	o	c	k		S	e	t	u	p									
		v					^			E	n	t			E	x	i	t	

Figure 6–14.

2. Enter the time in hh:mm:ss, 24-hour format and the date (in the following screen) in mm/dd/yyyy format.

C	l	o	c	k		S	e	t	u	p									
S	e	t		T	i	m	e			1	4	:	3	2	:	1	3		
		v					^			E	n	t			E	x	i	t	

Figure 6–15.

C	l	o	c	k		S	e	t	u	p									
S	e	t		D	a	t	e			0	3	/	0	5	/	0	3		
		v					^			E	n	t			E	x	i	t	

Figure 6–16.

Modbus Setup

1. The Modbus Setup menu enables to you set the baud rates and IDs for COM 3 and COM 4.

```
Configuration
Modbus Setup

  v   ^  Ent  Exit
```

Figure 6–17.

2. Select one of the baud rates available for RS485 Com 3 (38400, 19200, 9600, 4800, 2400, and 1200 bps), or select **Disable**.

```
Modbus Setup
Modbus COM3 Baudrate

  v   ^  Ent  Exit
```

Figure 6–18.

3. Set the ID (network address) for Com 3. The address can be between 1 and 255.

```
Modbus Setup
Modbus COM3 ID

  v   ^  Ent  Exit
```

Figure 6–19.

Set the baud rate and the ID for COM 4 in the same manner using the submenus for COM 4.

Dual Range Setup

This menu allows you to set the dual range mode.

1. Set the dual range mode to Remote Range Select or to Auto Range for the 4–20 mA output signal. If you select Auto Range, the 4–20 mA output signal switches to high range when the reading goes above the low range full scale value. When the signal drops below 90% of the low range full scale value, the system switches back to low range.

   When Remote Range Select is enabled, output scaling is controlled by a remote contact input. When the input contacts are open, the system operates on low range. When the input contacts are closed, the system operates on high range.

C	o	n	f	i	g	u	r	a	t	i	o	n							
D	u	a	l		R	a	n	g	e		S	e	t	u	p				
		v					^			E	n	t			E	x	i	t	

Figure 6–20.

D	u	a	l		R	a	n	g	e		S	e	t	u	p				
D	u	a	l		R	a	n	g	e		M	o	d	e					
		v					^			E	n	t			E	x	i	t	

Figure 6–21.

2. The submenu shown below enables you to specify the full scale value (20 mA) for the high range of stream 1 as output on the 4–20 mA signal.

D	u	a	l		R	a	n	g	e		S	e	t	u	p				
H	i	g	h		R	a	n	g	e		S	t	r	e	a	m		1	
		v					^			E	n	t			E	x	i	t	

Figure 6–22.

3. The submenu shown below enables you to specify the full scale value (20 mA) for the low range of stream 1 as output on the 4–20 mA signal.

Dual Range Setup
Low Range Stream 1
v ^ Ent Exit

Figure 6–23.

Set the 20 mA scaling for the high and low ranges for stream 2 using the submenus for stream 2.

Inject Setup

1. Enter the Inject Setup menu to set injection parameters.

Configuration
Inject Setup
v ^ Ent Exit

Figure 6–24.

2. The injection time is the amount of time that the injection valve stays in the injection position. Set the inject time at half of the inject rate (1 to 9999 seconds).

Inject Setup
Injection Time
v ^ Ent Exit

Figure 6–25.

3. Set the injection rate (the amount of time to wait between sample injections). The rate can be between 2 and 9999 seconds. A 6-port valve injects at each actuator move in both positions. Thus, **if a 6-port valve is used, set the rate to twice the desired injection interval.**

I	n	j	e	c	t		S	e	t	u	p								
I	n	j	e	c	t	i	o	n		R	a	t	e						
		v					^			E	n	t			E	x	i	t	

Figure 6–26.

Autocal Setup

1. Enter this menu to configure the autocal function.

C	o	n	f	i	g	u	r	a	t	i	o	n							
A	u	t	o	c	a	l		S	e	t	u	p							
		v					^			E	n	t			E	x	i	t	

Figure 6–27.

2. The Autocal Mode submenu allows you to enable/disable periodic automatic calibration of the analyzer.

A	u	t	o	c	a	l		S	e	t	u	p							
A	u	t	o	c	a	l		M	o	d	e								
		v					^			E	n	t			E	x	i	t	

Figure 6–28.

3. If the autocal function is enabled, access the Autocal Interval submenu to specify the length of time between automatic calibrations. The interval can be set between 1 to 9999 minutes.

A	u	t	o	c	a	l		S	e	t	u	p							
A	u	t	o	c	a	l		I	n	t	e	r	v	a	l				
		v					^			E	n	t			E	x	i	t	

Figure 6–29.

4. Allowed Deviation is the percentage of deviation from the programmed autocal value that is acceptable without updating the calibration factor. This function is used primarily when using calibration sample for system validation tests. When an automatic calibration is performed, the analyzer calculates the percentage the new calibration factor deviates from the previous calibration factor. If the percentage deviation is less than the allowed deviation, the system keeps the previous calibration factor. If the deviation exceeds the allowed deviation and is less than the Recal Deviation, the new calibration factor replaces the previous one.

A	u	t	o	c	a	l		S	e	t	u	p							
A	l	l	o	w	e	d		D	e	v	i	a	t	i	o	n			
		v					^			E	n	t			E	x	i	t	

Figure 6–30.

5. Recal Deviation is the percentage of deviation from the programmed autocal value that is acceptable to compute new calibration factors. Access this submenu to specify this percentage. Note that an Autocal Fail alarm activates if the deviation exceeds the amount specified.

   See the figure below.

Autocal Setup
Recal Deviation
v ^ Ent Exit

Figure 6–31.

6. If set to recalibrate, the calibration line moves, maintaining the same slope. It is similar to the manually initiated adjust reading function. Setting both deviations to the same value disables the autocal, making it a validation only function.

   The autocal/validation functions can be used with a programmable value other than the high calibration value.

Autocal Setup
Autocal Value
v ^ Ent Exit

Figure 6–32.

7. You can direct the reading during auto calibration to stream 1 or 2, 4–20 mA output, or none of the outputs.

Autocal Setup
Calibration Output
v ^ Ent Exit

Figure 6–33.

Alarms Setup

Review the following for instructions pertaining to alarm setup.

1. Access the menu items by pressing **Enter**.

C	o	n	f	i	g	u	r	a	t	i	o	n							
A	l	a	r	m	s		S	e	t	u	p								
		v					^			E	n	t			E	x	i	t	

Figure 6–34.

2. The Sample Flow alarm is available if the flow meter option is present. The set point for the low sample flow alarm is a percentage of the 4–20 mA signal from the flow meter.

A	l	a	r	m	s		S	e	t	u	p								
S	a	m	p	l	e		F	l	o	w		A	l	a	r	m			
		v					^			E	n	t			E	x	i	t	

Figure 6–35.

3. To set up a Chamber Flow alarm, enter the set point at which the low flow alarm for the flow measured at the detector chamber in the PUVF should activate. The value can be from 0 to 1000 cc/m.

A	l	a	r	m	s		S	e	t	u	p								
C	h	a	m	b	e	r		F	l	o	w		A	l	a	r	m		
		v					^			E	n	t			E	x	i	t	

Figure 6–36.

4. To set up a Lamp Voltage alarm, enter the maximum lamp voltage at which the alarm should activate. The value can be from 0 to 1200 V.

A	l	a	r	m	s		S	e	t	u	p								
L	a	m	p		V	o	l	t	a	g	e		A	l	a	r	m		
		v					^			E	n	t			E	x	i	t	

Figure 6–37.

5. Set up a Lamp Voltage Rate of Change alarm by entering the rate of change in lamp voltage at which the alarm should activate. The value can be from 1 to 50 V per 30 seconds.

A	l	a	r	m	s		S	e	t	u	p								
L	a	m		V		r	a	t	e		o	f		C	h	a	n	g	e
		v					^			E	n	t			E	x	i	t	

Figure 6–38.

6. Set up a Chamber Temperature alarm by entering the +/- deviation from 45°C at which the alarm should activate.

A	l	a	r	m	s		S	e	t	u	p								
C	h	a	m	b	e	r		T	e	m	p	.		A	l	a	r	m	
		v					^			E	n	t			E	x	i	t	

Figure 6–39.

7. Select one of the TS Level Alarms modes. Select Disable, Non Latching, or Latching mode for the concentration alarms. If you select nonlatching, the alarm clears when the measured concentration drops below the associated value. If you select latching, the alarm must be acknowledged before it will clear.

A	l	a	r	m	s		S	e	t	u	p								
T	S		L	e	v	e	l		A	l	a	r	m	s		M	o	d	e
		v					^			E	n	t			E	x	i	t	

Figure 6–40.

8. Set the High Alarm for stream 1 by entering the first level of high concentration for stream 1 at which the alarm should activate.

A	l	a	r	m	s		S	e	t	u	p								
H		A	l	a	r	m		S	t	r	e	a	m		1				
		v					^			E	n	t			E	x	i	t	

Figure 6–41.

9. Set the High High alarm for stream 1 by entering the second level of high concentration for stream 1 at which the alarm should activate. There are also submenus for setting the high alarm and the high high alarm for stream 2. If applicable, set these alarms as done for stream 1.

A	l	a	r	m	s		S	e	t	u	p								
H	H		A	l	a	r	m		S	t	r	e	a	m		1			
		v					^			E	n	t			E	x	i	t	

Figure 6–42.

Calibration

Overview

The analyzer requires a two-point linear calibration. During the calibration procedure the average of the raw detector signals corresponding to two known sulfur concentrations are latched by the unit and retained in non-volatile memory.

During normal operation, the average detector reading is interpolated on the line to derive the sulfur concentration reported.

The graph below illustrates a SOLA II calibration.

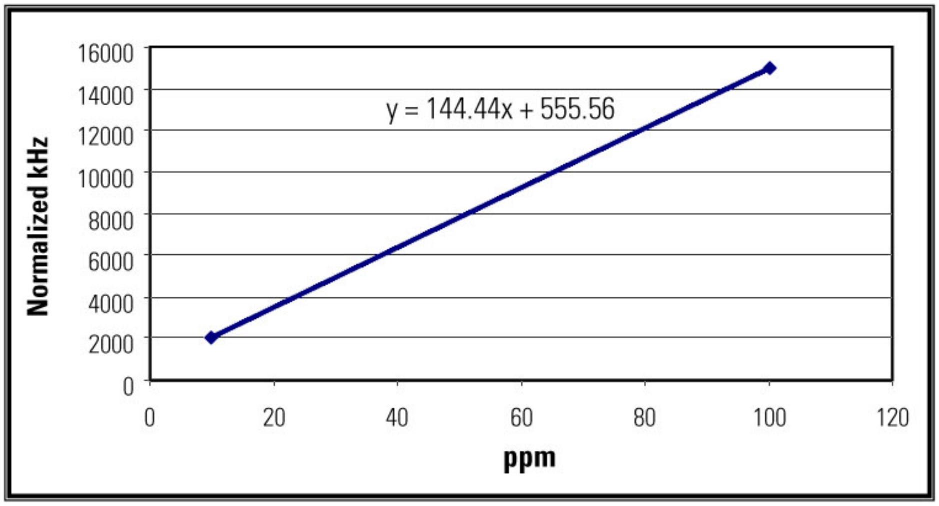

Figure 6–43.

Prior to calibrating the instrument, the sulfur concentration expected at the two points must be entered in the calibration setup menus (Configuration > **Calibration Setup**). In the software, these points are referred to as high and low calibration values.

For the graph above, the values would be:

Low cal value = 10.00 ppm	Low cal = 555.600 kHz
High cal value = 100.00 ppm	High cal = 15000.000 kHz

The high calibration value needs to be as close as possible to the full range sulfur concentration expected in the process, and the low calibration value is normally set to zero so that only one standard is required for calibration.

The values and a graph for a typical calibration are shown below.

Low cal value = 0.00 ppm	Low cal = 555.600 kHz
High cal value = 100.00 ppm	High cal = 15000.000 kHz

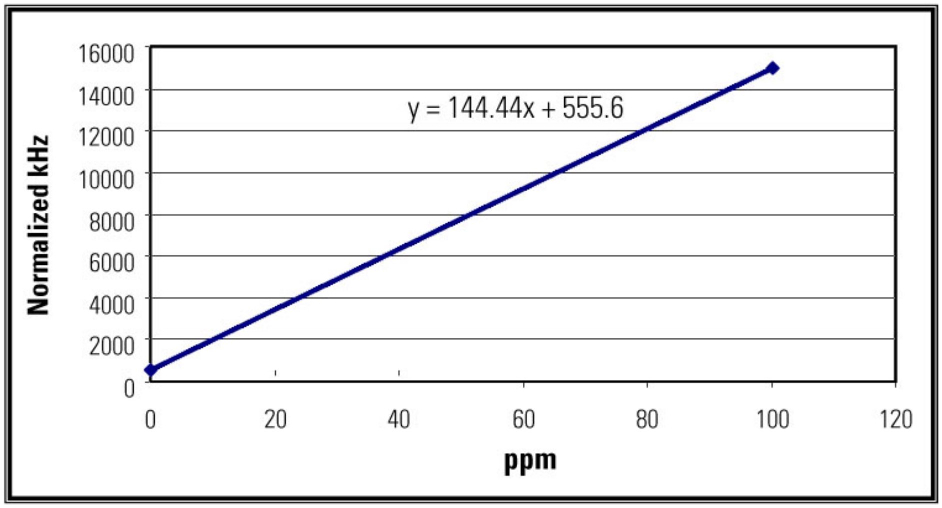

Figure 6–44. Typical SOLA II calibration

The high and low calibration can be performed independently. Changing either one of the calibration points will change the slope of the line. This is illustrated in the next two graphs.

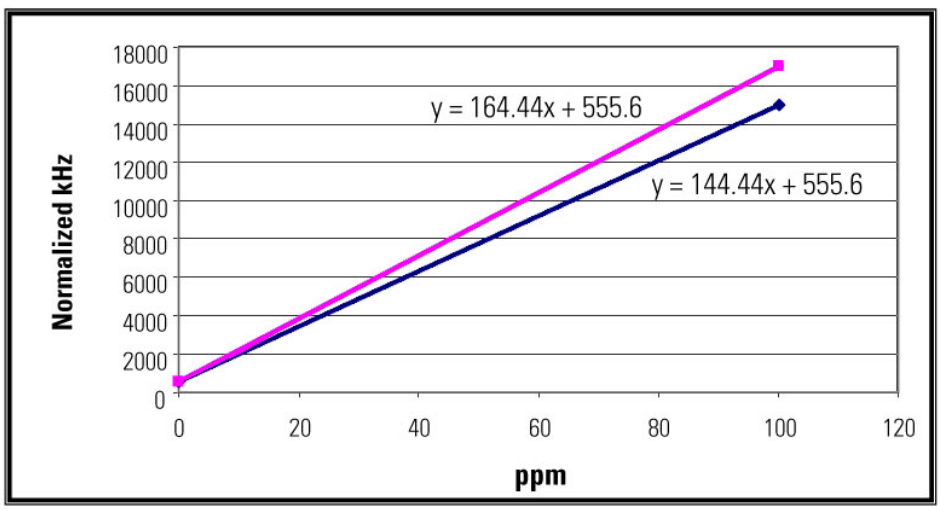

Figure 6–45. High calibration

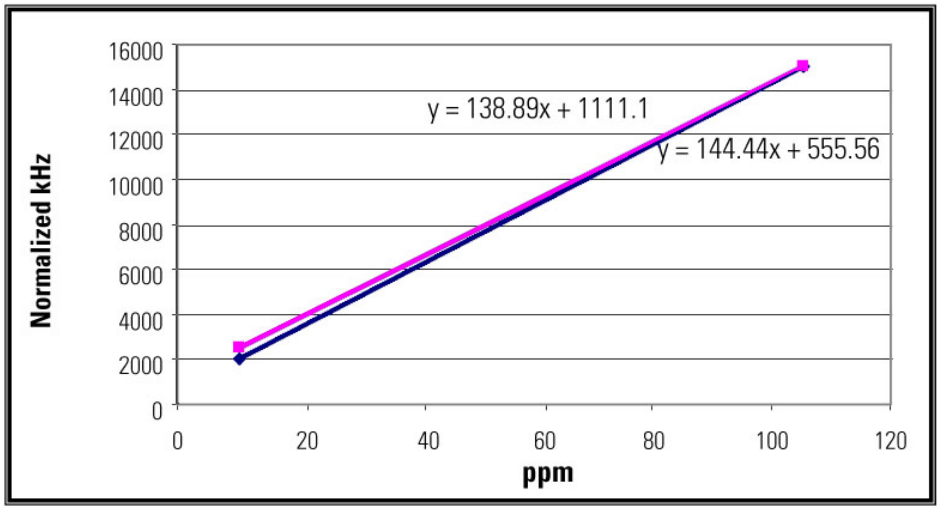

Figure 6–46. Low calibration

If necessary, the Adjust Reading function in the Calibration Setup menu can be used to correct the calibration by moving the line without changing the slope (see Figure 6–47). Enabling the Autocal function will cause the software to perform this correction automatically.

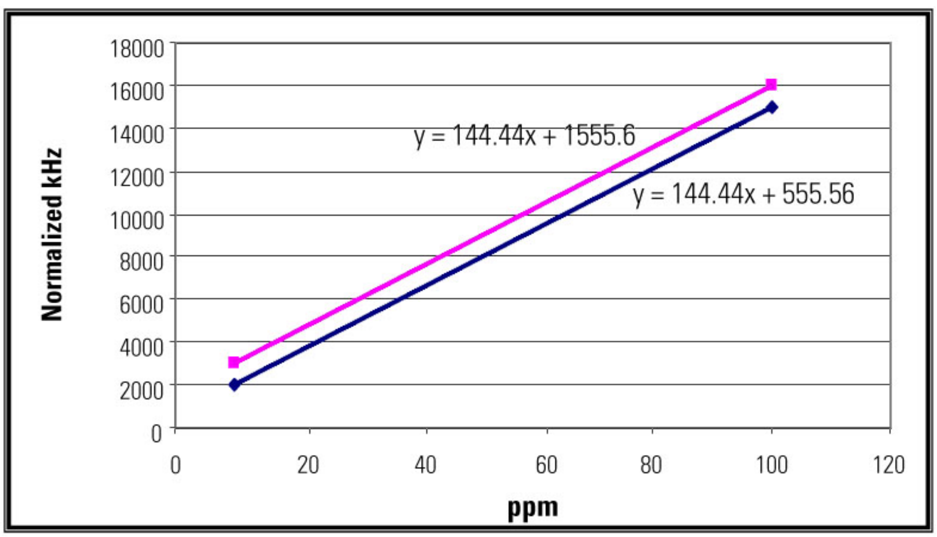

Figure 6–47. Corrected calibration

Several calibration functions can be performed. These are discussed in the following sections.

Performing a Low Calibration at Zero*

*No injections

Note This is the most common form of low calibration that requires only one standard. For SOLA II Trace, it is recommended that a low concentration standard be used. σ

Note To prevent repetition, these sections do not include screen shots. Each menu item within the Calibration Setup menu is shown in "Calibration Setup Menu Items." σ

To perform a low calibration with no injections, follow the steps below.

1. Go to Configuration > Calibration Setup > **Low Cal Value**. Set the low calibration value to zero.

2. Exit the Calibration Setup menu.

3. Reduce the pressure at the solenoid manifold air regulator to zero (this is the bottom regulator located in the pneumatic cabinet). Lowering the solenoid manifold pressure will accomplish two things:
   a. The diverter valve will switch to the diverter position blocking the sample.
   b. The injection valve will stop injecting, letting only the carrier gas run through the system.

4. Let the unit run until the sulfur concentration reported is stable.

5. Go to Configuration > Calibration Setup > **Recalibrate Low**. Press **YES** to accept the new low calibration.

At this point, the average of the detector signal is latched to correspond to a zero sulfur concentration.

Performing a High Calibration

Performing a high calibration can be achieved in two ways, depending on the sample conditioning system installed.

The high calibration standard is normally contained in a pressurized cylinder. The pneumatic output of the analyzer can be used to switch the corresponding selection valve in the SCS, or the high calibration standard can be manually introduced to the analyzer. Based on this, the Calibration Setup menu offers two functions:

- Calibrate High: Used when the analyzer is expected to switch the valves.
- Recalibrate High: Used when the calibration standard is introduced manually to the analyzer.

The Calibrate High Function

1. Go to Configuration > Calibration Setup > **High Cal Value**. Set the high calibration value to match the concentration of the standard used.

2. Step down to the Average Cal Readings screen. It is recommended that you set this value to the maximum (240).

3. Exit the Calibration Setup menu, and go to Configuration > Stream Setup > **Purge Time**. Set this value. It should be long enough for the unit to stabilize (time varies depending on the location of the switching valve in the SCS and the flow rate of the sample). Exit this menu.

4. Go back to the Calibration Setup menu. Step down to the Calibrate High screen, and press **Enter** to perform the calibration.

At this point, the analyzer will energize the calibration solenoid and start a purge cycle. Once the purge cycle is completed, the detector reading will be averaged for the programmed number of calibration readings (readings are performed once a second). The resulting average will be latched to correspond to the high calibration value concentration.

The Recalibrate High Function

Use this function if manually introducing the high calibration standard to the analyzer.

Note It is possible to force the calibration solenoid to turn on by going to Configuration > Stream Setup > **Cal Inlet** and selecting **ON**. If you do this, you can use the Recalibrate High function on systems where the analyzer pneumatic output selects the calibration stream. σ

Note It is important to remember that if the calibration standard is introduced manually and running as stream one, density compensation must be turned off if used. σ

1. Go to Configuration > Calibration Setup > **High Cal Value**. Set the high calibration value to match the concentration of the standard used. Exit the menu.

2. Connect the calibration standard to the unit, and let it flow through the injection valve.

3. Let the reported concentration reach a new value and stabilize.

4. Go to Configuration > Calibration Setup > **Recalibrate High**. Press **YES** to accept the new high calibration.

At this point, the current average of the detector signal is latched to correspond to the high calibration value concentration.

Adjusting the Reading

If the reported value of the SOLA II does not match a known sample value or the standard flowing through the instrument, you can adjust the reading. To do so, go to Configuration > Calibration Setup > **Adjust Reading**. The current reading will be displayed in an editing screen so that you can modify the reading to match the desired reading.

Note Do not use this function if the difference between the expected reading and the analyzer's reported reading is significant. The Adjust Reading function should only be used for making minor corrections to the calibration. Using this function improperly can momentarily hide malfunctions in the unit that need to be corrected. σ

Calibration Setup Menu Items

This section contains the menu items within the Calibration Setup menu in the order they appear. Specific instructions on the various calibration functions are discussed in the previous sections.

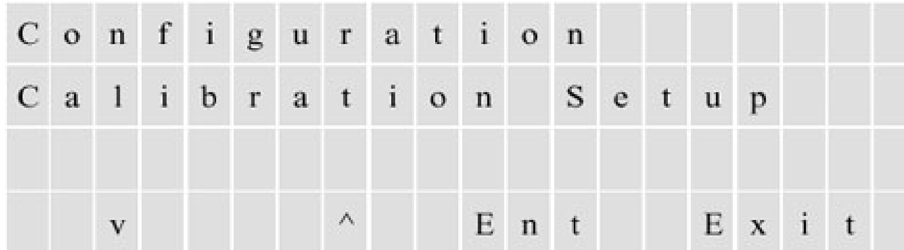

Figure 6–48. Main menu heading

1. Select the engineering unit related to the concentration entered for the calibration values: ppm, ppb, or mg/L.

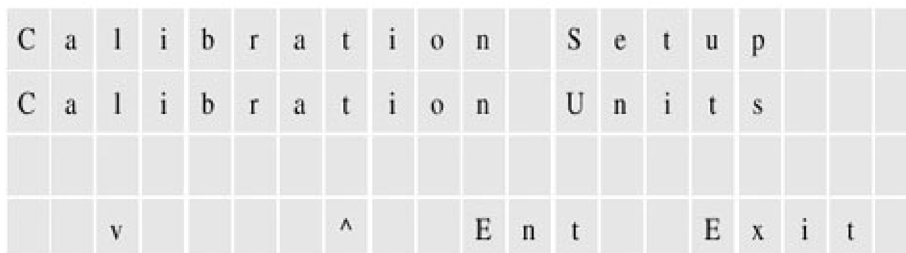

Figure 6–49.

2. Enter the concentrations of the high calibration standard. See "Performing a High Calibration" for more.

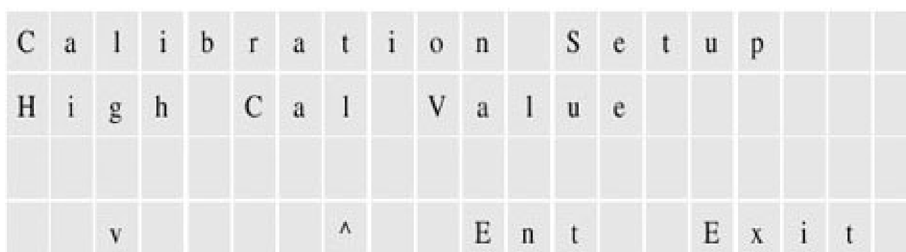

Figure 6–50.

3. Enter the concentration of the low calibration standard. Note that if using only one calibration standard and no injections to calibrate the background, enter zero. See "Performing a Low Calibration at Zero" for more.

C	a	l	i	b	r	a	t	i	o	n		S	e	t	u	p			
L	o	w		C	a	l		V	a	l	u	e							
		v					^			E	n	t			E	x	i	t	

Figure 6–51.

4. Set the number of readings the analyzer should average during calibration (1–60 readings).

C	a	l	i	b	r	a	t	i	o	n		S	e	t	u	p			
A	v	e	r	a	g	e		C	a	l		R	e	a	d	i	n	g	s
		v					^			E	n	t			E	x	i	t	

Figure 6–52.

5. Begin a calibration for the high concentration standard. See "Performing a High Calibration" for more.

C	a	l	i	b	r	a	t	i	o	n		S	e	t	u	p			
C	a	l	i	b	r	a	t	e		H	i	g	h						
		v					^			E	n	t			E	x	i	t	

Figure 6–53.

6. Begin a calibration for the low concentration standard or for zero background.

C	a	l	i	b	r	a	t	i	o	n		S	e	t	u	p			
C	a	l	i	b	r	a	t	e		L	o	w							
		v					^			E	n	t			E	x	i	t	

Figure 6–54.

7. Perform a calibration without the purge cycle for the high concentration standard. See “Performing a High Calibration” for more.

   You can do the same for the low concentration standard by accessing the Recalibrate Low menu item (not shown). See “Performing a Low Calibration at Zero” for more.

C	a	l	i	b	r	a	t	i	o	n		S	e	t	u	p			
R	e	c	a	l	i	b	r	a	t	e		H	i	g	h				
		v					^			E	n	t			E	x	i	t	

Figure 6–55.

8. Adjust calibration during operation to match lab results through the Adjust Reading menu item. Enter a concentration, and the reading is forced to match the value entered. See “Adjusting the Reading” for more.

C	a	l	i	b	r	a	t	i	o	n		S	e	t	u	p			
A	j	u	s	t		R	e	a	d	i	n	g							
		v					^			E	n	t			E	x	i	t	

Figure 6–56.

9. Review/edit the frequency stored during calibration of the high standard. You can do the same for the low standard or zero background accessing the Low Cal KHz menu item.

C	a	l	i	b	r	a	t	i	o	n		S	e	t	u	p			
H	i	g	h		C	a	l		K	H	z								
		v					^			E	n	t			E	x	i	t	

Figure 6–57.

10. Calibration Output

C	a	l	i	b	r	a	t	i	o	n		S	e	t	u	p			
C	a	l	i	b	r	a	t	i	o	n		O	u	t	p	u	t		
		v					^			E	n	t			E	x	i	t	

Figure 6–58.

Density Compensation Setup

Density correction is used for reporting the total sulfur in ppm w/w and can be accomplished using a density transmitter (densitometer) for each stream with the output connected to the analyzer's 4–20 mA inputs or by entering a fixed correction factor.

When using the optional densitometer inputs, the densities that correspond to 4 mA and 20 mA must be entered. The analyzer maintains a moving average of the 4–20 mA readings and converts the readings to g/cc using a linear interpolation. The sulfur reading is then corrected by multiplying it by the ratio between the calibration sample density and the measured density of the sample.

When the density of the sample is known and remains relatively constant, a fixed correction factor can be used. In this method, the total sulfur reading is multiplied by the value entered. If no correction is desired, set the correction factor to 1.000.

The following provides instructions for both methods. If using a densitometer, refer to the instructions with Figures 6–59 through 6–63. Menu items for stream 1 are used.

1. Enter the Density Compensation Setup menu.

C	o	n	f	i	g	u	r	a	t	i	o	n							
D	e	n	s	i	t	y		C	o	m	p		S	e	t	u	p		
		v					^			E	n	t			E	x	i	t	

Figure 6–59.

2. Select **Live**. If you are using stream 2, be sure the menu item is for stream 2.

D	e	n	s	i	t	y		C	o	m	p		S	e	t	u	p		
S	t	r	l		C	o	m	p	e	n	s	a	t	i	o	n			
		v					^			E	n	t			E	x	i	t	

Figure 6–60.

3. Enter the density of the calibration standard (in units of g/cc).

D	e	n	s	i	t	y		C	o	m	p		S	e	t	u	p		
C	a	l		D	e	n	s	i	t	y									
		v					^			E	n	t			E	x	i	t	

Figure 6–61.

4. In units of g/cc, enter the density that corresponds to the 4 mA output of the densitometer used (Figure 6–62). In the following screen (Figure 6–63), enter the density that corresponds to the 20 mA output of the densitometer.

Density Comp Setup
Density @ 4 mA
v ^ Ent Exit

Figure 6–62.

Density Comp Setup
Density @ 20 mA
v ^ Ent Exit

Figure 6–63.

The following provides instructions on entering a correction factor using stream 2.

1. Select **Fix** in the Str2 Compensation menu item. If using stream 1, be sure the menu item is for stream 1.

Density Comp Setup
Str2 Compensation
v ^ Ent Exit

Figure 6–64.

2. Enter the correction factor. The value may be from 0 to 9.999.

D	e	n	s	i	t	y		C	o	m	p		S	e	t	u	p		
S	t	r	2		C	o	r	r	e	c	t	i	o	n		F	c	t	r
		v					^			E	n	t			E	x	i	t	

Figure 6–65.

Note that when using a correction factor, you do not need to enter the Cal Density menu.

Chapter 7
Viewing Alarms

The second top-level menu is the View/Ack Alarm menu.

```
Version 1.00        
View/Ack Alarms     
                    
  v    ^  Ent  Exit 
```

Figure 7–1.

Access this menu to review all active alarms. Use the up and down arrows to scroll through the alarms individually. Press **Ack** to acknowledge the alarm.

```
View/Ack Alarms     
Inject Temperature  
                    
  v    ^  Ack  Exit 
```

Figure 7–2.

Chapter 8
Diagnostics

There are four submenus within the Diagnostics top-level menu: Input & Output Test, View Parameters, Com Ports RX TX, Pulse UV Control.

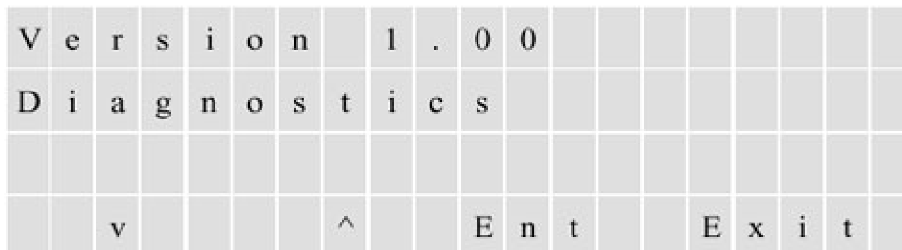

Figure 8–1.

Input & Output Test Menu

The Input & Output Test menu consists of four groups of submenus: Set Outputs Menu, View Mux Analogs, 4-20 mA Inputs, and View Digital Inputs.

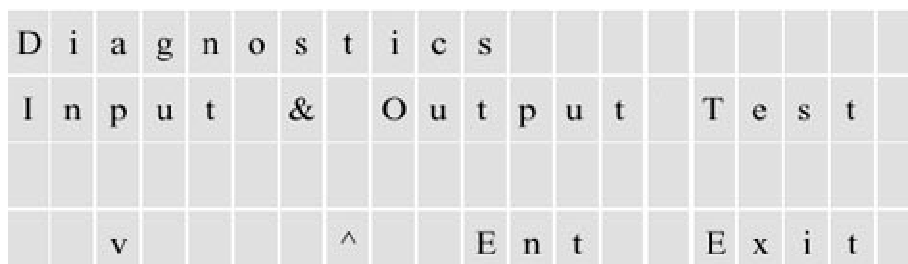

Figure 8–2.

Set Outputs

In the Set Outputs group, press **Tgle** to toggle the associated relay on and off.

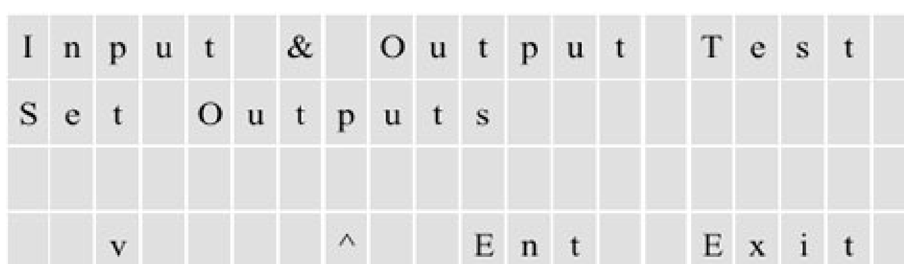

Figure 8–3.

Following are the relays that can be accessed through the Set Outputs group.

Table 8–1.

Output	Function
Malfunction	Malfunction relay (fail safe).
Off Line	Denotes calibration cycle or suspended analysis (fail safe).
H Alarm	High alarm relay.
HH Alarm	High high alarm relay.
Stream Selected	Indicates the active stream.
Range Selected	
RLY 7	Purge fail (fail safe).
RLY 8 Spare	
Stream 1 4–20 mA	Press **Enter** to change the 4–20 mA output for stream 1 to 4, 8, 12, 16, or 20 mA.
Stream 2 4–20 mA	Press **Enter** to change the 4–20 mA output for stream 2 to 4, 8, 12, 16, or 20 mA.
Sample Solenoid	Controls the sample diverter.
Stream 1 Solenoid	Controls the valve for stream 1.
Stream 2 Solenoid	Controls the valve for stream 2.
Inject Solenoid	Controls the injection valve.
Cal Solenoid	Controls the calibration/stream valve.
Solenoid 6	Controls high/low flow
Solenoids 7–8	See note below
Bench CNTRL ##	Reserved for factory test only; the 2 pound signs (##) indicate the control output.

Note Solenoids 7 and 8 are reserved for future applications and are not installed in the standard unit. σ

View MUX Analogs

You can view the MUX analogs by accessing this menu. Note that all signals are displayed as raw frequencies.

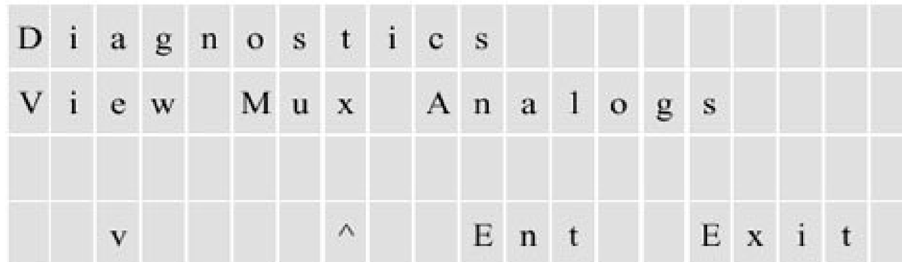

Figure 8–4.

Following are the analogs in the order they appear within menu:

1. ADC 0 Lamp V
2. ADC 1 Chamber Flow
3. ADC 7 Pressure
4. ADC 9 PMT V
5. ADC 10 Chamber T
6. ADC 11 Ambient T

View 4–20 mA Inputs

Access this submenu to view the optional 4–20 mA inputs.

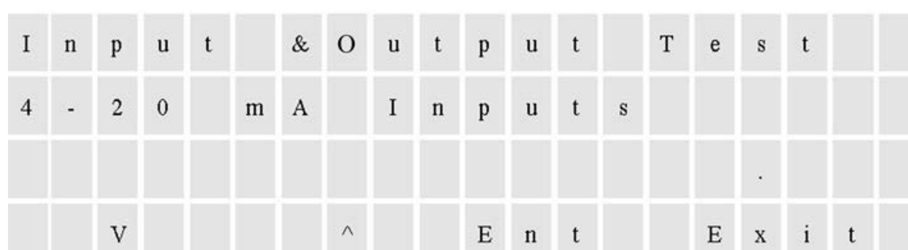

Figure 8–5.

View Digital Inputs

When you access the View Digital Inputs menu, the status of the inputs is reported but the functions are ignored.

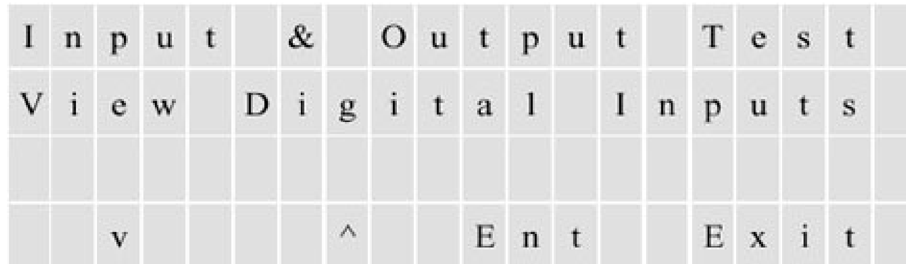

Figure 8–6.

Following is a list of inputs and their functions.

Table 8–2.

Input	Function
Purge Fail	Displays the status of the purge sense pressure switch.
Flow Switch	Displays the status of the flow monitoring switch.
Watlow Alarm	Displays the status of the Watlow alarm input[1]
I/O Board	Displays the status of all eight inputs simultaneously. Zero (0) denotes open. One (1) denotes closed.
CPU Digital In	
Dip Switches	Displays the positions of dip switches located in the motherboard (dip switches are used to indicate options installed)
I/O Board Option	
4–20 mA Input Option	
Stream Select 1	Displays the status of stream select switch #1
Stream Select 2	Displays the status of stream select switch #2
Range Control	Displays the status of the range control switch
Remote Cal	Displays the status of the remote calibration switch
Remote Suspend	Displays the status of the remote suspend switch

View Parameters

Each menu item within the View Parameters menu displays the parameter name, current value, minimum value, and maximum value (see Figure 8–8). When you select a parameter to view, the minimum and maximum values are reset to the current value. Displaying the minimum, maximum, and current values for a period of time enables you to monitor signal stability.

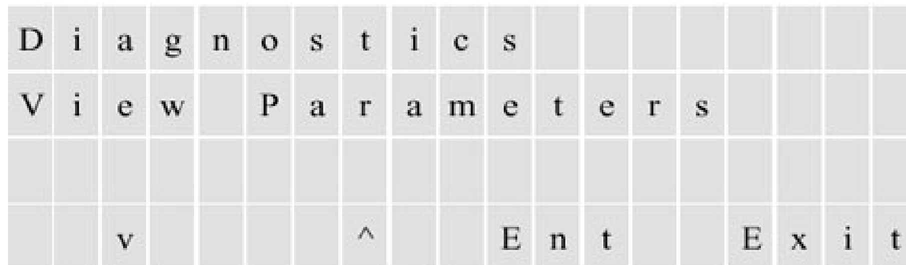

Figure 8–7.

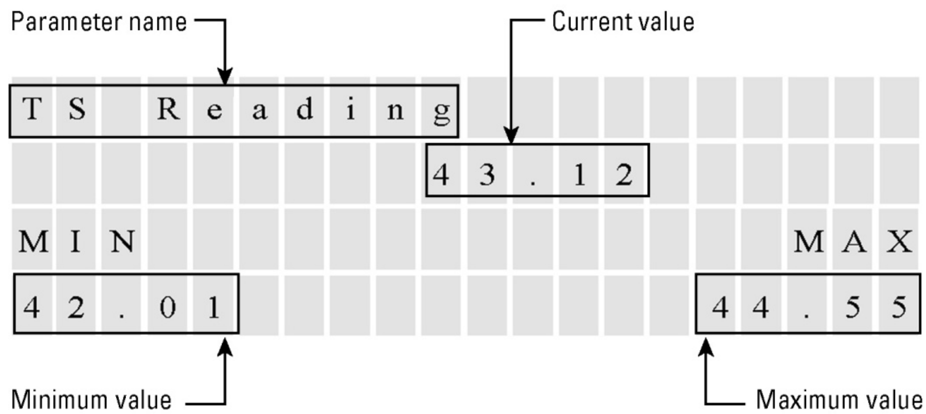

Figure 8–8.

Following are the menu items within the View Parameters menu.

Table 8–3.

Menu Item	Description
At line sample	Access this item to view the latest at line sample results: Sample AVG: The Average Concentration of the sample. SD: The Standard Deviation computed during the average. % RSD: The Relative Standard Deviation computed as a percentage of the average.
TS Reading	The concentration reading.
Response Factors	The slope (kHz/ppm or kHz/ppb sensitivity) and the offset (calculated at 0 concentration).
Working Average Sec	When switching from the normal average to the fast average and back to normal, the average time used can be observed from this menu item.

Menu Item	Description
% of Deviation	The percentage of deviation of the most current reading with respect to the average. This is the value used to switch to the fast average.
Rate of Change ppm/s	The rate of change of the sulfur reading expressed as ppm/sec.
AVG PMT signal kHz	The average of the raw detector signal.
Normalized PMT kHz	The frequency proportional to the PMT output normalized to the gain of 100; also displays the gain currently selected.
PMT Signal kHz	The actual frequency proportional to the PMT output; also displays the gain currently selected.
PMT Voltage	The input voltage to the PMT.
Internal Temperature	The temperature inside the electronics enclosure.
Chamber Temperature	The temperature inside the reaction chamber.
Chamber Flow	The flow through the reaction chamber.
Chamber Pressure	The pressure sensed at the reaction chamber.
Lamp Intensity	The frequency proportional to the lamp intensity.
Lamp Voltage	The lamp input voltage.
Stream 1 Density	The density of stream 1.
Stream 2 Density	The density of stream 2.

View Com Activity

This menu displays activity for Coms 1–4.

```
Diagnostics
Com Ports Rx Tx
               .
  V    ^  Ent  Exit
```

Figure 8–9.

Pulse UV Control

Following are the menu items within the Pulse UV Control menu.

Caution This menu is intended for factory test only. Incorrect settings can result in damage to the unit. σ

Table 8–4.

Menu Item	Description
Flash Lamp ON/OFF	Turn the UV lamp flashing on or off.
Auto Gain ON/OFF	Turn the amplifier auto gain selection on or off. **Note** Auto gain defaults to ON during normal operation. σ
PMT Signal Gain	Select the amplifier gain (1, 2, 5, 10, 20, 50, 100). **Note** The selection is only valid when auto gain is turned OFF. σ
Test Gains	Place the gain selection under manual control to verify the functionality of the programmable gain amplifier.
Test LED ON/OFF	Test the LED by turning it on and off.
Flash Frequency	Change the UV lamp flash frequency (normally 10 Hz).
Flash Time	Change the duration of the flashing pulse (normally 100 µs).
S&H Time (Sample & Hold Time)	Change the duration of the sample portion of the sample and hold analog front end (normally 100 µs). (Sample portion is the amount of time the sample and hold device is in the SAMPLE state.)

Chapter 9
At Line-Grab Sample

This function was developed primarily for pipeline applications. The sampling system was designed for the pipeline enclosure in order to provide an additional pump to facilitate introduction of sample. Access this top-level menu to enable the analyzer to analyze and report the results of a sample previously collected from a source other than the regular process input. The sample to be analyzed is introduced into the instrument in the same manner that a calibration standard is.

There are three parameters to configure: starting sample ID, average sampling time, and the relative standard deviation of the samples taken.

1. Each sample is identified with a number (starting sample ID). The numbers increment sequentially until a new starting sample ID is programmed.

At Line Grab Sample
Starting Sample ID
v ^ Ent Exit

Figure 9–1.

2. Average sampling time is the number of seconds that the sample is averaged to compute the result. It can be between 60 and 240 seconds.

At Line Grab Sample
Avg Sampling Time
v ^ Ent Exit

Figure 9–2.

3. The relative standard deviation (RSD) of the samples taken is computed as a percentage of the computed average. If it is less than or equal to the programmed value, the analyzer reports a successful sample. If it is greater than the programmed value, an error is reported.

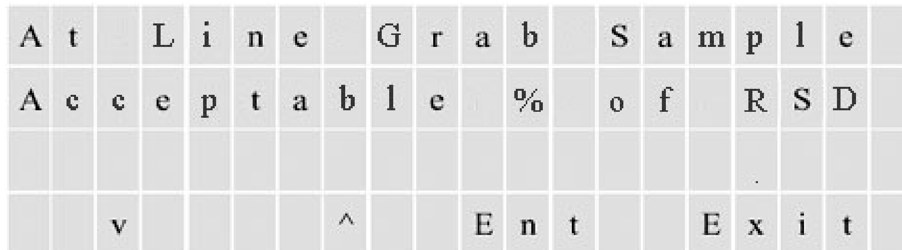

Figure 9–3.

Activate the function from the front panel or the SOLA web interface.

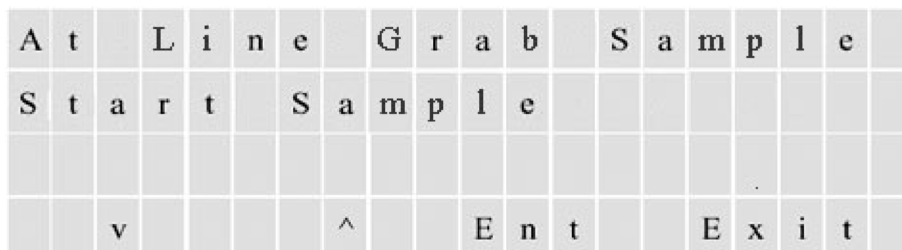

Figure 9–4.

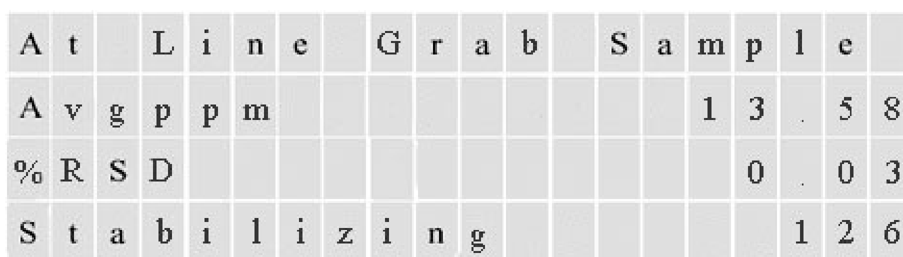

Figure 9–5. At line sampling screen

Chapter 10
Maintenance & Troubleshooting

Safety Precautions

Caution Some internal components can be damaged by small amounts of static electricity. Take appropriate precautions (use a properly grounded antistatic wrist strap) when handling electronic boards and components.

To avoid damaging internal components, follow these precautions when performing any service procedure:

λ Wear an antistatic wrist strap that is properly connected to earth ground. If an antistatic wrist strap is not available, be sure to touch a grounded metal object before touching any internal components.

λ Handle all printed circuit boards by the edges.

λ Carefully observe the instructions in each procedure. σ

Maintenance Schedule

Table 10–1. Maintenance schedule

Frequency	Tasks
Monthly	Calibrate the analyzer (Chapter 6).
Every six months	Visually inspect and clean the instrument. Check the instrument flow rates as explained later in this chapter. Replace the injection valve rotor or slider according to Appendix B.
Annually	Test the instrument for internal leaks as explained later in this chapter.
Every 18 months	Replace the pyrolyzer heater as explained later in this chapter.

Visual Inspection & Cleaning

The analyzer should be inspected occasionally for obvious visible defects, such as loose connectors, loose fittings, cracked or clogged Teflon lines, and excessive dust or dirt accumulation. Dust and dirt can accumulate in the instrument and can cause overheating or component failure. Dirt on the components prevents efficient heat dissipation and may provide conducting paths for electricity.

Warning Remove all instrument power before cleaning electronics. σ

The best way to clean the inside of the instrument is to first carefully vacuum all accessible areas and then blow away the remaining dust with low-pressure compressed air. Use a soft paintbrush or cloth to remove stubborn dirt.

Leak Tests

Use the following leak test procedure to verify that there are no system leaks.

1. Set the sample and air regulators for zero pressure.

2. Replace the tubing from the EXHAUST bulkhead on the left side of the instrument with a plug.

3. Adjust the auxiliary air regulator for 20 psig pressure.

4. Turn the auxiliary air regulator fully counterclockwise to close the supply flow.

5. Watch the analyzer pressure for 15 minutes.

6. If the pressure drops significantly, perform the following to locate the leak:

   a. Adjust the sample and air regulators for 20 psig pressure.

   b. Check the system fittings with a liquid or electronic leak detector.

   c. Correct any leakage.

   d. Repeat the leak test.

7. When the system passes the leak test, adjust the sample and air regulators fully counterclockwise to close supply flows.

8. Remove the plug from the EXHAUST bulkhead and reconnect the EXHAUST vent line.

9. Adjust the sample and air regulators to the pressures specified in the application notes shipped with the instrument or as recorded in the instrument logbook.

10. Allow the analyzer to warm up until it stabilizes.

Flow Rate Checks

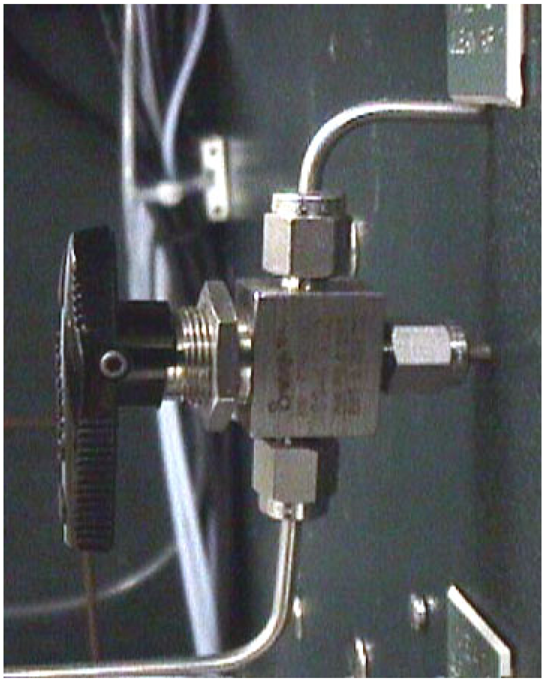

Figure 10–1. Three-way valve for measuring flow rates

1. Obtain a precision flow measurement instrument such as a bubble meter.

2. Ensure that all pressure regulators are set to the correct pressures as shown on the calibration data shipped with the instrument or as recorded in the instrument logbook.

3. Ensure that the analyzer is stabilized at normal operating temperatures before proceeding.

4. Suspend the analyzer according to Chapter 5.

5. Turn the MEAS. CLEAN AIR 1 3-way valves to point down for flow measurement.

6. Connect the flow meter to the MEAS. CLEAN AIR 1 port and adjust the CLEAN AIR 1 regulator to obtain the required flow.

7. Turn the MEAS. CLEAN AIR 1 3-way valves to point up for normal operation.

8. Turn the MEAS. CLEAN AIR 2 3-way valves to point down for flow measurement.

9. Connect the flow meter to the MEAS. CLEAN AIR 2 port and adjust the CLEAN AIR 2 regulator to obtain the required flow.

10. Turn the MEAS. CLEAN AIR 2 3-way valves to point up for normal operation.

11. Restart the analyzer according to Chapter 5.

The Rotary Valve

For detailed instructions on maintaining, removing, and replacing the rotary valve, refer to Appendix B.

The Mixing Chamber

1. Shut down the system according to Chapter 4.

2. Loosen the fittings that connect the tubing to the mixing chamber.

3. Loosen the screw located in the center of the bracket holding the mixing chamber to the bottom of the enclosure.

4. Carefully slide the mixing chamber from the bracket.

Note Install the mixing chamber by following the above steps in reverse. σ

Replacing the Pyrolyzer Heater

Warning The pyrolyzer can be extremely hot, even after power is turned off. Use extreme care to prevent burns! σ

The pyrolyzer heater is enclosed in the pyrolyzer housing, which is shown in the figure below.

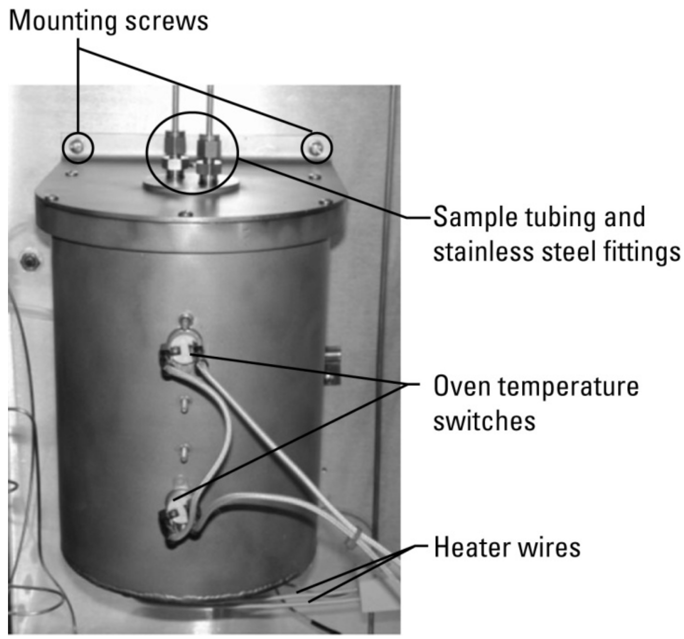

Figure 10–2. Pyrolyzer housing

The following table lists the part numbers for the parts referenced in this procedure. With the exception of the heater being replaced, the existing parts can be reused if in good condition. The part numbers are provided here for convenience.

Table 10–2. Parts list for heater replacement

P/N	Qty.	Description
27-1108-0	1	Thermocouple, S-type
29-1230-0	1	Heater, fiber insulated, 60 V/450 W
29-1231-0	1	Insulation, flameless burner
30-1025-0	1	Pyrolyzer tube, looped
40-0025	0.5 ft^2	Kaowool® insulation
56-1074-0	1	Terminal, 2 pole ceramic block, 30 A
64-1301-0	2	Heater wire sleeve, flameless burner
65-1041-0	1 ft	Insulation, fiberglass
68-1269-2	2	Red SS, 1Tx4T
89-2917-0	1	Pyrolyzer, tested assembly (includes housing, housing lid, O-ring, screws, washers)
HA-101812	2	Ferrule, 1/4 graphite

1. Follow the maintenance shutdown procedure in Chapter 4 to shut down the analyzer system. Allow the system to cool completely.

2. Carefully remove the two sample tubes from the top of the pyrolyzer housing using a backup wrench to keep the stainless steel fittings from turning.

3. Loosen the terminal block screws and disconnect the thermocouple wires. Be sure to note the orientation of the wire colors.

4. If installed, disconnect the wires from the oven temperature switches; the wire between the two sensors can be left in place.

5. Slightly loosen the two screws that attach the bottom of the housing to the back of the oven.

6. Support the housing while removing the top two mounting screws that hold it to the back of the oven. After both screws have been removed, lift the pyrolyzer up and out of the oven. Do not discard the mounting screws. You will need them later.

7. Remove the six screws and washers from the lid of the housing (Figure 10-3). Set them aside for later use.

Figure 10–3. Remove the pyrolyzer housing lid

8. Gently lift the lid off and set it aside.

Note The pyrolyzer tube, insulation, and Kaowool insulation will be attached to the lid (Figure 10-4). Carefully lift all of it out to avoid damaging the pyrolyzer tube. σ

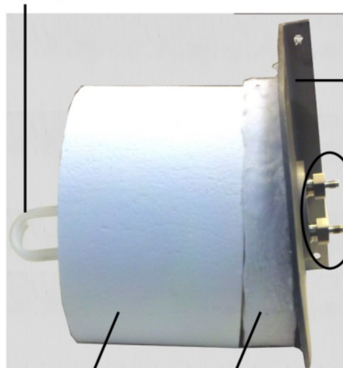

Figure 10–4. Housing lid with insulation and pyrolyzer tube attached

9. As shown in Figure 10-5, the heater wires are attached to the terminal block. Remove the heater wires from the terminal block and straighten the wires. Remove the fiberglass insulation that covers the heater wires (Figure 10-6). Set the insulation aside. You will need it later.

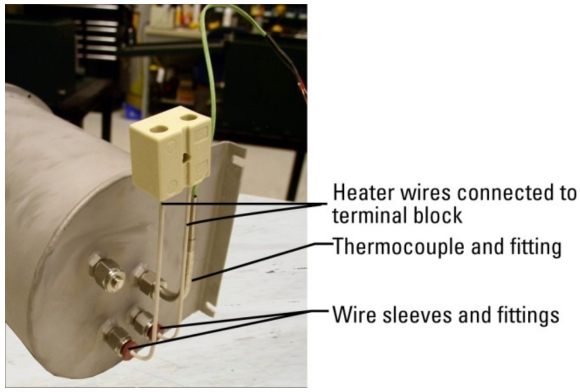

Figure 10–5. Heater wires and thermocouple

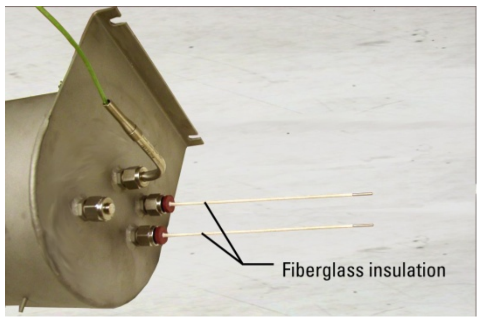

Figure 10–6. Remove the fiberglass insulation

10. Loosen the fittings around the heater wires and remove the wire sleeves. Set the sleeves and fittings aside.

11. Loosen the thermocouple fitting and remove the thermocouple from the housing. Set it aside for re-installation later.

12. You should now be able to remove the heater from the housing.

13. Insert the replacement heater into the housing (Figure10-7). Feed the two heater wires through the two fittings on the other side of the housing (Figure 10-8).

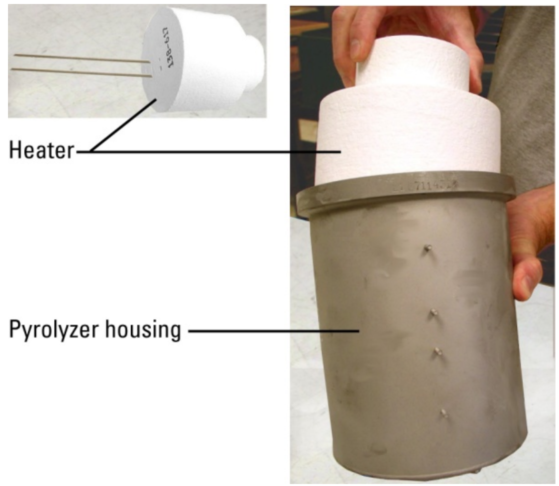

Figure 10–7. Insert replacement heater into housing

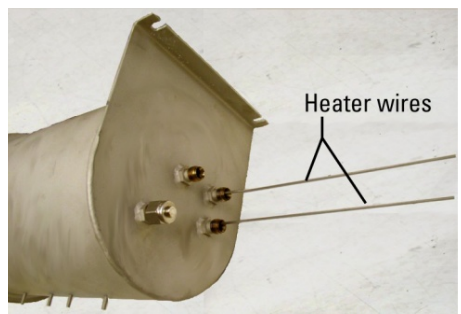

Figure 10–8. Heater wires fed through fittings

14. Slide the wire sleeves onto the heater wires. Tighten the stainless steel fittings (Figure 10-9).

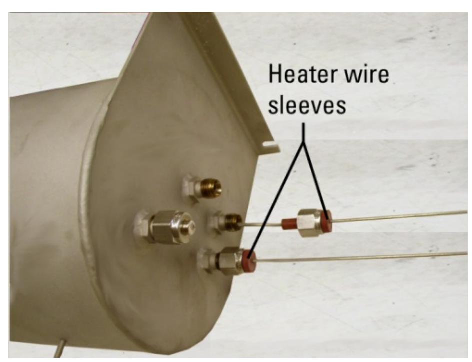

Figure 10–9. Wire sleeves and fittings

15. You will need to make a hole in the heater insulation to accommodate the thermocouple. Insert a drill bit through the fitting in the housing for the thermocouple and press it through the heater insulation to make the hole. Remove the bit, and then carefully feed the thermocouple tube through the stainless steel fitting on the housing (Figure 10-10). Tighten the thermocouple fitting to secure it to the housing.

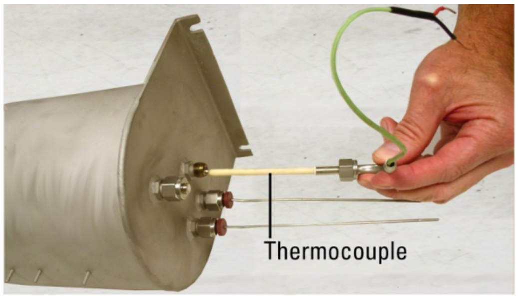

Figure 10–10. Insert the thermocouple

16. Slide the two pieces of fiberglass insulation that you removed earlier over the heater wires, leaving 3/8" exposed (Figure 10-11).

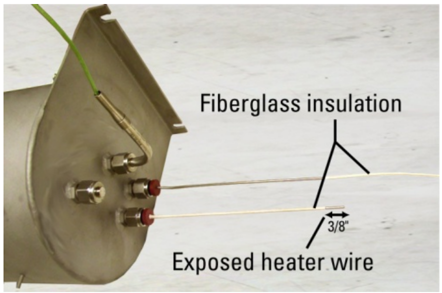

Figure 10–11. Add the fiberglass insulation

17. Insert the ends of the heater wires into the terminal block and tighten them. Bend the wires as shown in Figure 10-12.

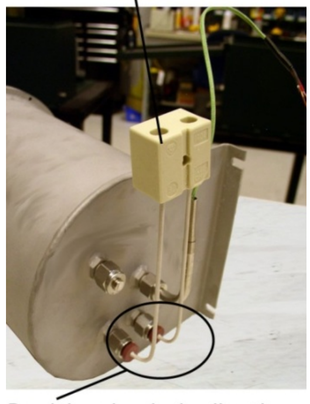

Figure 10–12. Heater wires inserted into terminal block

18. Inspect the O-ring around the open end of the pyrolyzer housing. If necessary, replace it and apply a lubricant compound, such as Dow Corning® 111, around it (Figure 10-13).

Figure 10–13. Pyrolyzer housing O-ring

19. Gently slide the lid into the housing.

Note The pyrolyzer tube, insulation, and Kaowool insulation should still be attached to the lid. Slide the lid back in carefully to avoid damaging the pyrolyzer tube. σ

20. Use the six screws and washers removed earlier to secure the lid to the housing.

21. With an air gun placed at the end of one fitting, blow out any dust or debris that may have dropped inside the pyrolyzer quartz or glass tube (Figure 10-13).

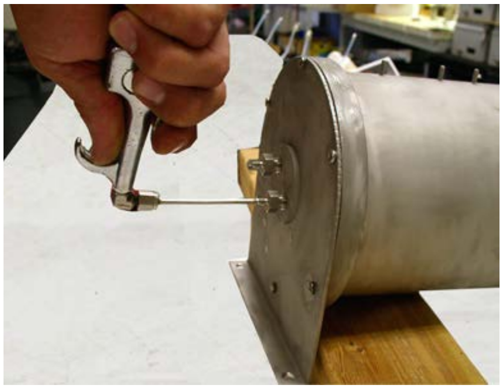

Figure 10–14. Blow out the debris

22. Secure the pyrolyzer housing to the oven enclosure using the screws removed earlier (two mounting screws on top of housing, two on bottom).

23. If necessary, reconnect the wires from the oven temperature switches.

24. Reconnect the heater wires to the pyrolyzer.

25. Reconnect the thermocouple wires.

26. Reconnect the sample tubing.

27. Follow the initial startup procedure in Chapter 4 to restart the analyzer.

The Pyrolyzer Reaction Tube

Replacement

Follow the steps below to replace the pyrolyzer tube (p/n 30-1025-0).

1. Complete steps 1 through 7 in the previous section, "Replacing the Pyrolyzer Heater."

2. Gently lift the lid off the housing.

   Note The pyrolyzer tube, insulation, and Kaowool insulation will be attached to the lid (Figure 10-15). Carefully lift all of it out of the housing. σ

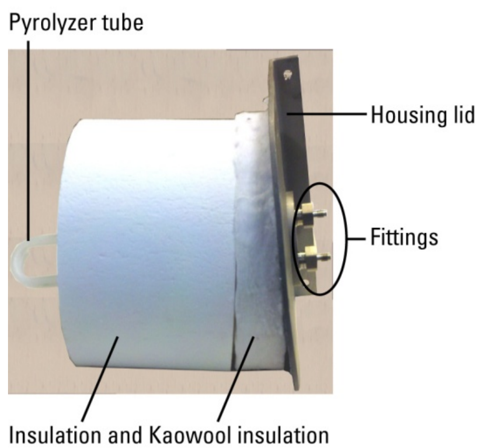

Figure 10–15. Housing lid with insulation and pyrolyzer tube attached

3. To remove the existing pyrolyzer tube, unscrew the two fittings from the lid while holding the tube in place. Remove the pyrolyzer tube and set it in a safe location. Set the fittings, insulation, and Kaowool insulation aside for use in the next steps.

4. Carefully push both ends of the replacement pyrolyzer tube through holes of the insulation (Figure 10-16).

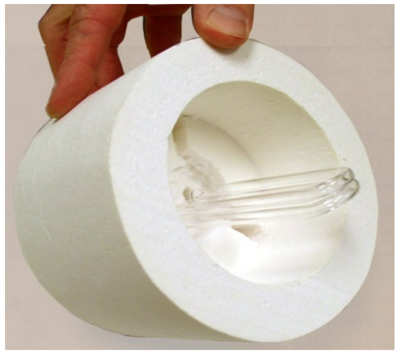

Figure 10–16. Pyrolyzer tube inserted into the insulation

5. Holding the pyrolyzer tube in place, apply the Kaowool insulation over the top of the insulation (Figure 10-17).

Figure 10–17. Apply the Kaowool insulation

6. Holding the insulation and pyrolyzer tube, gently attach the housing lid against the insulation, allowing both ends of the tube to come out of the lid approximately 1/2”. Attach one of the graphite ferrules and one of the fittings removed earlier to each of the pyrolyzer tube ends. See Figure 10-18.

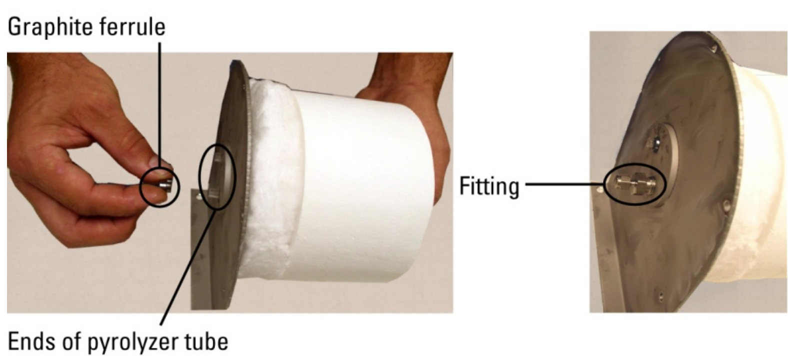

Figure 10–18. Reattach the ferrules and fittings

7. Gently slide the lid back into the housing and secure it using the screws and washers removed earlier.

8. With an air gun placed at the end of one fitting, blow out any dust or debris that may have dropped inside the pyrolyzer quartz or glass tube (Figure 10-13).

9. Follow steps 22 through 27 in the previous section, "Replacing the Pyrolyzer Heater," to re-install the housing and complete this procedure.

Decoking

Coking (carbon buildup) can occur in the pyrolyzer reaction tube when sample or calibration flow is too high or when there is no airflow. It is evidenced by a light brown or black coating on the inside of the pyrolyzer tube. Carbon built up in the reaction tube absorbs SO_2, resulting in poor instrument performance and invalid results.

Note We do not recommend decoking the tube. Instead, replace the tube according to the previous section. σ

General Troubleshooting

The analyzer has been designed to achieve a high level of reliability. Only premium components are used to ensure that complete failure is rare.

Note In the interest of completeness, manuals and drawings included with the system may provide information pertaining to options not included with your system. Information in application notes supersedes general information in these documents. σ

In the event of problems or failure, the troubleshooting guidelines presented in Table 10-4 may be helpful in isolating the fault. Additional information can be obtained from the following sources:

- System drawings
- Application notes for the supplied system
- Manuals and data sheets for other associated equipment

The application notes supplied with each system include information specific to the configuration of the installed system. These notes will typically include pressure settings, flow settings, temperature settings and other special situations or adjustments.

If it becomes necessary to contact Thermo Fisher Scientific with software or hardware problems, please have the following information available:

- Valve type
- Sample composition
- Options installed
- Ranges

Table 10–3. Troubleshooting

Malfunction	Possible Cause	Action
Analyzer does not start up	No power	Ensure instrument is connected to the proper source.
	Digital electronics	1. Ensure boards are seated properly and interconnecting cables are in place. 2. Replace boards one at a time to isolate faulty board.
No response to sample	Instrument problems	Check for alarm messages and correct as necessary.
	Bad calibration	Ensure proper calibration.
	Flasher power supply	Replace with known good board.
	Lamp trigger pak	Replace with known good board.
	Lamp **Do not look directly into lamp without proper eyewear!**	Remove lamp and socket from flash holder by loosening the single set screw. Lamp flash should be clearly visible at 20 yards distance in well-lit room.
	PMT high voltage power supply	Check voltage on high voltage power supply connector: Should be close to the setting.
	PMT	Replace with known good board.
	Digital electronics	Replace board one at a time to isolate faulty board.
	Low or no sample flow	1. Check trend of chamber flow at workstation. If chamber flow is low or trending down, check for stoppage at the injection valve. 2. Sample diverter valve may be inhibiting sample flow. Remove the analyzer from suspend mode, correct any alarm conditions, and/or ensure solenoid air manifold is set at 60 psig.
ALARM displayed: Sample Flow (determine alarm type by accessing the View/Ack Alarm menu)	- Sample supply inadequate or valves are closed or misaligned - Filtration system plugged - Fast loop bypass flow set too high	- Check process conditions and availability of sample supply. Ensure all valves are properly aligned. - Clean or replace filters. - Adjust bypass flow rate.
ALARM displayed: Chamber Flow (determine alarm type by accessing the View/Ack Alarm menu)	- Plugged line from mixing chamber to valve - Inadequate supply of combustion air	- Check lines.
ALARM displayed: Lamp Voltage alarm (determine alarm type by accessing the View/Ack Alarm menu)	- UV lamp is old/deteriorated - Bench contaminated with incompletely combusted materials.	- Replace UV lamp. - Purge system with carrier air (no sample) until output signal stabilizes. May take several days in severe cases.
ALARM displayed: Chamber Temperature (determine alarm type by accessing the View/Ack Alarm menu)	- Detector temperature not stabilized after service or enclosure opened - Ambient temperature or purge air is outside ambient temperature limits - Thermistor not positioned correctly	- Close doors and allow system to stabilize. - Measure ambient and purge air temperatures and correct as necessary. - Reposition Thermistor.

Malfunction	Possible Cause	Action
ALARM displayed: Cal Fail (determine alarm type by accessing the View/Ack Alarm menu)	- Analyzer problems - Recal deviation too low - Calibration standard does not match entered value - Faulty previous calibration or recently replaced calibration	- Check for other alarms and correct as necessary. - Adjust recal deviation. - Correct calibration value entry. - Manually start a calibration to force a new calibration factor standard update.
ALARM displayed: Inject Temperature (determine alarm type by accessing the View/Ack Alarm menu)	- Instrument is starting up and not reaching control temperature for the pyrolyzer and oven - Pyrolyzer heater failure - Pyrolyzer or oven temperature failure	- Normal alarm during startup until pyrolyzer and oven temperatures stabilize. - Check pyrolyzer temperature. If much lower than normal and not increasing, check for voltage across the heater terminals. If voltage is present, shut down the instrument, disconnect the pyrolyzer heater contacts and measure heater continuity. Replace heater if it shows open. - Check electronics and replace if necessary.
ALARM displayed: Valve Fault (determine alarm type by accessing the View/Ack Alarm menu)	- Injection valve worn or scratched, causing port-to-port leakage -Defective flasher lamp, trigger pak, or lamp intensity control electronics	- Replace valve rotor. In extreme cases, replace entire valve head. Check filtration system to ensure particulate is not getting to the injection valve. -Check lamp, trigger pak, and electronics. Replace if necessary.
ALARM displayed: Purge Fail (determine alarm type by accessing the View/Ack Alarm menu)	- Loss of instrument air pressure - Improper settings - Leakage at oven or electronic enclosure doors - Leakage throughout electrical conduit	- Check instrument air source pressure. - Ensure oven air and purge pressures are set properly. - Ensure oven and electronics enclosure doors are closed tightly and that door seals are in good condition. - Ensure electrical conduit seals are poured.
Excessive signal noise	Internal sample or carrier leakage	Check instrument for leaks.
	Defective or low sensitivity PMT	Check electronics and replace if necessary.
No 4-20 mA DC output current	Incorrect or damaged wiring[1]	Check wiring diagrams to ensure 4-20 mA DC signal connected to proper terminals with correct polarity. Check for short or open in wiring.
Inaccurate 4-20 mA DC output current	Incorrect or damaged wiring[1]	Check wiring diagrams to ensure 4-20 mA DC signal connected to proper terminals with correct polarity. Check for short or open in wiring.
Unstable reading	Internal instrument leak	Check for leaks.
	Flasher lamp	Replace with known good lamp to see if problem is resolved.
	Lamp trigger pak	Replace.
Low lamp intensity	Flasher lamp	Ensure lamp and trigger pak are securely fastened.

[1] Fault on the I/O PCB.

Contact Information

The local representative is your first contact for support and is well equipped to answer questions and provide application assistance. You can also obtain support by contacting Thermo Fisher Scientific directly at the following locations.

12320 Cardinal Meadow Drive Sugar Land, TX 77478 USA +1 (800) 437-7979 +	A-101, 1CC Trade Tower Senapati Bapat Road Pune 411 016 Maharashtra, INDIA +91 (20) 6626 7000 +91 (20) 6626 7001 fax	Unit 702-715, 7/F Tower West Yonghe Plaza No. 28 Andingmen East Street, Beijing 100007 CHINA +86 (10) 8419-3588 +86 (10) 8419-3580 fax
Ion Path, Road Three Winsford, Cheshire CW7 3GA UNITED KINGDOM +44 (0) 1606 548700 +44 (0) 1606 548711 fax		
www.thermoscientific.com		

For returns, contact Thermo Fisher Scientific for specific instructions.

Warranty

Thermo Scientific products are warranted to be free from defects in material and workmanship at the time of shipment and for one year thereafter. Any claimed defects in Thermo Scientific products must be reported within the warranty period. Thermo Fisher shall have the right to inspect such products at Buyer's plant or to require Buyer to return such products to Thermo Fisher plant.

In the event Thermo Fisher requests return of its products, Buyer shall ship with transportation charges paid by the Buyer to Thermo Fisher plant. Shipment of repaired or replacement goods from Thermo Fisher plant shall be F.O.B. Thermo Fisher plant. A quotation of proposed work will be sent to the customer. Thermo Fisher shall be liable only to replace or repair, at its option, free of charge, products that are found by Thermo Fisher to be defective in material or workmanship, and which are reported to Thermo Fisher within the warranty period as provided above. This right to replacement shall be Buyer's exclusive remedy against Thermo Fisher.

Thermo Fisher shall not be liable for labor charges or other losses or damages of any kind or description, including but not limited to, incidental, special or consequential damages caused by defective products. This warranty shall be void if recommendations provided by Thermo Fisher or its Sales Representatives are not followed concerning methods of operation, usage and storage or exposure to harsh conditions.

Materials and/or products furnished to Thermo Fisher by other suppliers shall carry no warranty except such suppliers' warranties as to materials and workmanship. Thermo Fisher disclaims all warranties, expressed or implied, with respect to such products.

EXCEPT AS OTHERWISE AGREED TO IN WRITING BY Thermo Fisher, THE WARRANTIES GIVEN ABOVE ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AND Thermo Fisher HEREBY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR PURPOSE.

Items not Covered under Warranty

The following parts are considered consumable items and **are not covered under the warranty**:

- Injection valve and associated parts
- Inline filter
- UV lamp
- Pyrolyzer tube, quartz
- Pyrolyzer O-ring, silicone
- Pyrolyzer tube graphite ferrules

Appendix A
Watlow EZ-ZONE® PM6 Series

Controller Description

The Watlow EZ-ZONE® PM6 series controller is used to control the temperatures of the pyrolyzer furnace and the analyzer oven. The controller provides a signal output if the zone temperature is outside a specified range.

This appendix provides basic operating instructions and default configuration settings. For complete operating information and troubleshooting, refer to the EZ-ZONE PM PID Controller user's manual.

Hardware Setup

The EZ-ZONE PM6 is wired at the factory according to your application. No other hardware settings are required.

Display & Keys

The display and keys on the EZ-ZONE PM6 are shown below and described in the table that follows.

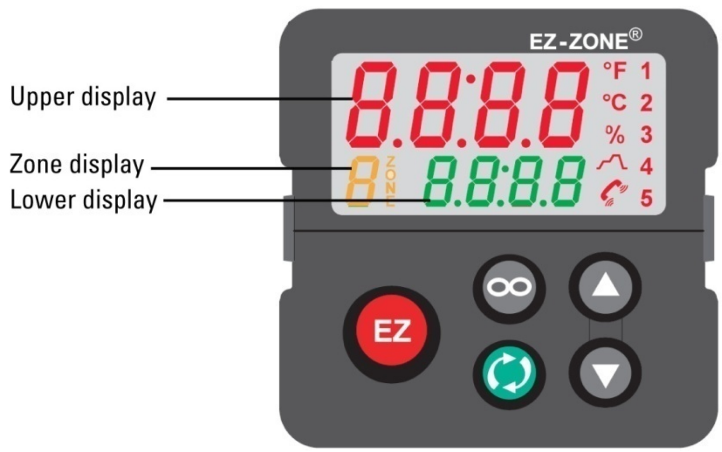

Figure A–1. EZ-ZONE PM6 series controller

Table A–1. Controller display & keys

Display/Key	Description
Upper display	When in the Home page, displays the process value. Otherwise, the upper display shows the value of the parameter in the lower display.
Zone display	Indicates the controller zone: 1-9 = Zones 1 through 9 A = Zone 10 b = Zone 11 C = Zone 12 d = Zone 13 E = Zone 14 F = Zone 15 h = Zone 16
Lower display	Indicates the set point or output power value during operation, or the parameter associated with the value shown in the upper display.
°F , °C	Indicates whether the temperature is displayed in degrees Fahrenheit or Celsius.
%	The percent LED lights when values are displayed as a percentage or when the open-loop set point is displayed.
	This LED indicates the status of a profile. When lit, a profile is running. When flashing, a profile is paused.
	Indicates communication activity by flashing when another device is communicating with the controller.
1 through 5	The number LEDs indicate output activity.
	Press the Infinity key to back up one level, or press and hold the key for two seconds to return to the Home page. Once on the Home page, this key may be used to clear alarms and errors (if they may be cleared).
	Press the Advance key to enter the selected menu.
	When in the Home page, use the Up and Down keys to adjust the set point in the lower display. When in other pages, use the keys to change the upper display to a higher or lower value or to change a parameter selection.

Software Configuration

There are two ways to configure the EZ-ZONE PM6. You can use the menu system built into the controller and configure it using the display and appropriate keys to navigate through the system. Alternatively, you can use the EZ-ZONE Configurator software. Instructions for both methods of configuration are provided in the EZ-ZONE PM PID Controller user's manual.

The built-in menu system and configuration software have the following main pages.

- Setup page: Used to set up a control prior to operation.
- Operations page: Used to monitor or change runtime settings.
- Factory Page: Used to enable password protection, create a custom Home Page, and perform other tasks that do not have an effect on the control when running.
- Home Page: The page that is displayed when the control is initially powered up.

Parameters for the EZ-ZONE PM6 are set to the optimum values for your application at the factory. The defaults settings are provided here in the event the configuration is changed without authorization.

Caution! Changing the parameters may adversely affect the system performance. σ

Pyrolyzer Settings

The default settings for the pyrolyzer are provided in the tables on the following pages.

Table A–2. Pyrolyzer settings: Setup Page > Analog Input 1

Parameter		Default		Comment
Display	Software	Display	Software	
SEn	Sensor Type	tC	Thermocouple	
Lin	TC Linearization	S	S	For Type S thermocouple
FiL	Filter		0.5	For smoothing the process signal.
i.Er	Input Error Latching	oFF	Off	
dEC	Display Precision	0	Whole	

Table A–3. Pyrolyzer settings: Setup Page > Control Loop 1

Parameter		Default		Comment
Display	Software	Display	Software	
h.Ag	Heat Algorithm	Pid	PID	The method of heat control.
C.Ag	Cool Algorithm	oFF	Off	
t.tUn	TRU-TUNE+ Enable	no	No	
t.Agr	Autotune Aggressiveness	Crit	Critical	Critical damped aggressiveness of autotuning calculations.
UFA	User Failure Action	USEr	User	When user switches to manual mode, controller sets output power to last open-loop set point entered by user.
FAiL	Input Error Failure	oFF	Off	When an input error switches control to manual mode, controller sets output to 0%.
L.dE	Open Loop Detect Enable	no	No	
rP	Ramp Action	oFF	Off	
L.SP	Low Set Point		0°C	The minimum value of the closed loop set point range.
h.SP	High Set Point		1150°C	The maximum value of the closed loop set point range.
SP.Lo	Set Point Open Limit Low		-100.0%	The minimum value of the open loop set point range.
SP.hi	Set Point Open Limit High		100.0%	The maximum value of the open loop set point range.

Table A–4. Pyrolyzer settings: Setup Page > Output 1

Parameter		Default		Comment
Display	Software	Display	Software	
Fn	Output Function	hEAt	Heat	
o.Ct	Output Control	Ftb	Fixed Time Base	
o.tb	Output Time Base		0.5	
o.Lo	Output Low Power Scale		0%	The power output will never be less than the value specified and will represent the value at which output scaling begins.
o.hi	Output High Power Scale		15%	The power output will never be greater than the value specified and will represent the value at which output scaling stops.

Table A–5. Pyrolyzer settings: Setup Page > Output 2

Parameter		Default		Comment
Display	Software	Display	Software	
Fn	Output Function	ALM	Alarm	
Fi	Output Function Instance		1	

Table A–6. Pyrolyzer settings: Setup Page > Alarm1

Parameter		Default		Comment
Display	Software	Display	Software	
A.ty	Alarm Type	dE.AL	Deviation Alarm	
A.hy	Alarm Hysteresis		2°C	
A.Lg	Alarm Logic	AL.o	Open On Alarm	The output condition during an alarm state.
A.Sd	Alarm Sides	both	Both	Both high and low sides can trigger the alarm.
A.LA	Alarm Latching	nLAt	Non-Latching	
A.bL	Alarm Blocking	oFF	Off	

Parameter		Default		Comment
Display	Software	Display	Software	
A.Si	Alarm Silencing	oFF	Off	
A.dSP	Alarm Display	on	On	An alarm message will display when an alarm is active.
A.dL	Alarm Delay Time		0	

Table A–7. Pyrolyzer settings: Setup Page > Function Key

Parameter		Default		Comment
Display	Software	Display	Software	
LEu	Active Level	high	High	
Fn	Action Function	uSr.r	User Set Restore	
Fi	Function Instance		1	

Table A–8. Pyrolyzer settings: Setup Page > Global1

Parameter		Default		Comment
Display	Software	Display	Software	
C_F	Display Units	C	C	Display units are in °C.
AC.LF	AC Line Frequency	60	60 Hz	The frequency to the applied AC line power source.
C.LEd	Communications LED Action	both	Both	Both comm port 1 and 2 selected.
ZonE	Zone	oFF	Off	
ChAn	Channel	on	On	The Channel LED is on.
d.PrS	Display Pairs		1	The number of display pairs.
d.ti	Display Time		0	The time delay for toggling between channel 1 and channel 2.
USr.S	User Settings Save	nonE	None	
USr.r	User Settings Restore	nonE	None	

Table A–9. Pyrolyzer settings: Operations Page > Analog Input 1

Parameter		Description	
Display	Software		
	Analog Input Value	The process value (°C).	
	Input Error	The cause of the most recent error. Possible displays listed below.	
			None
			Open
			Fail
			Shorted
			Measurement Error
			Bad Calibration Data
			Ambient Error
			RTD Error
			Not Sourced
	Calibration Offset	The offset applied to the input reading to compensate factors that cause the input reading to vary from the actual process value (°C). Default = 0.	

Table A–10. Pyrolyzer settings: Operations Page > Monitor 1

Parameter		Description	
Display	Software		
C.MA	Control Mode Active	The control mode currently in effect. Possible displays listed below.	
		oFF	Off
		AUto	Auto
		MAn	Manual
h.Pr	Heat Power	The current heat output level (%).	
C.Pr	Cool Power	The current cool output level (%).	
C.SP	Closed-Loop Set Point	The set point currently in effect (°C).	
Pv.A	Process Value Active	The current filtered process value using the control input (°C).	

Table A–11. Pyrolyzer settings: Operations Page > Control Loop 1

Parameter		Default		Comment
Display	Software	Display	Software	
C.M	Control Mode	AUto	Auto	The loop will use automatic control.
A.tSP	Autotune Set Point		90%	The percentage of the current set point that will be used by autotune.
AUt	Autotune	no	No	
C.SP	Closed-Loop Set Point		1100°C	The set point the controller will automatically control to.
id.S	Idle Set Point		24°C	The closed loop set point that can be triggered by an event state.
h.Pb	Heat Proportional Band		14°C	The PID proportional band for the heat outputs.
h.hy	Heat Hysteresis		2°C	The process value needs to be this far into the “on” region before the output turns on.
C.Pb	Cool Proportional Band		14°C	The PID proportional band for the cool outputs.
C.hy	Cool Hysteresis		2°C	The process value needs to be this far into the “on” region before the output turns on.

Parameter		Default		Comment
Display	Software	Display	Software	
t i	Time Integral		180	The PID integral (seconds).
td	Time Derivative		0	The PID derivative (seconds).
db	Dead Band		0°C	The offset to the proportional band.
o.SP	Open Loop Set Point		0.0%	The fixed level of output power when in manual (open loop) mode.

Table A–12. Pyrolyzer settings: Operations Page > Alarm 1

Parameter		Default		Comment
Display	Software	Display	Software	
A.Lo	Alarm Low Set Point		-5°C	The set point that will trigger a low alarm.
A.hi	Alarm High Set Point		5°C	The set point that will trigger a high alarm.

Table A–13. Pyrolyzer settings: Factory Page > Custom Setup 1

Parameter		Default		Comment
Display	Software	Display	Software	
PAr	Parameter	AC.Pu	Active Process Value	The parameter that will appear in the custom Home Page.
i id	Instance ID		1	

Table A–14. Pyrolyzer settings: Factory Page > Custom Setup 2

Parameter		Default		Comment
Display	Software	Display	Software	
PAr	Parameter	AC.SP	Active Set Point	The parameter that will appear in the custom Home Page.
i id	Instance ID		1	

Table A–15. Pyrolyzer settings: Factory Page > Custom Setup 3

Parameter		Default		Comment
Display	Software	Display	Software	
PAr	Parameter	AUt	Autotune	The parameter that will appear in the custom Home Page.
iid	Instance ID		1	

Table A–16. Pyrolyzer settings: Lock Page > Lock 1

Parameter		Default		Comment
Display	Software	Display	Software	
LoC.o	Operations Page		2	The security level of the Operations Page.
PAS.E	Password Enable	oFF	Off	
rLoC	Read Lock		1	The level of read security clearance.
SLoC	Write Security		0	The level of write security clearance.
LoC.L	Locked Access Level		1	
roLL	Rolling Password	oFF	Off	
PAS.u	User Password		63	
PAS.A	Administrator Password		156	

Oven Settings

The default settings for the pyrolyzer are provided in the tables on the following pages.

Table A–17. Oven settings: Setup Page > Analog Input 1

Parameter		Default		Comment
Display	Software	Display	Software	
SEn	Sensor Type	r0.1H	RTD 100 Ohm	
Lin	TC Linearization	S	S	For Type S thermocouple
rt.L	RTD Leads	2	2	The number of leads on the RTD wired to this input.
Unit	Units	Pro	Process	The type of units measured by the sensor.
S.Lo	Scale Low		0.00	The low scale for process inputs.
S.hi	Scale High		20.00	The high scale for process inputs.
r.Lo	Range Low		-18.0°C	The output low range.
r.hi	Range High		5537.0°C	The output high range.
P.EE	Process Error Enable	oFF	Off	
P.EL	Process Error Low Value		0.00	
FiL	Filter		0.5	For smoothing the process signal.
i.Er	Input Error Latching	oFF	Off	
dEC	Display Precision	0.0	Tenths	

Table A–18. Oven settings: Setup Page > Control Loop 1

Parameter		Default		Comment
Display	Software	Display	Software	
h.Ag	Heat Algorithm	Pid	PID	The method of heat control.
C.Ag	Cool Algorithm	oFF	Off	
t.tUn	TRU-TUNE+ Enable	no	No	
t.bnd	TRU-TUNE+ Band		0°C	
t.gn	TRU-TUNE+ Gain		3	
t.Agr	Autotune Aggressiveness	Crit	Critical	Critical damped aggressiveness of autotuning calculations.
P.dL	Peltier Delay		0.0	
UFA	User Failure Action	USEr	User	When user switches to manual mode, controller sets output power to last open-loop set point entered by user.
FAiL	Input Error Failure	oFF	Off	When an input error switches control to manual mode, controller sets output to 0%.
MAn	Fixed Power		0.0%	
L.dE	Open Loop Detect Enable	no	No	
L.dt	Open Loop Detect Time		240	
L.dd	Open Loop Detect Deviation		6.0°C	
rP	Ramp Action	oFF	Off	
r.SC	Ramp Scale	Min	Minutes	
r.rt	Ramp Rate		1.0°C	
L.SP	Low Set Point		0°C	The minimum value of the closed loop set point range.
h.SP	High Set Point		200.0°C	The maximum value of the closed loop set point range.
SP.Lo	Set Point Open Limit Low		-100.0%	The minimum value of the open loop set point range.

Parameter		Default		Comment
SP.hi	Set Point Open Limit High		100.0%	The maximum value of the open loop set point range.

Table A–19. Oven settings: Setup Page > Output 1

Parameter		Default		Comment
Display	Software	Display	Software	
Fn	Output Function	hEAt	Heat	
Fi	Output Function Instance		1	
o.Ct	Output Control	Ftb	Fixed Time Base	
o.tb	Output Time Base		0.5	
o.Lo	Output Low Power Scale		0%	The power output will never be less than the value specified and will represent the value at which output scaling begins.
o.hi	Output High Power Scale		70%	The power output will never be greater than the value specified and will represent the value at which output scaling stops.

Table A–20. Oven settings: Setup Page > Output 2

Parameter		Default		Comment
Display	Software	Display	Software	
Fn	Output Function	ALM	Alarm	
Fi	Output Function Instance		1	

Table A–21. Oven settings: Setup Page > Alarm 1

Parameter		Default		Comment
Display	Software	Display	Software	
A.ty	Alarm Type	dE.AL	Deviation Alarm	
A.hy	Alarm Hysteresis		2°C	
A.Lg	Alarm Logic	AL.o	Open On Alarm	The output condition during an alarm state.
A.Sd	Alarm Sides	both	Both	Both high and low sides can trigger the alarm.

Parameter		Default		Comment
A.LA	Alarm Latching	nLAt	Non-Latching	
A.bL	Alarm Blocking	oFF	Off	
A.Si	Alarm Silencing	oFF	Off	
Display	Software	Display	Software	
A.dSP	Alarm Display	on	On	An alarm message will display when an alarm is active.
A.dL	Alarm Delay Time		0	

Table A–22. Oven settings: Setup Page > Function Key 1

Parameter		Default		Comment
Display	Software	Display	Software	
LEu	Active Level	high	High	
Fn	Action Function	uSr.r	User Set Restore	
Fi	Function Instance		1	

Table A–23. Oven settings: Setup Page > Global 1

Parameter		Default		Comment
Display	Software	Display	Software	
C_F	Display Units	C	C	Display units are in °C.
AC.LF	AC Line Frequency	60	60 Hz	The frequency to the applied AC line power source.
C.LEd	Communications LED Action	both	Both	Both comm port 1 and 2 selected.
ZonE	Zone	oFF	Off	
ChAn	Channel	on	On	The Channel LED is on.
d.Pr5	Display Pairs		1	The number of display pairs.
d.ti	Display Time		0	The time delay for toggling between channel 1 and channel 2.
USr.S	User Settings Save	nonE	None	
USr.r	User Settings Restore	nonE	None	

Table A–24. Oven settings: Operations Page > Analog Input 1

Parameter		Description	
Display	Software		
Ain	Analog Input Value	The process value (°C).	
i.Er	Input Error	The cause of the most recent error. Possible displays listed below.	
		nonE	None
		OPEn	Open
		FAiL	Fail
		Shrt	Shorted
		E.M	Measurement Error
		E.CAL	Bad Calibration Data
		Er.Ab	Ambient Error
		E.rtd	RTD Error
		NSrc	Not Sourced
i.CA	Calibration Offset	The offset applied to the input reading to compensate factors that cause the input reading to vary from the actual process value (°C). Default = 0.	

Table A–25. Oven settings: Operations Page > Monitor 1

Parameter		Description	
Display	Software		
C.MA	Control Mode Active	The control mode currently in effect. Possible displays listed below.	
		oFF	Off
		AUto	Auto
		MAn	Manual
h.Pr	Heat Power	The current heat output level (%).	
C.Pr	Cool Power	The current cool output level (%).	

Parameter		Description
C.SP	Closed-Loop Set Point	The set point currently in effect (°C).
Pu.A	Process Value Active	The current filtered process value using the control input (°C).

Table A–26. Oven settings: Operations Page > Control Loop 1

Parameter		Default		Comment
Display	Software	Display	Software	
C.m	Control Mode	AUto	Auto	The loop will use automatic control.
A.tSP	Autotune Set Point		90%	The percentage of the current set point that will be used by autotune.
AUt	Autotune	no	No	
C.SP	Closed-Loop Set Point		190.0°C	The set point the controller will automatically control to.
id.S	Idle Set Point		25.0°C	The closed loop set point that can be triggered by an event state.
h.Pb	Heat Proportional Band		14.0°C	The PID proportional band for the heat outputs.
h.hy	Heat Hysteresis		2.0°C	The process value needs to be this far into the “on” region before the output turns on.
C.Pb	Cool Proportional Band		14.0°C	The PID proportional band for the cool outputs.
C.hy	Cool Hysteresis		2.0°C	The process value needs to be this far into the “on” region before the output turns on.
ti	Time Integral		180	The PID integral (seconds).
td	Time Derivative		0	The PID derivative (seconds).
db	Dead Band		0.0°C	The offset to the proportional band.
o.SP	Open Loop Set Point		0.0%	The fixed level of output power when in manual (open loop) mode.

Table A–27. Oven settings: Operations Page > Alarm 1

Parameter		Default		Comment
Display	Software	Display	Software	
A.Lo	Alarm Low Set Point		-5°C	The set point that will trigger a low alarm.
A.hi	Alarm High Set Point		5°C	The set point that will trigger a high alarm.

Table A–28. Oven settings: Factory Page > Custom Setup 1

Parameter		Default		Comment
Display	Software	Display	Software	
PAr	Parameter	AC.Pu	Active Process Value	The parameter that will appear in the custom Home Page.
iid	Instance ID		1	

Table A–29. Oven settings: Factory Page > Custom Setup 2

Parameter		Default		Comment
Display	Software	Display	Software	
PAr	Parameter	AC.SP	Active Set Point	The parameter that will appear in the custom Home Page.
iid	Instance ID		1	

Table A–30. Oven settings: Factory Page > Custom Setup 3

Parameter		Default		Comment
Display	Software	Display	Software	
PAr	Parameter	AUt	Autotune	The parameter that will appear in the custom Home Page.
iid	Instance ID		1	

Table A–31. Oven settings: Lock Page > Lock 1

Parameter		Default		Comment
Display	Software	Display	Software	
LoC.o	Operations Page		2	The security level of the Operations Page.

Parameter		Default		Comment
PAS.E	Password Enable	oFF	Off	
rLoC	Read Lock		1	The level of read security clearance.
SLoC	Write Security		0	The level of write security clearance.
LoC.L	Locked Access Level		1	
Display	Software	Display	Software	
roLL	Rolling Password	oFF	Off	
PAS.u	User Password		63	
PAS.A	Administrator Password		156	

The Lockout Menu

Each menu in the Factory page and each page except the Factory page has a security level assigned to it. You can change the read and write access to these menus and pages through the Lockout menu [LoC]. These security functions are described in detail in the EZ-ZONE PM PID Controller user's manual.

Appendix B
Rotary Valve Service

Some applications use rotary valves manufactured by Valco Instruments Co. Inc. (VICI). This appendix describes operation and cleaning instructions for the valves typically used. The material in this appendix is taken from VICI Technical Note 201 (TN-201 9/00), copyright 2000 VICI and from VICI Technical Note 409 (TN-409 4/01), copyright 2001 VICI. Technical Notes used with permission (www.VICI.com).

Caution The sample line must be purged with air to remove all sample prior to performing valve maintenance to prevent sample leaking to the pyrolyzer. Open the oven and disconnect the tubing from the injection valve to the pyrolyzer before servicing the valve. σ

Initial Precautions

Note For Valco W and UW Type valves. σ

After unpacking the valve, do not remove the protective tape from the valve ports until you are ready to install the valve. As supplied, all surfaces are clean and free of contaminants, and must be kept clean to prevent valve damage. Open ports and fittings cause unnecessary risk of particulate matter entering the valve and scratching the sealing surfaces, which is the most frequent cause of premature valve failure.

Note The most common source of particulate and chemical contamination is tubing which has not been properly cleaned before installation in the valve. To avoid this problem, Valco Instruments suggests using their electrolytically pre-cut and polished tubing, available in standard lengths for any plumbing requirement. σ

Note If other tubing is to be used, make certain that all tubing ends are free of burrs and cut square with the tube axis, and that all tubing has been cleaned chemically and mechanically. σ

Note Failure to observe proper cleanliness procedures during installation of the valve voids the manufacturer's warranty. σ

Make sure that tubes are seated completely before forming the one-piece Valco ferrule on the tube. This ensures that the minimum connection volume is obtained. (For more information on installing fittings, refer to VICI Technical Note 503, "Fitting Instructions").

Valve Disassembly

Caution Do not disassemble the valve unless the system malfunction is definitely isolated to the valve; perform all other system checks first. If disassembly is required, make certain that the following instructions are carefully observed. σ

Disassembly operations must be performed in a clean, well-lighted area. Flush all hazardous or toxic materials from the valve before starting. **Please read the entire procedure before beginning.**

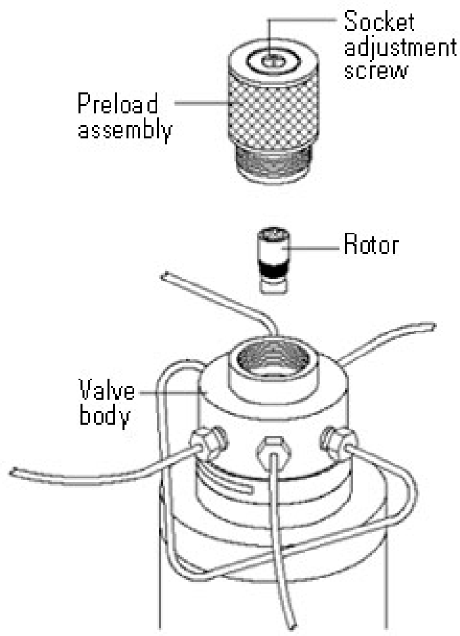

Figure B–1. Rotary valve disassembly

As this figure illustrates the valve can be disassembled for cleaning and/or rotor replacement without removing the loops and tubing from the valve or removing the valve from the actuator or mounting bracket.

1. Unscrew the entire knurled preload assembly. Do not tamper with the preset socket adjustment screw.

2. Engage the end of the rotor (Figure B–2) with a pencil-type magnet, available from VICI or any electronic components supplier. Cycle the valve one time to break the "shear seal" between the rotor and the valve body.

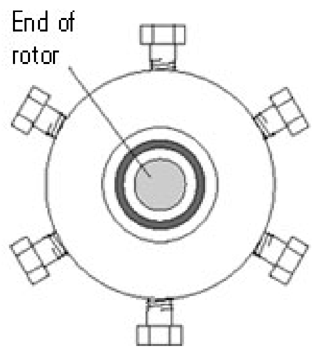

Figure B–2. Preload removed (preload end view)

Caution Any contact between the interior of the valve body and the metal of the rotor or any tool used is likely to cause damage. σ

3. Carefully withdraw the rotor from the valve body with the magnet. Once the rotor is removed, note the orientation of the rotor tab, which is marked with an ID letter denoting the type of seal material.

Cleaning the Valve Body

Follow these instructions to clean the valve body.

1. Wet a cotton swab with a solvent compatible with the chromatographic system. Isopropyl alcohol is recommended.

2. Gently swab the polished interior of the valve to remove any loose residue.

3. Blow with clean compressed gas to remove any lint left by the swab.

4. Visually inspect the interior of the valve body. The conical surface should appear highly polished. If any scratches are visible between the ports or anywhere that might suggest a potential leakage path or wear source, the valve should be returned to the factory for grinding and polishing.

Cleaning the Rotor

1. Carefully grasp the rotor on either end and briefly immerse it in solvent. If it is difficult to grip the rotor securely, hemostats or needle-nosed pliers may be helpful. Grip the tab end, being careful not to mar the metal or touch the polymer.

2. Gently wipe the polymer with a clean tissue.

3. Blow with clean compressed gas to remove any lint left by the tissue.

4. Visually inspect the rotor. If it shows any scratches and/or a narrowing of the flow passages, replacement is necessary.

Rotor Assembly

1. Place the clean rotor on the pencil magnet and orient it so that the tab properly engages the slot of the drive mechanism. The list in Figure B–3 shows how to orient the ID letter for different VICI valves (A C6W is shown in Figure B–4).

2. Insert the rotor into the valve body, being careful that the tab does not touch the polished interior of the valve body. Make sure the rotor tab (Figure B–4) is fully inserted into the slot in the driver.

3. Using a pencil or other small pointed object, hold the rotor in place in the valve body while pulling the magnet free.

4. Replace the knurled preload assembly, tightening it into the valve body by hand just beyond the point where it touches the rotor. Cycle the valve 10 times to seat the sealing surfaces, leaving the valve fully in its clockwise or counterclockwise position.

5. Tighten the preload in quarter-turn increments, cycling the valve 10 times after each step. The preload must end up fully bottomed-out, but attempts to tighten further do not affect the sealing forces.

Note Make certain that the valve is never left partially actuated. It should always be in either its fully clockwise or fully counterclockwise position. σ

Number of ports	ID letter towards
3	Port 2
4	Port 3
6	Port 4
8	Port 5
10	Port 6
Internal sample	Side of valve with four ports

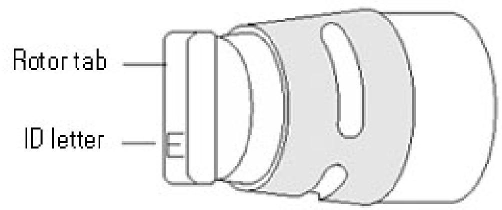

Figure B–3. Location of ID letter on valve rotor

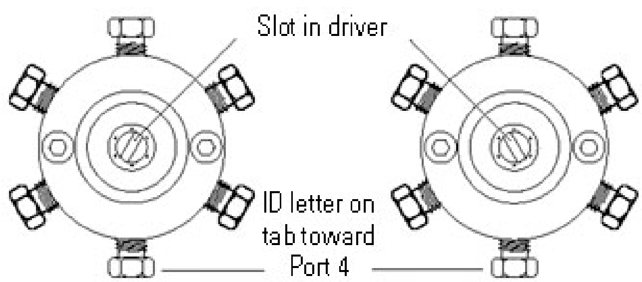

Figure B–4. C6 W valve with preload and rotor removed (preload end view)

Conditioning Procedure for High Temperature Valves

High temperature valves require conditioning when the rotor is replaced. If a high temperature valve (WT or UWT series) is used at less than 300°C, it may become sticky or difficult to turn. This tendency can usually be eliminated by repeating the conditioning procedure that is initially done at the factory. With carrier gas (oxygen-free) flowing through all the ports, rapidly heat the valve to 325°C. When this temperature is reached, cycle the valve 10 times and let it cool to operating temperature.

Two-Position Air Actuator O-ring Replacement

You will need the following to perform the tasks described in this section.

- 9/64" hex driver
- 3/8" open-end wrench
- 3/16" screwdriver
- An awl or small jeweler's screwdriver
- Silicone lubricant (such as Dow Corning® DC-111)
- Lint-free tissues and a clean shop rag
- Standard O-ring kit (VICI P/N OR)
- High temperature O-ring kit (VICI P/N ORT)

Disassembly

1. Apply air pressure to the actuator inlet nearest the valve. Then use the open-end wrench to remove the air supply lines from the actuator.

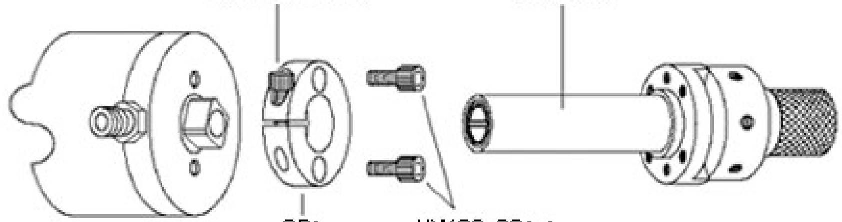

Figure B–5.

2. Remove the valve and valve-mounting hardware from the actuator (as shown in Figure B–5):

   a. Use the 9/64" hex driver to loosen the HWSC-SC8-10B/socket-head screw in the black anodized CR3/clamp ring on the actuator.

   b. Pull off the standoff with the valve attached.

   c. Use the 9/64" hex driver to remove the two HWSC-SC8-6/socket-head screws that hold the clamp ring to the actuator.

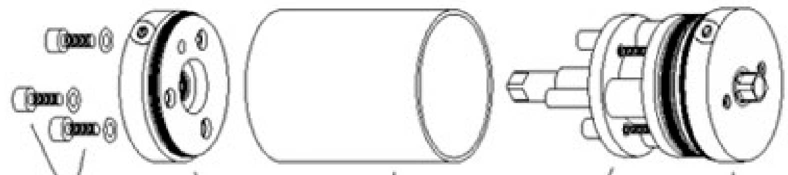

Figure B–6. Steps 3–6

3. Use the 9/64" hex driver to remove the three end cap screws with PEEK washers (some models have slotted head screws instead of hex head).

4. Place the actuator on a hard work surface with the end cap screw holes up. Push down on the cylinder and the female end cap pops up.

5. While holding the cylinder and the rest of the assembly together, pull the female end cap all the way off. If the bearing and washers fall out, set them aside.

6. Repeat the procedure with the actuator inverted, so that the cylinder slides loose from the male end cap. Remove the cylinder.

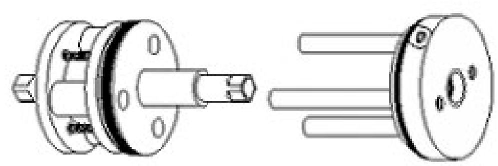

Figure B–7. Steps 7–8

7. Pull the subassembly off the male end cap as indicated in Figure B–7. (NOTE: Recently purchased actuators may have a subassembly made primarily of molded plastic, differing in appearance from the one shown in previous figures. The procedures are the same for either type.)

8. Loosen **but do not remove** the three slotted head screws that hold the subassembly together.

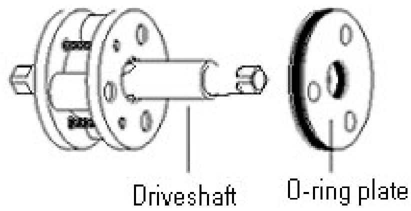

Figure B–8.

9. Take care to hold the rest of the subassembly together, and slide the O-ring plate off the drive shaft. Refer to reassembly instructions in "Assembly" if the subassembly does come apart).

Replacement

The O-rings to be replaced are in the two end caps and the O-ring plate. The internal end cap O-rings are easier to access if the washers and bearing are removed. Follow the steps below.

1. Use a small screwdriver or awl to remove the old O-rings, being careful not to scratch the metal.

2. Use a lint-free tissue to clean the O-ring grooves as completely as possible.

3. Upon installation, coat each new O-ring with a thin layer of Dow Corning DC-111 (or similar silicone lubricant).

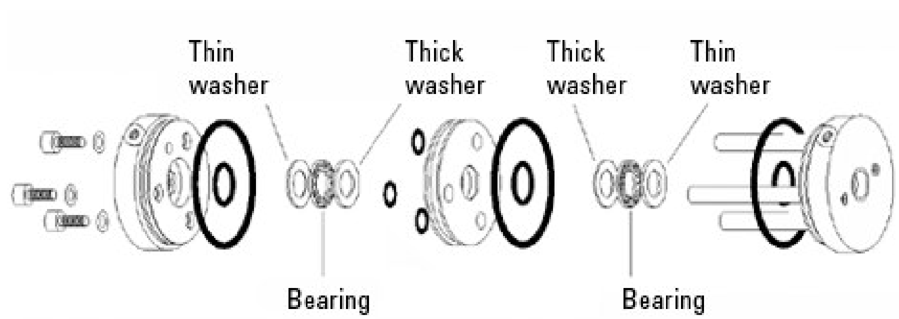

Figure B–9. Locations of O-rings

Where possible, apply a slight rotating action to the parts as they go over or through the O-rings to help prevent any nicking or tearing of the new parts.

Assembly

1. Being careful that the subassembly does not come apart, gently push the O-ring plate onto the drive shaft. Make sure that the threaded holes in the plate are facing the subassembly.

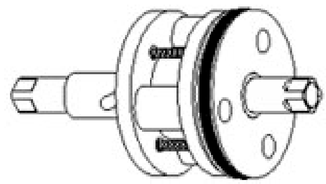

Figure B–10.

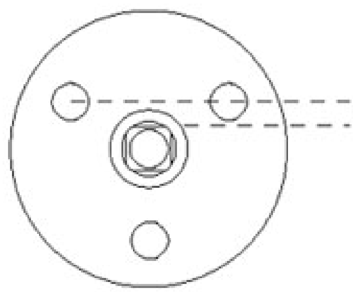

Figure B–11.

2. Screw the slotted-head screws into the O-ring plate, and push the drive shaft into the O-ring plate as far as it will go, as shown in Figure B–10.

3. Place the washers and bearing in the male end cap (thin washers in first, as shown Figure B–9). One of the flats on the drive shaft lines up with a line drawn between two of the holes in the O-ring plate (Figure B–11).

   Slide the subassembly onto the pins of the male end cap with this flat lined up with the air inlet on the end cap.

4. Install the cylinder, sliding it over the subassembly and pressing the male end cap into it.

5. Place the washers and bearing in the female end cap. Press the end cap into the cylinder, making sure that the air inlet hole is in the same orientation as the one in the male end cap.

6. Install the three end cap screws with the PEEK washers provided.

7. Replace the valve mounting hardware and air supply lines.

8. Apply air pressure to the actuator inlet nearest the valve so that the actuator is in the same position it was in when the valve was removed.

9. Slide the valve with its standoff into the clamp ring, making sure that the square hole in the valve coupling or in the end of the standoff drive shaft is fully engaged by the square of the actuator drive shaft. Tighten the clamp ring screw.

Valve Alignment

Valves installed using two 3-way solenoids or a Valco Digital Valve Interface do not maintain actuation force after they have been actuated. For accurate valve alignment, a temporary method of supplying continuous air pressure to the selected actuator inlet must be contrived. Follow the instructions below.

1. Switch the actuator from one position to the other several times to make sure that the play in the coupling mechanism has been absorbed.

2. Visually inspect the valve body cutout to determine if the rotor pin is against the stop. If so, proceed to step 3. If not, skip to step 4.

3. Switch the actuator to its other position and repeat the visual inspection. If the rotor pin is touching the stop in this position also, the valve and actuator are properly aligned. If the pin does not touch the stop, proceed with step 4.

4. Switch the actuator to the other position.

5. Slowly loosen the clamp ring screw until the valve body moves, indicating that the actuator has traveled to the end of its stroke. Immediately retighten the clamp ring screw.

6. Repeat the visual inspection. If the steps have been executed correctly, the rotor pin should contact the stops in both positions. If it does not, repeat the entire procedure.

Follow these steps to rebuild the subassembly:

Rebuild the Assembly

1. Put a liberal coating of Dow Corning DC-111 on the slots in the drive shaft.

2. Place the ball retainer over the shaft so that the holes in the retainer line up with the slots in the shaft.

3. Put the balls in the holes of the retainer so that they rest in the slots. They should be held in place by the thick lubricant.

4. Notice that the slots in the female race extend all the way to one end but not the other. Observe also that one end of the drive shaft has a 1/4" hole. Put that end of the drive shaft into the end of the female race that has the slot openings, sliding the balls into the slots.

5. Place the male end cap on a flat work surface. Set the O-ring plate on the end cap with the pins lined up to go through the three small O-rings. Pressing the plate in dislodges the O-rings; do not press the plate in.

6. The two bearing plates are identical except that one has three countersunk holes to accept the subassembly screw heads. Locate the bearing plate that is not countersunk and line it up on top of the O-ring plate (if both bearing plates are countersunk, they are interchangeable). Press down to force the pins through the O-rings and bearing plate, continuing until the two parts are riding about half way down the pins.

7. Slide the three bushings over the pins.

8. Install the drive shaft/ball assembly with the 1/4" hole end down. The female race should between the bushings.

9. Place the remaining bearing plate in position with the countersunk holes up, and screw the entire assembly together. Tighten the screws in rotation to insure optimum alignment.

10. Pull the subassembly off the male end cap so that its orientation can be checked, and proceed with step 2 of “Assembly”.

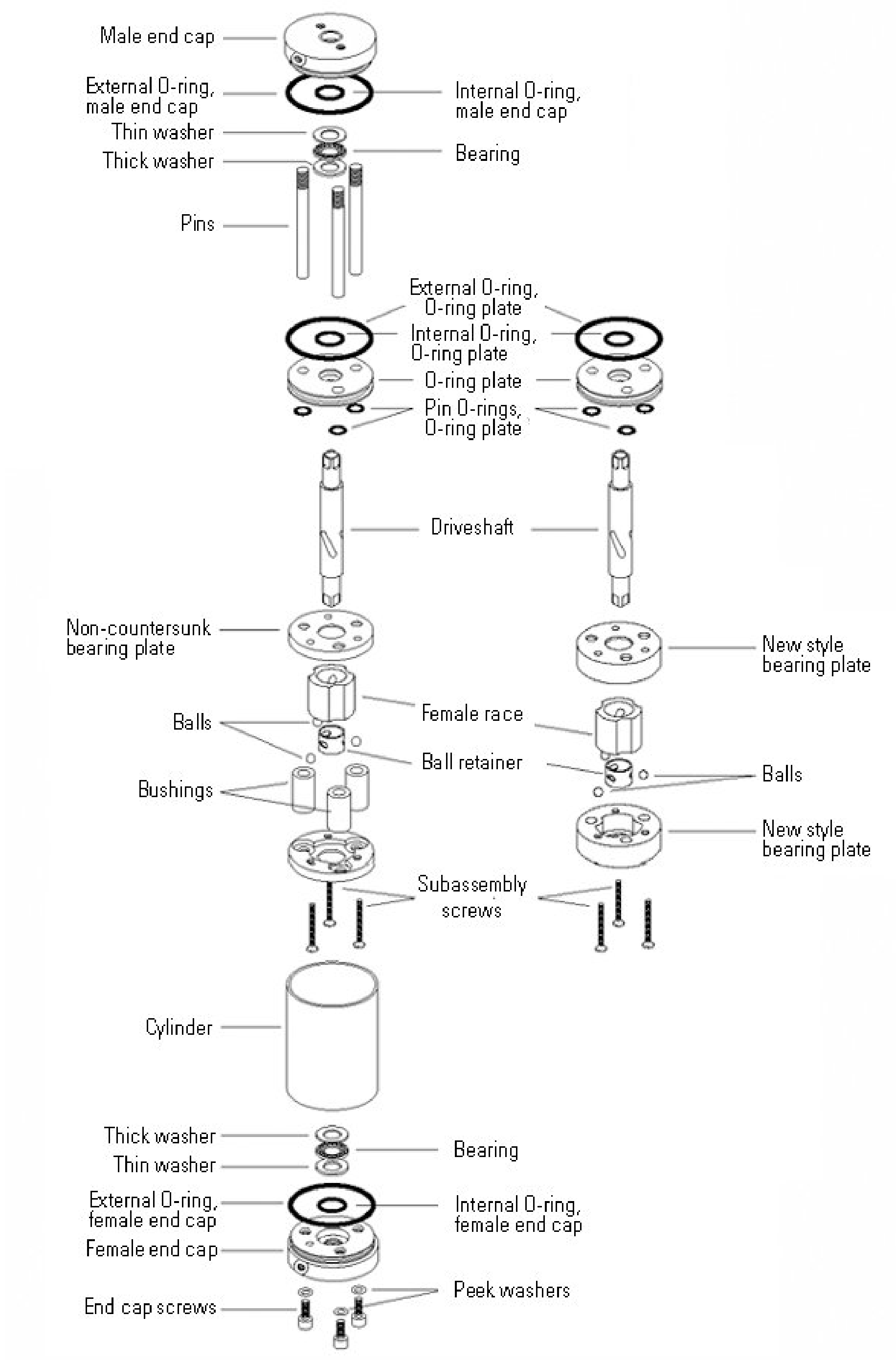

Figure B–12. Exploded view of two-position actuator

Appendix C
Dinfa Valve Service

Overview

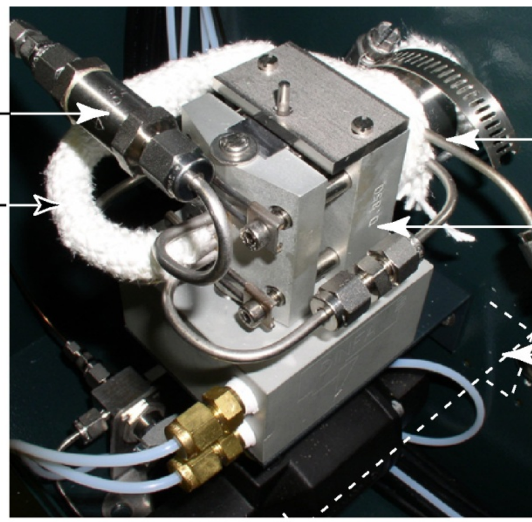

Figure C–1. Dinfa valve mounting & parts locator

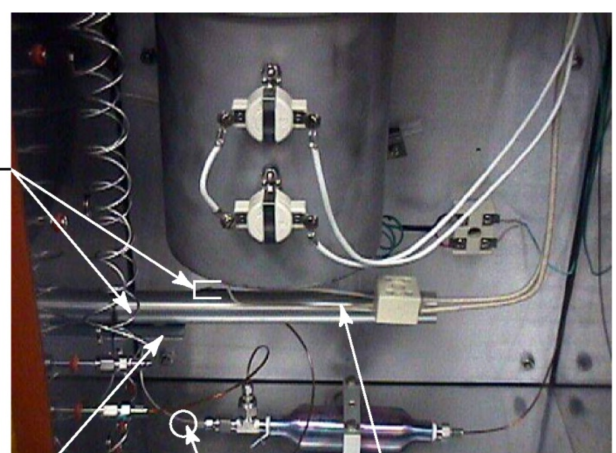

Figure C–2. Position of heat transfer tube in oven

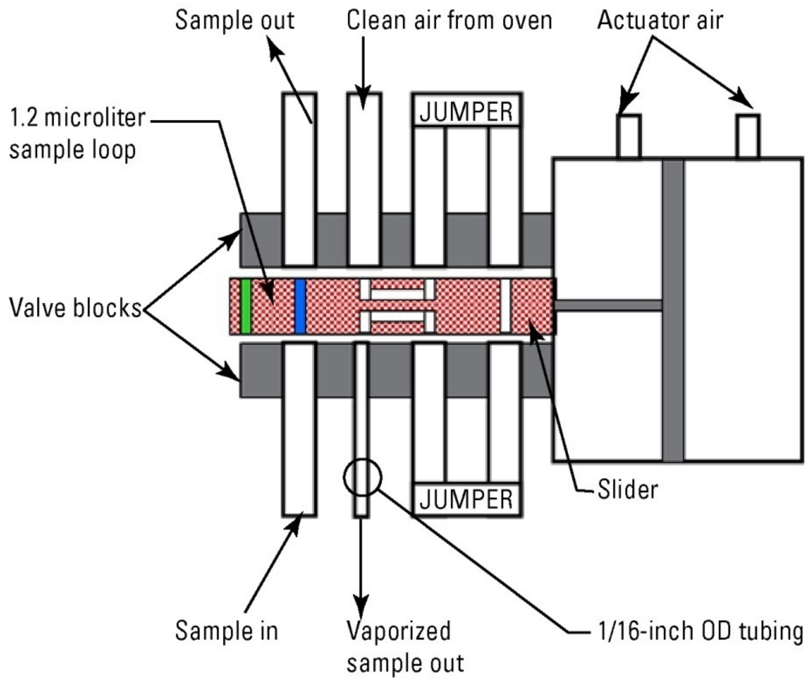

Figure C–3. Dinfa 8-port liquid injection valve, sample load position

Note To set up two injections/minute, set the injection cycle to 30 sections and the injection time to 15 seconds. σ

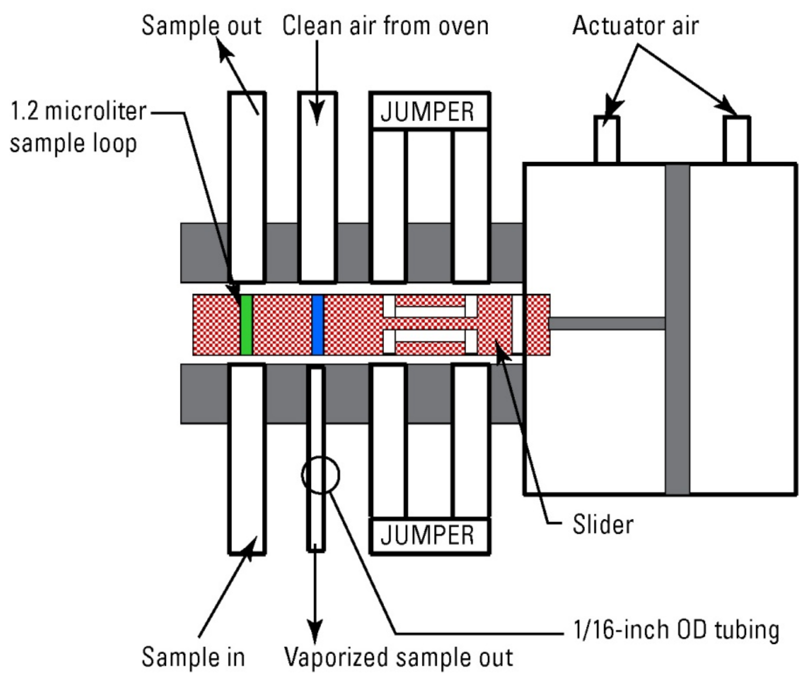

Figure C–4. 8-port liquid injection valve, inject position

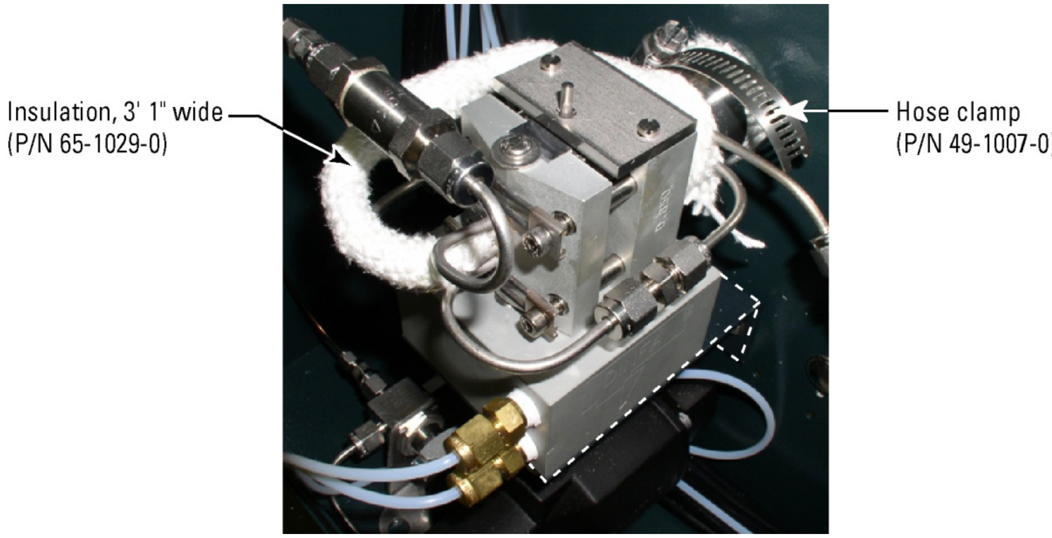

Figure C–5. Insulated Dinfa valve

If the valve is removed for maintenance, replace the insulation according to the following steps.

1. Insulate the clean air tubing from the oven and heat transfer tube by installing the insulation in a continuous run, starting with the clean air tubing. Secure the insulation with a hose clamp.

2. Adjust the clean air 2 regulator to 190 cc/min. (approximately 90 psig) with the oven temperature set to 190°C and clean air to flow through the valve.

3. Set the make-up air (clean air 1) to 60 psig.

4. Allow the oven and pyrolyzer temperatures to stabilize at 190°C and 1100°C, respectively.

5. Apply sample and observe the results. **Do not exceed 50 psig of sample pressure.**

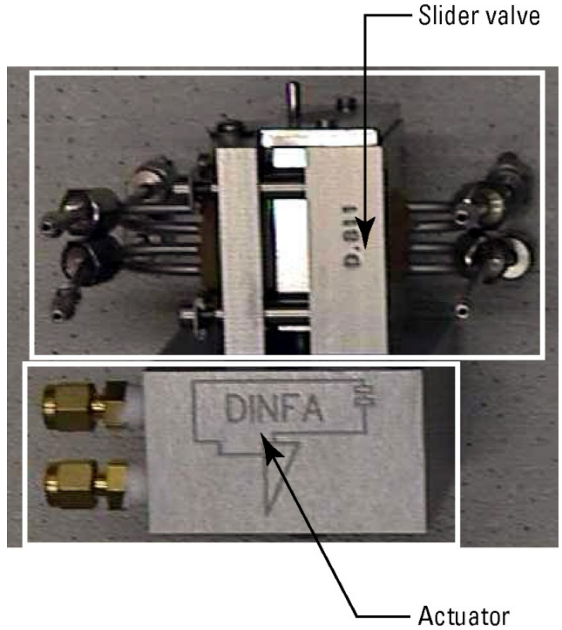

Figure C–6. Dinfa 8-port liquid injection valve

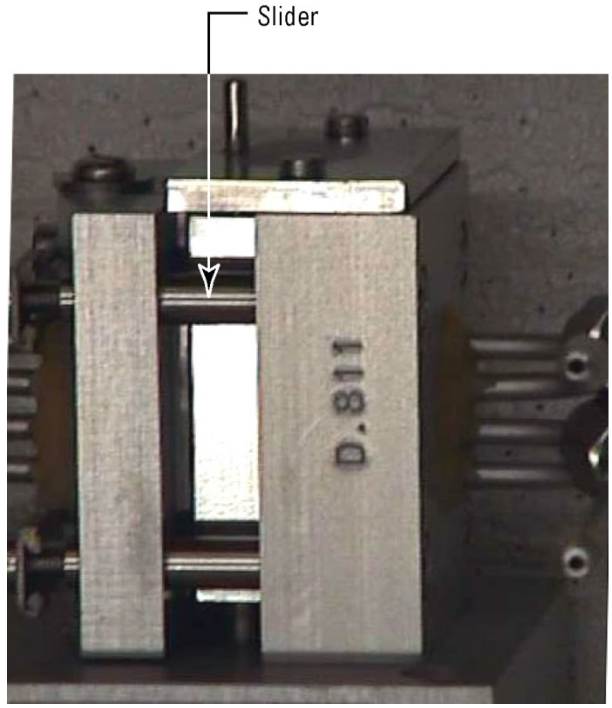

Figure C–7. Close-up of slider

Troubleshooting

- If you suspect a valve leak, tighten the valve block tension adjustment bolts (Figure C–8).
- If there is insufficient signal, ensure the injection cycle is set for 30 seconds and injection is set for 15 seconds.
- If the analyzer response time is slower with the Dinfa valve:
  - The heat transfer tube is not insulated properly, or there is insufficient clean airflow through the valve.
  - The clean air tubing from the oven to the Dinfa valve is not properly insulated.

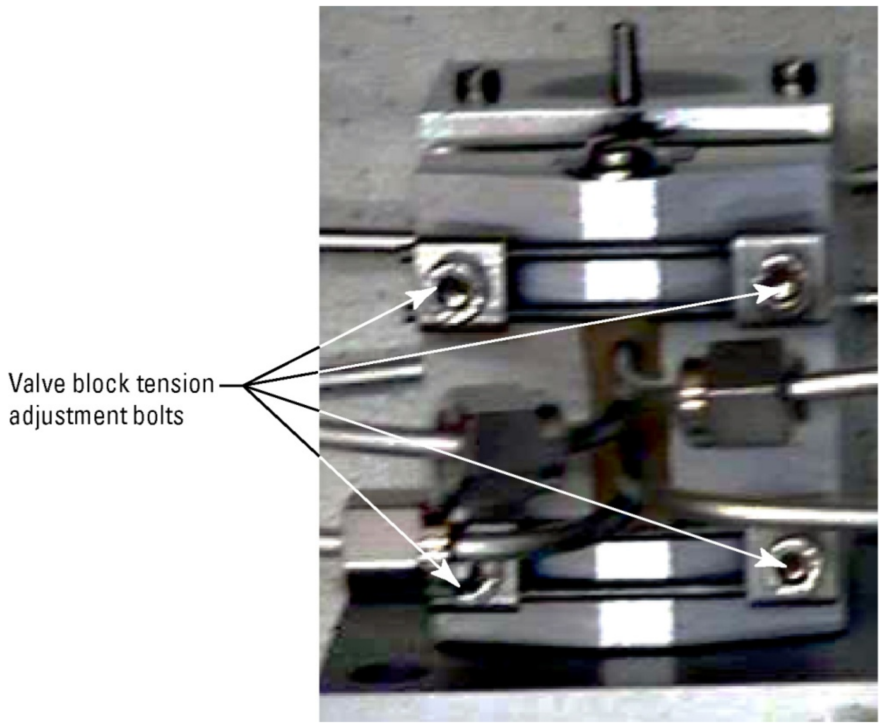

Figure C–8. Valve block tension adjustment bolts

Appendix D
TCP/IP Bridge

The SOLA II Modbus TCP/IP option is a microprocessor-driven board that provides a bridge between the SOLA II standard serial Modbus and a TCP/IP Modbus network using 10 Base-T.

Hardware Configuration

- TCP/IP Bridge board installed inside the SOLA II enclosure
- SOLA II Modbus configuration must be set to 38400 baud with Modbus ID 1
- Bridge board has a standard RJ45 connector for the 10 Base-T cable

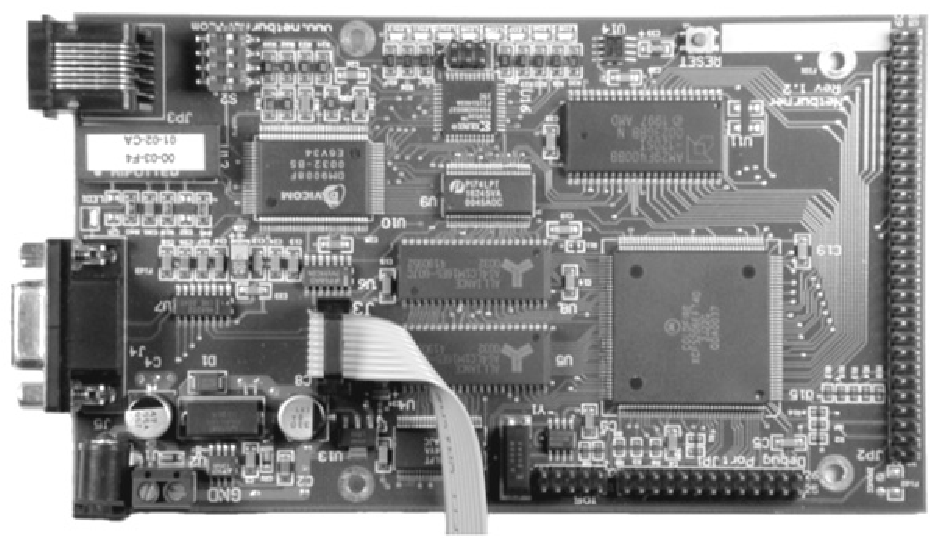

Figure D–1. TCP/IP Ethernet bridge board, P/N 55-1220-0 (older models)

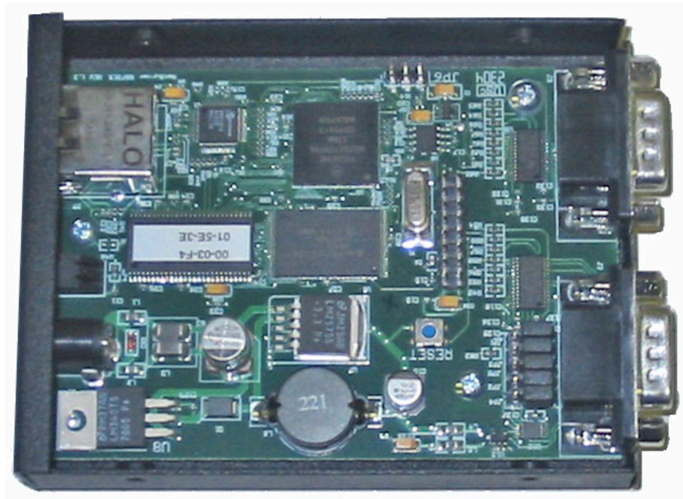

Figure D–2. TCP/IP Ethernet bridge board, P/N 55-1228-0 (newer models)

Software Configuration

As shipped, the Bridge defaults to an IP address of 00.00.00.00. At power-up (with an IP address of 00.00.00.00), the Bridge attempts to negotiate an IP through a DHCP server. If a DHCP server is not available or if it is desired to assign the instrument a static IP, use the provided utility program to set up the IP address. Perform the following steps to search for the Bridge on the network and assign an IP address.

1. Locate the IPSetup.exe utility that is included with the disk that ships with the TCP/IP Bridge option.

2. Run the IPSetup.exe utility from any IBM®-compatible PC connected to the same network as the Bridge. The utility automatically searches the network and reports any bridges found.

3. If more than one bridge is installed on the network, each can be identified by its MAC address (see Figure D–2). The MAC address is recorded on the label near the RJ45 connector on the Bridge board.

4. Record the IP address assigned to the bridge. This is the IP address required for configuring a workstation or DCS to query the SOLA II. On the TCP/IP Modbus frame, the unit ID must always be set to 1.

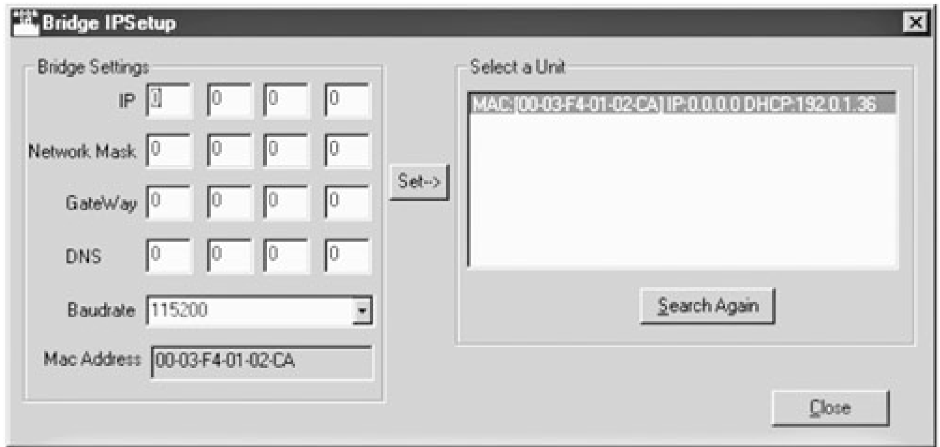

Figure D–3. Example display with DHCP server present

To set a static IP, enter the IP address and press the Set--> button.

The Browser Interface

Once you have configured the Bridge IPSetup utility successfully, you can access instrument control via the browser interface. Open your browser, and enter "http://" followed by the IP address into the address line of the browser. For example, if the IP address is 10.209.64.145, enter "http://10.209.64.145" into the address line. The SOLA II TCP/IP Bridge main page opens (Figure D–4). The main page displays the status of the instrument and refreshes every 15 seconds.

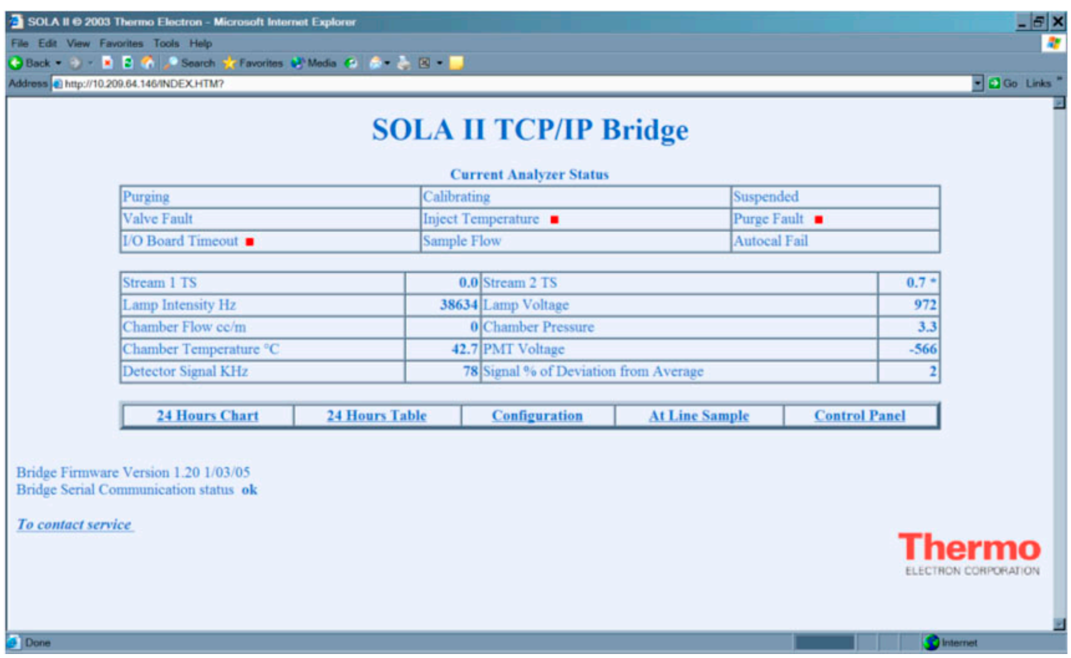

Figure D–4.

24 Hours Chart

Access this screen to display a graph of activity for the last 24-hour period. The top graph charts activity for Stream 1, Stream 2 (if applicable), and the detector frequency. The bottom graph charts activity for the lamp intensity (Lamp I), lamp voltage (Lamp V), temperature (Temp), and flow.

Click on **Main Page** or **24 Hours Table Format** to exit this screen.

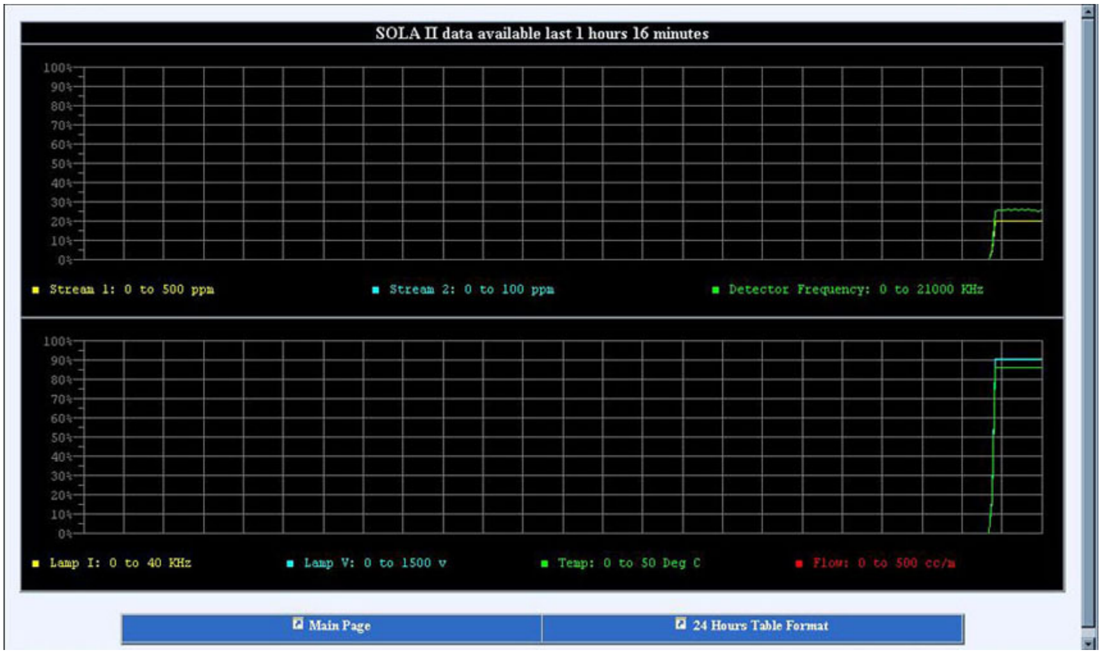

Figure D–5.

24 Hours Table Format

Accessing this display allows you to view activity for the last 24 hours in a table format. You can also save the data and import it into a Microsoft Excel spreadsheet.

If necessary, scroll to the bottom of the page, and click on **Main Page** or **24 Hours Chart** to exit this screen.

Configuration

Figures D–6 through D–14 display the parameters you can access from a remote location by clicking **Configuration**. If the passcode is not 0000, you must enter the correct passcode to change the parameters. Click **Apply** to save the changes.

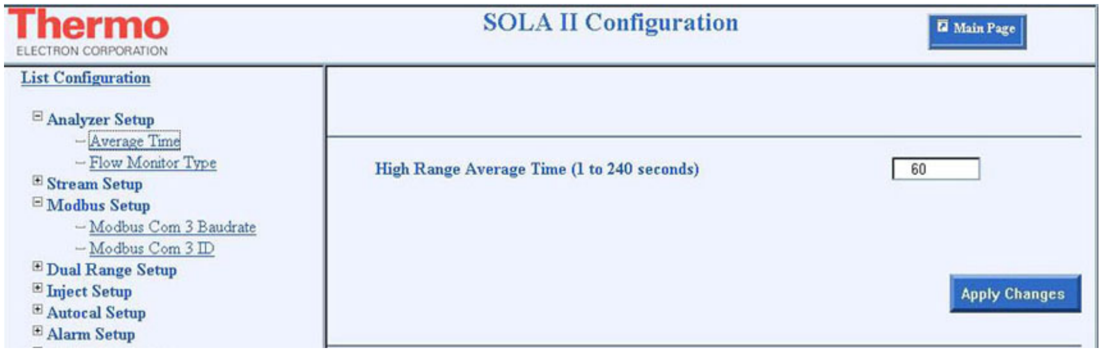

Figure D–6. Analyzer setup

Figure D–7. Stream setup

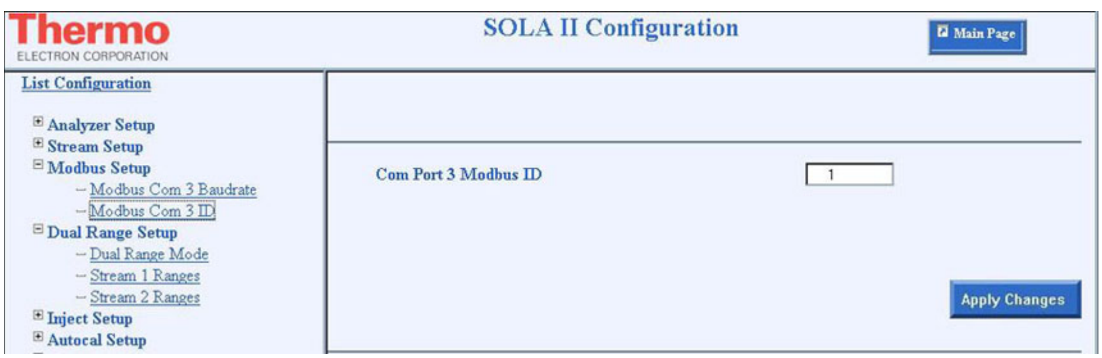

Figure D–8. Modbus setup

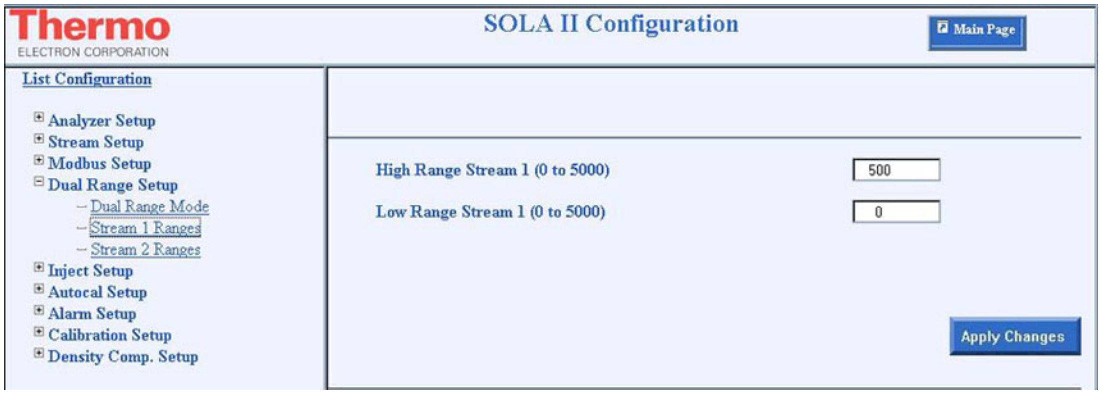

Figure D–9. Dual range setup

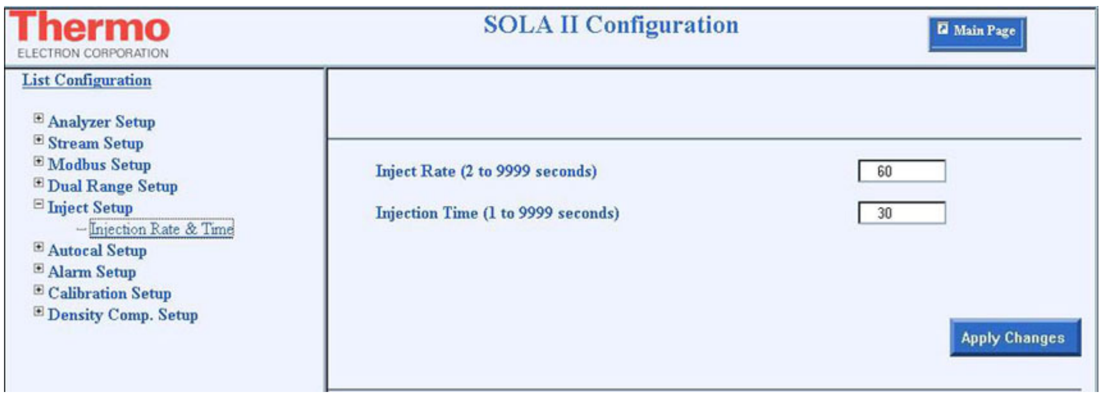

Figure D–10. Inject setup

Figure D–11. Autocal setup

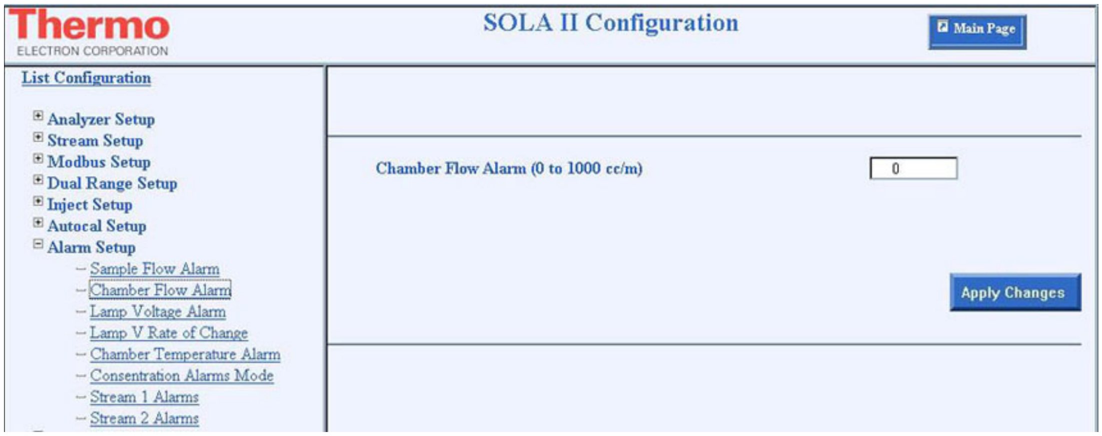

Figure D–12. Alarm setup

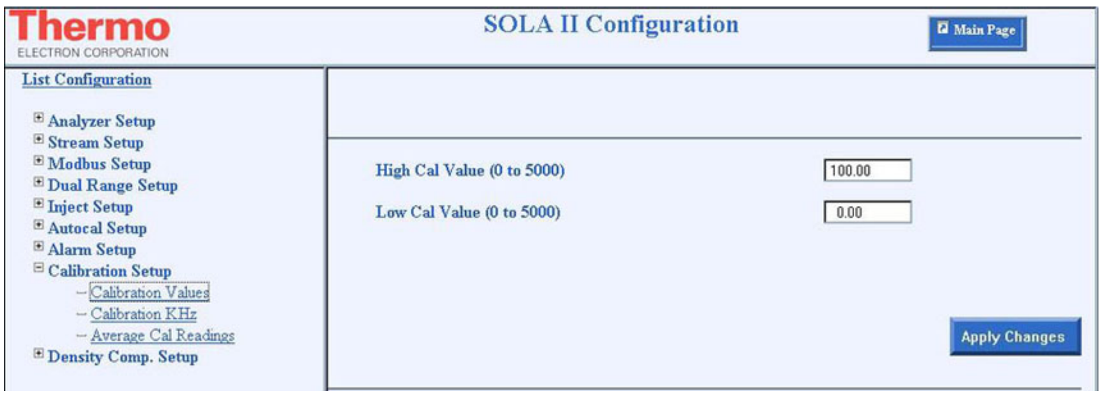

Figure D–13. Calibration setup

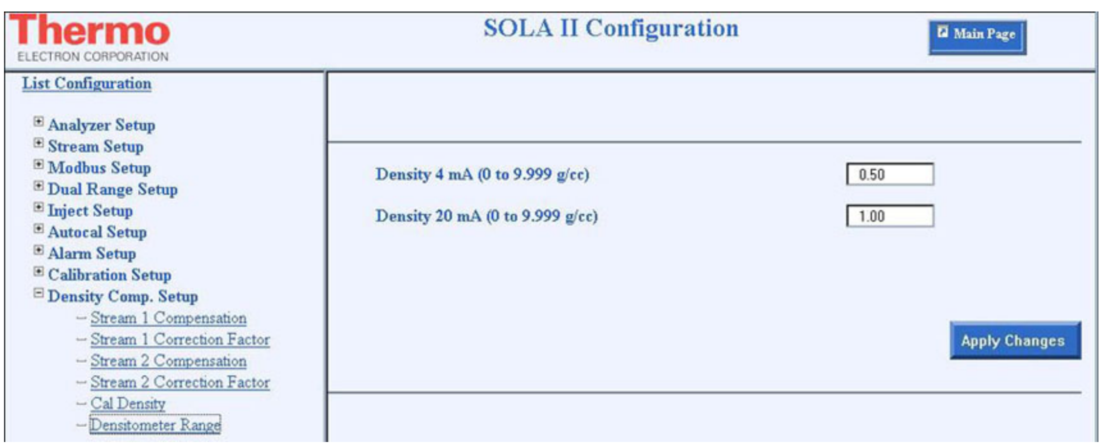

Figure D–14. Density compensation setup

At Line Sample

The SOLA Web Interface version 1.20 provides a form with additional fields in order to identify the sample. With this version, you can also print results on any local printer attached to the PC that is running the web browser.

Figure D–15. At line grab sample form

Complete this form and click **Start Sample** to begin the sampling process.

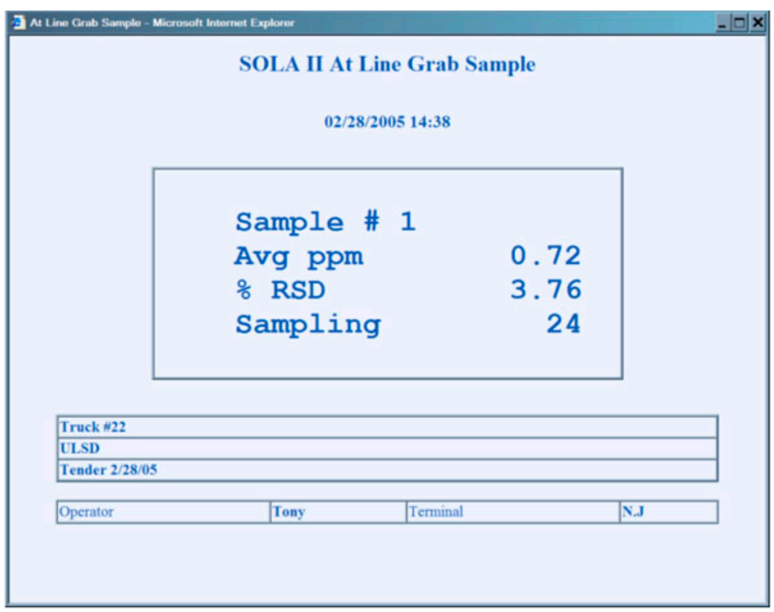

Figure D–16. Sampling in process

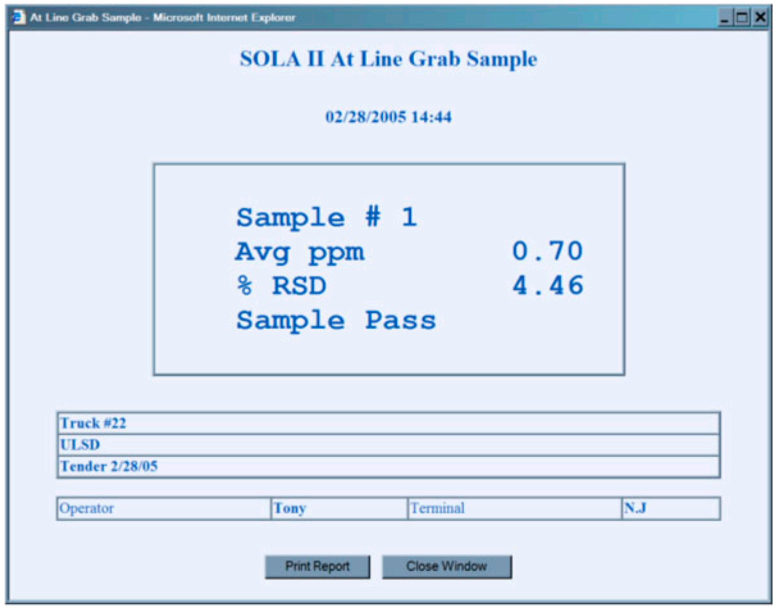

Figure D–17. Sample results

Appendix E
Version 1.20 Modbus Registers

Table E–1.

Function	Description
01	Read Coils
02	Read Status Input
03	Read Holding Registers
04	Read Input Registers
05	Set Single Coil
06	Set Single Holding Register
15	Set Multiple Coils
16	Set Multiple Holding Registers

Coils (0)0001 to (0)0040

Table E–2.

Coil Number	Description
1	Enable Modbus Remotes[1]
2	Stream Select 0[2]
3	Stream Select 1[2]
4	Reserved
5	Remote Low Cal
6	Remote High Cal
7	Remote Suspend
8	Remote Autocal
9	Alarm Ack
10	Reserved
11	Reserved
12	Reserved
13	Reserved

Coil Number	Description
14	Reserved
15	Reserved
16	Reserved
17	Solenoid 1
18	Solenoid 2
19	Solenoid 3
20	Solenoid 4
21	Solenoid 5
22	Solenoid 6
23	Solenoid 7
24	Solenoid 8
25	Reserved
26	Reserved
27	Reserved
28	Reserved
29	Reserved
30	Reserved
31	Reserved
32	Reserved
33	Reserved
34	Reserved
35	Reserved
36	Reserved
37	Reserved
38	Reserved
39	Reserved
40	Reserved

[1] If this coil is set to 1 by the host, the remote functions are controlled through the Modbus, and the digital inputs are ignored. If the coil is set to 0 (default power-on condition), the rest of the coils are ignored, and the remote functions are controlled by the digital inputs.

[2]Same function as the remote stream select digital inputs.

Status Inputs (1)0001 to (1)0025

Table E–3.

Status Input Number	Description
10001	Low Alarm
10002	High Alarm
10003	I/O Board Timeout
10004	Sample Low Flow Alarm
10005	Lamp Voltage Alarm
10006	Pyrolyzer/Oven temperature Fault
10007	Autocal Error
10008	Purge Fault
10009	Stream Selected: 0 = Stream 1, 1 = Stream 2
10010	Valve Fault
10011	Purging
10012	Calibrating
10013	Suspended
10014	Autocal Performed Clear after read
10015	New Cal Factor Clear after read
10016	Chamber Flow Alarm
10017	Grab Sample Active
10018	Grab Sample Ended
10019	Reserved
10020	Reserved
10021	Reserved
10022	Reserved
10023	Reserved
10024	Reserved
10025	Reserved

Note: Stream 1 = Reg 30001/32768 * Reg 30003
Stream 2 = Reg 30002/32768 * Reg 30004

Input Registers (3)0001 to (3)0040

Table E–4.

Input Register Number	Description
30001	Analog Output 1 (Stream 1 reading)
30002	Analog Output 2 (Stream 2 reading)
30003	Stream 1 Full Scale
30004	Stream 2 Full Scale
30005	Flow % of full scale * 100
30006	Reserved
30007	Reserved
30008	Reserved
30009	Normalized Detector reading kHz
30010	Detector Lamp Voltage
30011	Detector PMT Voltage
30012	Detector Chamber Temperature (deg C * 10)
30013	Detector Lamp Intensity Hz
30014	Reserved
30015	Reserved
30016	Reserved
30017	Reserved
30018	Last Autocal Frequency
30019	Last Autocal Deviation %
30020	Bench Chamber Flow
30021	Bench Pressure (*10)
30022	Density 1 g/cc *1000
30023	Density 2 g/cc *1000
30024	Reserved
30025	Reserved
30026	Reserved
30027	Reserved
30028	Reserved

Input Register Number	Description
30029	Reserved
30030	Reserved
30031	Reserved
30032	Reserved
30033	Reserved
30034	Reserved
30035	Reserved
30036	Reserved
30037	Reserved
30038	Reserved
30039	Reserved
30040	Reserved

Holding Registers (4)0001 to (4)0049

Table E–5.

Holding Register Number	Description
40001	High Cal Frequency kHz
40002	Low Cal Frequency kHz
40003	Stream 1 Recorder Full Scale
40004	Stream 2 Recorder Full Scale
40005	Injection Cycle (seconds)
40006	Injection Time (seconds)
40007	Purge Time (seconds)
40008	Cal units: 0 = ppm, 1 = %, 2 = ppb, 3 = mg/l
40009	High Cal Value (*10)
40010	High Alarm 1 (*10)
40011	High High Alarm 1 (*10)
40012	High Alarm 2 (*10)
40013	High High Alarm 2 (*10)
40014	Stream Mode Select: 0 = auto, 1 = stream 1, 2 = stream 2

Holding Register Number	Description
40015	Stream 1 Dwell Time
40016	Stream 2 Dwell Time
40017	Autocal Interval
40018	Allowed Autocal Deviation %
40019	Recal Autocal Deviation %
40020	Average Time (seconds)
40021	Flow Monitor Type
40022	Low Flow Alarm Set Point * 100
40023	Low Chamber Flow Alarm Set Point
40024	Density @ 4 mA g/cc *1000
40025	Density @ 20 mA g/cc *1000
40026	Stream 1 Recorder Low Scale
40027	Stream 2 recorder Low Scale
40028	Stream 1 Density Correction Factor *1000
40029	Stream 2 Density Correction Factor *1000
40030	Cal Density g/cc *1000
40031	Low Cal Value (*100)
40032	Reserved
40033	Reserved
40034	Lamp Voltage Alarm Set Point
40035	Lamp V Rate of change Alarm Set Point
40036	Chamber Temperature Alarm Set Point
40037	Average Cal Reads
40038	Alarm Mode
40039	Range Mode
40040	Autocal Mode
40041	Stream 1 Density Live
40042	Stream 2 Density Live
40043	Com 3 Baud Rate
40044	Com 3 ID

Holding Register Number	Description
40045	Passcode
40046	Fast Average (seconds)
40047	Average Override
40048	Grab Sample Average Time
40049	Grab Sample ID
40050	Grab Sample Accepted RSD
40051	Transmix Factor (Not Used)
40052	Stream 1 Flow: 1 = High, 0 = Low
40053	Stream 2 Flow: 1 = High, 0 = Low
40054	Autocal Value
40055	Cal 4-20 mA Output: 0 = none, 1 = Stream 1, 2 = Stream 2 4-20

Appendix F
The Workstation

Installing Workstation Software

The SOLA II workstation software is an application developed to run under National Instruments™ Lookout. The software consists of the following items:

- Lookout Development System
- Floppy disk with a subdirectory named SOLA containing the following files:
  - sIIcfg.l4p
  - sIIcfg.lks
  - sIIcfg.lka
  - sIIdl.l4p
  - sIIdl.lks
  - sIIdl.lka

1. Copy the SOLA subdirectory from the floppy disk to the c:\Program Files\NationalInstruments\Lookout subdirectory on the computer hard drive. Remove the disk from the drive and store in a safe place.

2. Click on **sIIcfg.l4p or sIIdl.l4p** to open the workstation through Lookout.

3. The workstation is configured to connect to the analyzer using the **Com port 1 at 9600 baud** and to expect the **analyzer Modbus address to be 1**. If the analyzer is equipped with the Serial to 10BaseT Bridge or if a different com port is used in the PC, the Modbus1 object needs to be edited.

4. Beginning at the Lookout main menu,

   a. Select **Edit** and switch to edit mode.

b. Select Object > Modify > **Modbus1** (Figure F–1).

c. Edit the Modbus object to select a different COM port or Modbus Ethernet (Figure F–2).

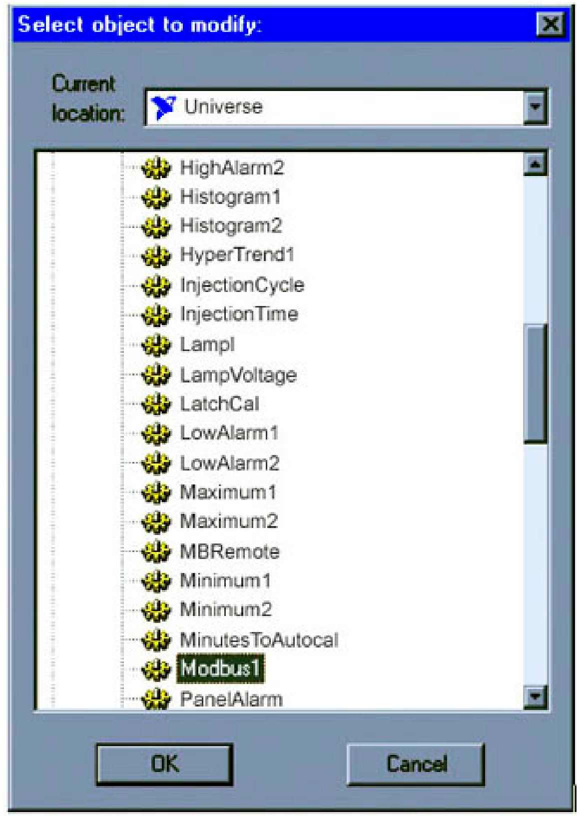

Figure F–1.

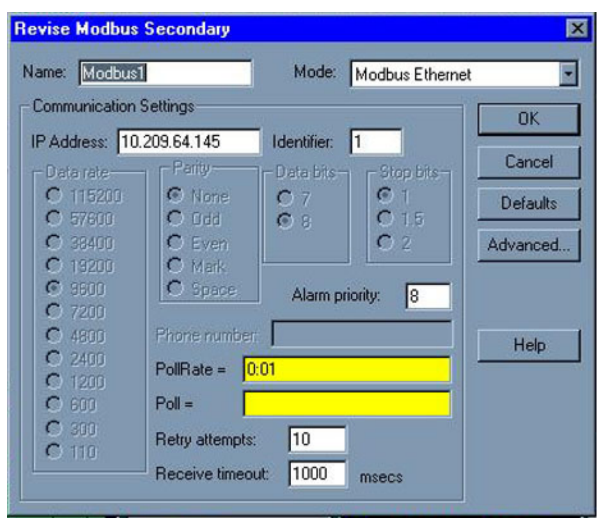

Figure F–2.

5. If Mode is set to Modbus Ethernet:

a. Set the IP address to the value assigned to the Bridge. The required IP address depends on the configuration of the Modbus Ethernet. Contact the person responsible for this network to obtain the correct IP address.

b. Set the identifier to 1.

If a serial port is used for the connection, configure the serial port parameters as follows:

a. Select Lookout Options > **Serial Ports**.

b. Verify that the port is configured as shown in Figure F–3.

Note The specified Receive gap, RTS delay, and CTS time-out are critical to achieve successful communication with the analyzer. Depending on the PC used, these numbers may need to be increased. σ

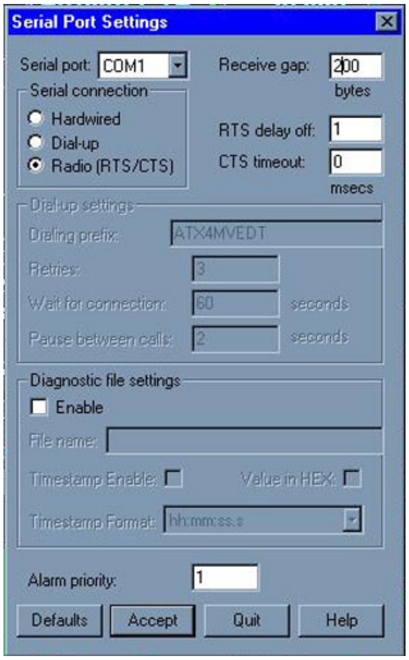

Figure F–3.

Workstation Operation

Using the operation application soladatalogg.l4p with LookOut enables you to monitor and control analyzer operation from the remote workstation.

Note The analyzer workstation operation and configuration applications must not be run simultaneously. If running, always close the configuration application before opening the operation application. σ

Real-time data from the analyzer is collected, displayed, trended, and archived on the remote computer hard drive. The database files containing analyzer data are accessible by other programs using ODBC or SQL (see the Lookout software manual provided with the system or instructions in the software you are using for more information).

Data from the analyzer is also saved on the hard drive in CSV format for easy use with spreadsheets, databases, statistical analysis, and other software programs. The data is stored in the c:\Program Files\National Instruments\Lookout\sola\ directory with subdirectories that match the year, month, and date for the analysis.

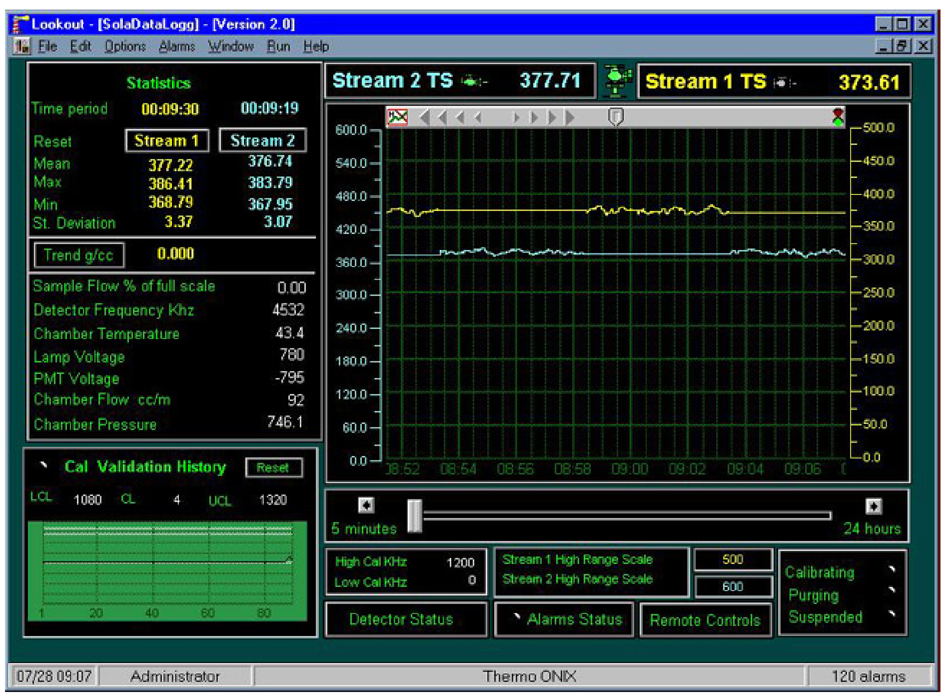

Figure F–4. Workstation main screen

As shown in Figure F–4, the main screen divided into several operating sectors that are described in the following sections.

Note The workstation collects real-time data from the analyzer. For proper operation, the workstation should be run continuously with a connection to the analyzer. σ

Statistics

The upper left sector displays statistics for the analyses of streams 1 and 2 (if second stream option is installed on the analyzer). Clicking **Reset** for the desired stream zeroes the statistics and starts accumulation of information. Time period displays the length of time for which the data has been accumulating.

Density Values & Trend

When densitometers are used, the densities of sample streams 1 and 2 are displayed on the screen. A trend plot of the densitometer inputs can be displayed by clicking the Trend g/cc button. Zero and full scale values for the plot are determined by the 4 mA and 20 mA density settings in the Density Comp Setup menu (Chapter 6).

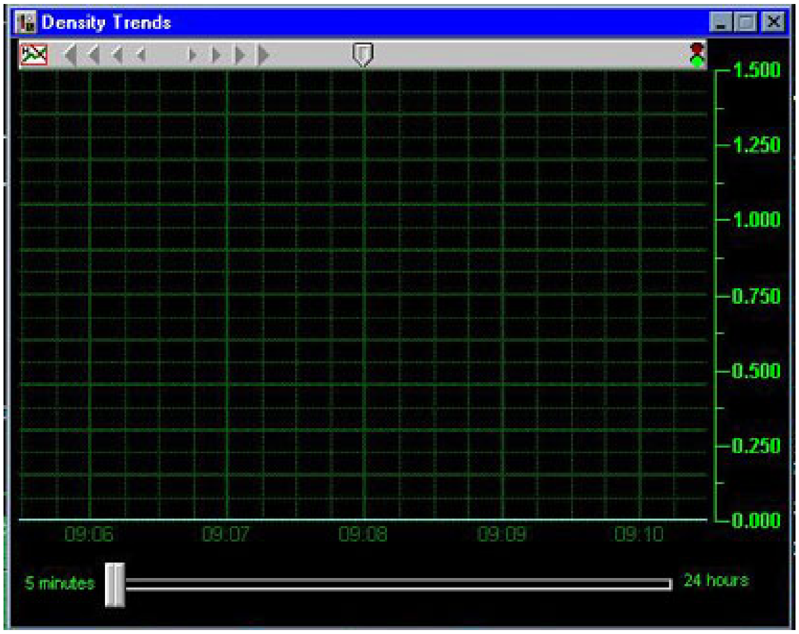

Figure F–5. Density values & trend

Cal Validation History

This chart trends the results of the calibration validation results. Click **Reset** to clear the values and begin a new trend.

Stream Plot

The Stream Plot area displays the trend of measured total sulfur for stream 1 and stream 2 (if second stream option is installed on the analyzer). The currently active stream is indicated by a green indicator on that stream name above the plot area. Full scale values for the plot are determined by setting the high range value for the associated 4–20 mA DC output for each stream.

The arrows (triangles) on the bar along the top of the plot area permit scrolling left or right along the time axis for viewing the plot. When scrolling, the red indicator at the right end of the bar turns on to indicate that viewed data is historical rather than real-time. Clicking the lower indicator of the two turns that indicator green and returns the plot to real-time data display. The total time period displayed on the plot can be varied from 5 minutes to 24 hours by moving the slider below the plot area.

The hypercursor in the middle of the upper bar can be selected and moved to any point along the trend to display an instantaneous value of the concentration in percentage of full scale.

Detector Status

Clicking **Detector Status** displays a list of current values for several status monitors and a trend chart showing historical values (Figure F–6). These status values are useful for troubleshooting.

Figure F–6. Detector status screen

Alarms Status

If an alarm, fault, or malfunction is detected, the indicator on the Alarms Status button turns red. Clicking **Alarms Status** displays a list of the alarms with an indicator for each. Active alarms are indicated by a red indicator preceding the name.

Figure F–7. Alarm status screen

Remote Controls

Clicking **Remote Controls** displays a set of switches used to control analyzer functions from the workstation).

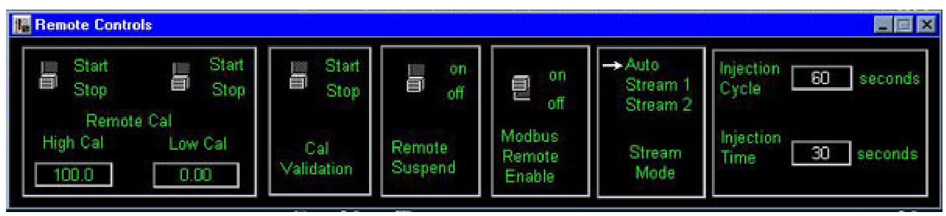

Figure F–8. Remote controls screen

1. Remote Cal: When turned ON, this control causes the analyzer to perform a calibration and update the calibration factor. The Allowed Deviation and Recal Deviation values are ignored.

2. Cal Validation: When turned ON, the analyzer performs an automatic calibration/validation. Values in the Allowed Deviation and Recal Deviation determine whether the calibration factor is updated to the new value.

3. Remote Suspend: When turned on, analyzer operation is suspended. When turned OFF, the analyzer functions normally.

4. Modbus Remote Enable: This enables/disables the ability to control certain functions from the workstation. Modbus Remote Enable must be set to ON before the other remote controls will work from the workstation.

Note When Modbus Remote Enable is set to ON, the hardware remote switches are disabled. If remote control of the analyzer using hardware switches is required, the Modbus Remote Enable must be set to OFF. σ

Analyzer Status

The three indicators at the lower right of the main screen display the status of the analyzer by placing a green indicator to the right of Calibrating, Purging, or Suspended. If the indicators are not green, the system is running a sample analysis.

Configuration

Access the configuration screen by closing the operation program and opening the SOLA configuration program. The following items can be configured from the configuration application at the workstation: Analyzer Setup, Densitometer Setup, Calibration Setup, Autocal / Validation Setup
Stream Setup.

Note The analyzer workstation operation and configuration applications must not be run simultaneously. If running, always close the configuration application before opening the operation application. σ

Figure F–9.

Appendix G
The X-Purge System

Description

The X-Purge assembly is used to provide safe operation of analyzer systems in Class 1, Division 1, Groups B, C, and D (NFPA) and Zone 1, Ex d[p] IIC T4 (ATEX and IECEx) hazardous areas. Safe operation is achieved by automatically disconnecting power from the analyzer system if the purge pressure is lost in any of the monitored enclosures or if purge flow out of either enclosure exhaust port is lost. The X-Purge system also ensures that the system is safe before it permits power to be applied to the analyzer system. To ensure continued safe operation of the analyzer system, the X-Purge unit must not be disabled or adjusted improperly.

On power-up, the X-Purge system checks the purge pressure in all monitored enclosures and for flow exiting the exhaust ports of the enclosures. When all monitored enclosures register pressures at least 0.3 inch of water (0.75 mbar) above the reference pressure, adequate flow is present at the enclosure exhaust ports, and the instrument air pressure is greater than 10 psig, a time delay relay begins its timed cycle. Typically, the time delay is used to ensure that at least four volumes of air are exchanged in the enclosures before power is applied to the system. (The number of exchanged volumes may be higher in some situations.) After the preset time delay is accomplished, the time delay relay applies power to the analyzer system.

Typically, the X-Purge assembly is designed for monitoring two enclosure purge pressures and two exhaust port flows. All of the pressures in the monitored enclosures must be at least 0.3 inch of water (0.75 mbar) higher than the atmospheric pressure around the analyzer system. This ensures that hazardous materials are less likely to leak into the purged enclosures. Pressure differential switches compare the pressure in the monitored enclosures with the pressure in the explosion proof X-Purge enclosure. The inside of the X-Purge enclosure is referenced to ambient pressure using a 1/4-inch breather drain with flame suppression. A flame arrestor is also installed between each pressure differential switch and the associated pressure enclosure that it monitors. A spark arrestor vent is used for exhaust purposes. It also maintains appropriate backpressure on the electronics enclosure and oven.

For T3 or T4 ratings, a bottled air backup source supplies air for purging the instrument in the event that instrument air pressure is lost. Instruments with a T3 rating must be allowed to cool for at least 45 minutes before opening the oven door. Instruments with a T4 rating must be allowed to cool for at least 140 minutes before opening the oven door.

Caution Failure to allow adequate cooling before opening the oven can lead to injury of personnel or damage to equipment. σ

Note Cable glands used to supply electrical power must be IP40 rated metallic cable glands. σ

Note Blanking elements or plugs used shall be in accordance with national standards. σ

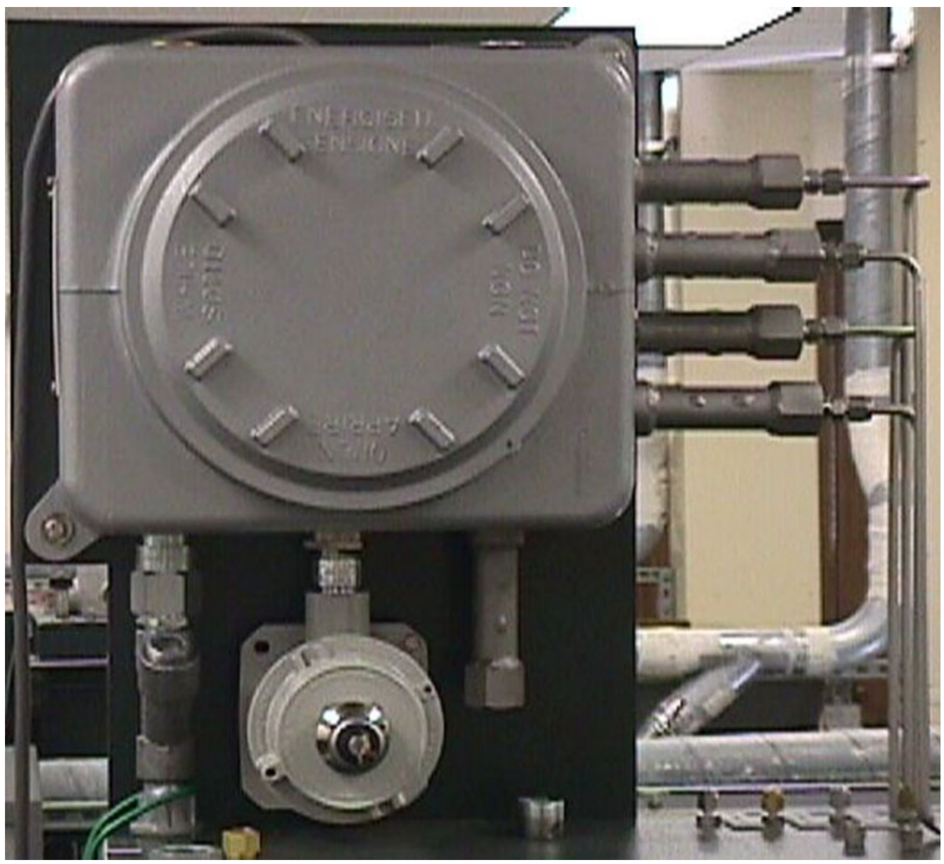

Figure G–1. Purge control unit (ATEX version shown. NFPA version has key switch inside enclosure)

X-Purge Specifications

Table G–1.

General specifications	
Certifications	CSA with C and US Mark: Class 1, Div. 1, Groups B, C, D hazardous areas ATEX: Zone 1, Ex px II T IECEx: Ex d[p] IIC T4
Programming	Programmable time delay
Function	Monitors 2 pressurized enclosures and 2 exhaust port flows

Table G–2. Normal conditions

Normal conditions	
Power	AC applied to X-Purge unit
Switches	Normal/Bypass: Set to NORMAL Time delay relay: Set to number of seconds for delay; time delay typically set from 480 to 600 seconds (see application notes for individual system)
X-Purge pressure	Minimum 10 psig
Y-Purge pressure (analyzer purge)	Set to approximately 10 psig or as specified in the application notes shipped with the analyzer
Oven air pressure	Minimum 10 psig or as specified in instrument application notes or system log books
Oven door	Closed tightly
Electronic housing door	Closed tightly
Instrument air ball valve for X-Purge unit	Open

Table G–3. Utility requirements

Utility requirements	
Instrument air	60–80 psig, 8 SCFM (maximum)
Instrument air quality	Water and oil free, -40°C (-40°F) dew point, particles < 5µ, ISA grade, hydrocarbon free
AC power	110 Vac, 50/60 Hz

Installation

Caution Before attempting to install the X-Purge system, review the material in Chapter 1 and all safety information in this manual and all other applicable documents. σ

Caution Applicable permits must be obtained and appropriate precautions must be taken to prevent possible injury to personnel or equipment damage when installing the system. σ

AC Power

AC power to the X-Purge is connected by the customer. Power wiring and circuit breakers must be sized appropriately. Refer to drawings provided with the system for connection information and power requirements. Customers must provide a suitable power switch near the system for use by maintenance personnel.

Warning Electrical power must be free of spikes, sags, surges, or electrical noise. σ

AC power to any system using the X-Purge is connected directly to the X-Purge unit rather than the analyzer. The X-Purge unit controls the power to the instrument to ensure safe operation in hazardous areas. Consult the following table for AC power connections to the X-Purge unit.

Table G–1.

Power	Terminal
Hot	TB1-1[1]
Neutral	TB1-3[2]
Ground	TB1-5
Power out (switched)	TB1-6

[1]Terminals 1 and 2 are jumpered together.

[2] Terminals 3 and 4 are jumpered together.

Alarm Signal

The X-Purge provides dry alarm contacts. To use the alarm contacts, refer to the following connection table. The alarm contacts are rated for 10 A at 120 Vac (240 Vac for 240 Vac units).

Table G–2.

Alarm Terminal	Terminal #
Open on alarm (closed when power is applied to the analyzer system)	TB1-7
Common	TB1-8
Closed on alarm (closed when purge is lost or during fast purge of analyzer system)	TB1-9

Startup

Caution Before initially starting the system, electrical power wiring must be checked for correct size and routing. All sample system plumbing must be thoroughly tested for leaks. σ

The following procedure should be performed when starting up any analyzer system that uses the X-Purge system.

Caution Do not open the explosion proof X-Purge enclosure in a hazardous area even when de-energized unless area has been properly tested and is known as being free from explosive gases. σ

The following procedure only addresses the application of power to the system. Consult the startup procedures in the instrument user's guide for additional requirements for system startup.

1. Consult the startup procedures in the instrument user's guide for general information on system startup. All requirements prior to applying power to the system must be performed before proceeding to the rest of this procedure.

2. Open the instrument air supply to the analyzer.

3. Close the oven door securely and adjust the oven air pressure regulator to the value required for the analyzer (refer to the application notes or logbook for the analyzer).

4. Close the electronic enclosure door. Ensure that it is tightened securely.

5. Apply power to the X-Purge unit.

6. After the predetermined purge time, the X-Purge unit applies power to the analyzer system. Typically, this takes about 10 minutes, but it may vary depending upon the system. Refer to the system application notes or logbook for the correct purge time.

Caution Do not open the X-Purge housing unless power is removed from the X-Purge or the area is known to be non-hazardous. σ

   If the unit does not apply power to the analyzer system after the required length of time, check for the following possible problems:

   a. Purge pressure at the analyzer purge pressure gauge is too low.

   b. Oven heater air pressure regulators set too low.

   c. Oven door open or leaking air.

   d. Electronic enclosure door open or leaking air.

7. Complete the remaining steps listed in the startup procedure included in the startup instructions in the instrument user's guide.

Shutdown

The X-Purge unit automatically removes power from the analyzer system if the purge pressure becomes less than 0.3 inch of water (0.75 mbar) in any monitored zone or if enclosure exhaust airflow drops too low. It also automatically removes power from the analyzer if the instrument air pressure at the X-Purge regulator is lower than about 10 psig. To remove power from the system manually, perform the following steps.

1. Perform all shutdown steps listed in the shutdown procedure in the instrument user's guide up to the point where power is turned off to the system.

2. Remove power to the X-Purge system.

3. Complete the remaining shutdown steps listed in the applicable shutdown procedure in the instrument user's guide.

Power or Purge Loss Shutdown

If AC power or purge pressure is lost, the X-Purge unit shuts off power to the analyzer system. When the power or purge pressure is restored, the X-Purge begins the purge timer. After the required purge time is achieved, the X-Purge unit applies power to the analyzer system.

The X-Purge controller interrupts the incoming analyzer electrical power. Power to 4–20 mA outputs is interrupted upon loss of purge or power, as the analyzer powers these outputs. The device receiving discrete and/or Modbus signals from the analyzer may apply power. Consequently, the purged analyzer enclosure could contain powered wiring even when power to the analyzer is interrupted. To ensure that the purged analyzer enclosure contains only non-incendiary power upon interruption of main analyzer power, you may elect to implement one of the following:

- Install the appropriate Intrinsically Safe (IS) barriers on Modbus and/or discrete signals.
- Utilize the X-Purge's alarm contacts to drive interposing relays configured such that the Modbus and/or discrete signal wiring continuity is broken upon loss of main analyzer power.

Maintenance

Caution Placing the NORMAL / BYPASS switch in the BYPASS position disables safe operation of the system. The BYPASS position is to be used ONLY when required for maintenance AND only if the area is non-hazardous. σ

Caution Do not open the explosion proof housing for the X-Purge unless the area is known to be non-hazardous. σ

Caution Do not leave the NORMAL / BYPASS switch in the BYPASS position after maintenance is completed. Do not leave the analyzer system unattended when the NORMAL / BYPASS switch is in the BYPASS position. Personnel must remove power from the system immediately if hazardous conditions are suspected. σ

Timer Adjustment

The required time delay for safe operation is determined at the factory. Adjustment of the time delay should not normally be required. Do not adjust the time delay unless you are certain that you will not create a potentially hazardous situation.

Caution Do not open the explosion proof housing for the X-Purge unless the area is known to be non-hazardous or the power is removed from the X-Purge unit. σ

Caution Do not decrease the timer setting lower than the value specified in the application notes provided with the system or lower than the initial setting when received from Thermo Fisher. σ

Caution If the timer setting is too short, the analyzer system is not purged adequately before power is applied. This can result in equipment damage and injury to personnel. σ

The time delay relay uses digital switches to set the length of delay before applying power to the analyzer system. The number of seconds for the delay can be determined by adding the numbers together for all switches that are set to the ON position. (The switches are located on the top of the time delay relay inside the X-Purge housing.) For example, if switches 256, 128, 64, and 32 are ON, the time delay is 8 minutes (i.e. 256 + 128 + 64 + 32 = 480 seconds). When replacing the time delay relay, the switches on the new relay must be set the same as on the relay being replaced.

Appendix H
Software Menu Tree

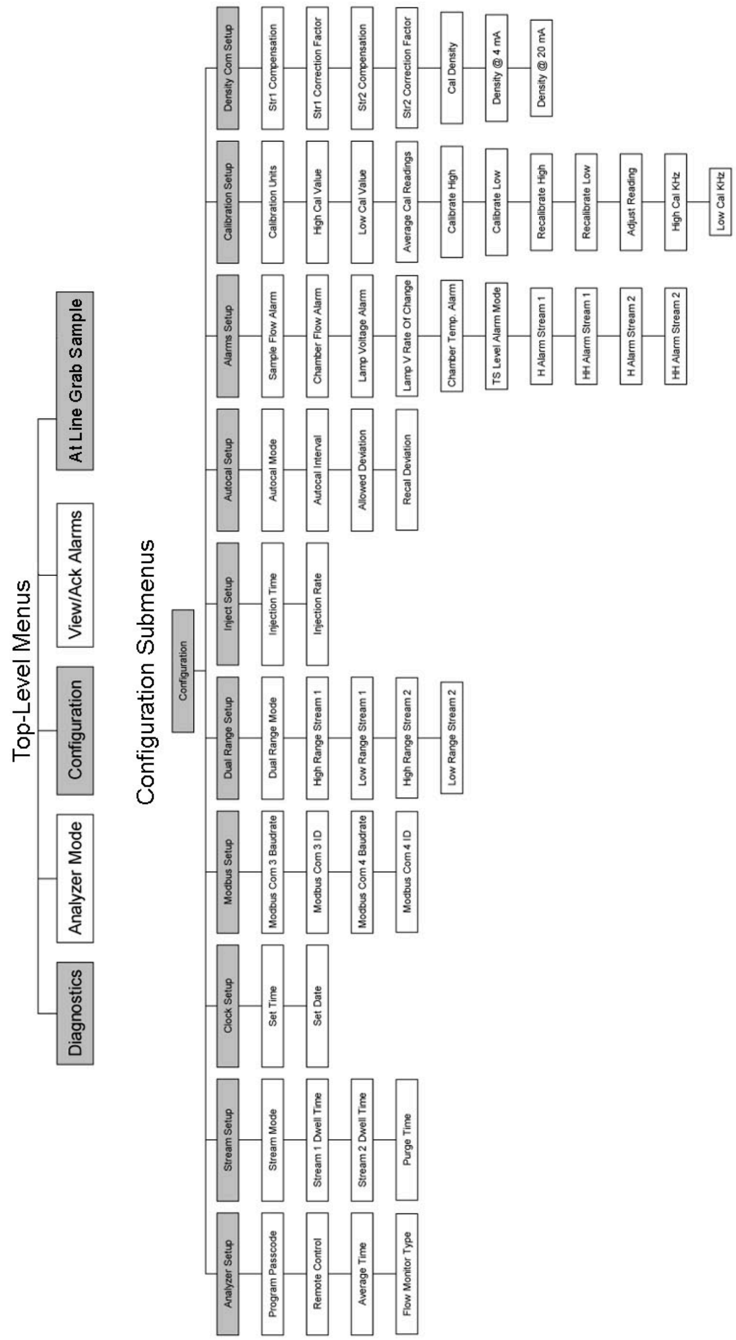

Figure H–1. Top-level menus & configuration subgroups

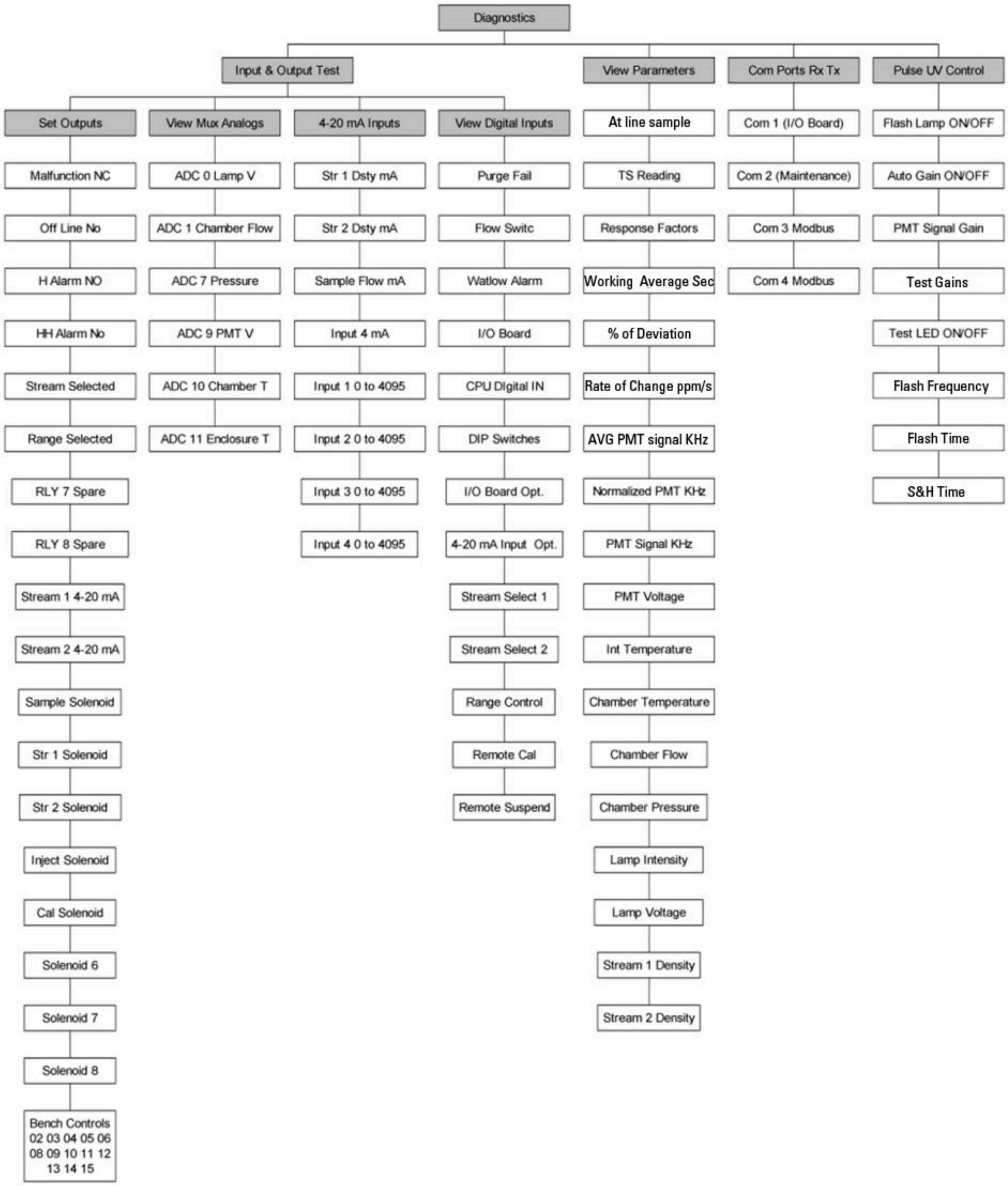

Figure H–2. Diagnostics subgroups

Appendix I

PUVF Optical Bench

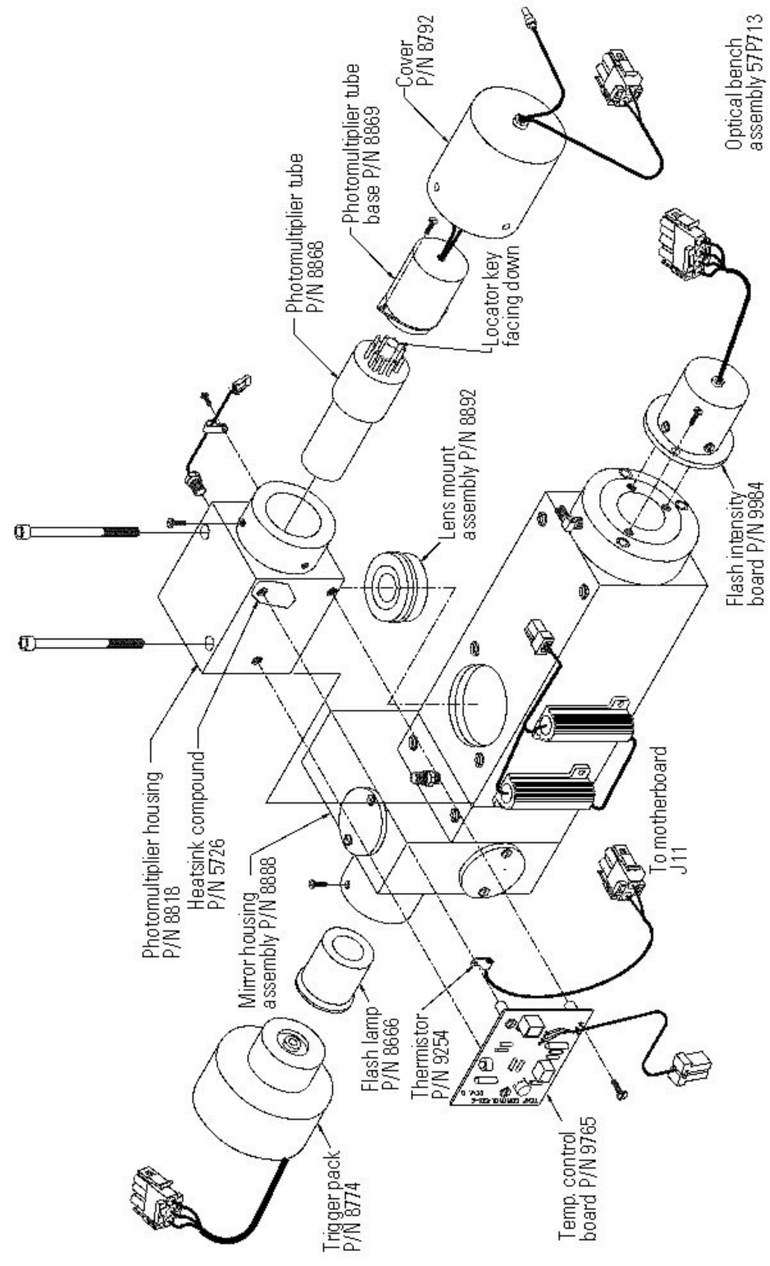

Figure I–1. Optical bench assembly exploded diagram

Appendix J
Dual PMT Supply Option

Overview

The SOLA II Dual PMT Supply option was designed to address the need of certain applications requiring sulfur measurements in fuels with a large variation in the total sulfur concentration.

The typical applications where this option can be used are the inlet and outlet of desulphurization reactors, batch process of different fuels, and dual stream applications were the sulfur concentration expected on each stream varies by a large factor.

Note This option is not suitable for continuous monitoring of a stream where large changes in sulfur concentrations are expected and continuous reporting is necessary. σ

During initial setup and calibration of a SOLA II, the optimum PMT supply voltage is set so that the highest concentration expected produces a signal that is within the range that the rest of the electronics can process. The voltage applied to the PMT is a negative DC voltage, and the lower the PMT voltage the greater the sensitivity of the detector.

Looking at previous applications as examples, a SOLA II calibrated for a full scale range of 8000 ppm S w/w was set up with a PMT voltage of -570 Vdc, and a SOLA II calibrated for a full scale range of 10 ppm S w/w was set up with a PMT voltage of -950 Vdc.

The current dual range option on the SOLA II only modifies the scaling of the 4–20 mA output to provide higher output resolution at the low end of the scale. The analytical calibration is always done on the highest range required.

The Dual PMT Supply option adds the capability of two **independent analytical calibrations**. During setup and calibration, supply A is assigned to one range and supply B to the other. The voltage on each supply is adjusted using the corresponding POT to accommodate the desired range. The analyzer is then calibrated and tested for each range. During normal operation, the supply voltage to the PMT is routed from either supply under software control.

The preferred method of unit configuration is to assign Cal A to one stream and Cal B to the other. Selecting the stream remotely or from the analyzer front panel automatically selects the desired power supply and calibration parameters.

It is also possible to set up a single stream for auto ranging. The analyzer will switch to the higher full scale calibration when the concentration is above the full scale of the lower calibration and switch back when the concentration is less than 90% of the lower calibration full scale. Stabilization time is needed during this change. Calculate this time by adding the programmed fast average time to the programmed purge time. Note that the analyzer will not update readings during this period.

Menu Changes for Dual PMT Supply Option

The Dual PMT Supply option requires a different version of the SOLA II software installed in the unit to operate properly. The software introduces several changes to the standard configuration menus. These differences are discussed in the following sections.

Calibration Setup

With this option, you will need to configure each calibration (Cal A and Cal B) independently. The calibrate and re-calibrate functions are available for both calibrations, but the re-calibrate function will only operate if the calibration selected is the one currently running. The Calibration Setup menu consists of parameters for Cal A and Cal B. Cal A items appear first.

1. Cal A Units
2. Cal A High Value
3. Cal A Low Value
4. Calibrate A High
5. Calibrate A Low
6. Recalibrate A High
7. Recalibrate A Low
8. Cal A High KHz
9. Cal A Low KHz

These items are repeated for Cal B.

AutoCal Setup

It is only possible to automatically validate/re-calibrate one of the calibrations (A or B). Validating on the lowest concentration calibration will be sufficient most of the time to verify that the analyzer is working properly.

The menu consists of one item: Autocal on Cal. Select Cal A or Cal B.

Stream Setup

Each stream has to be configured to use Cal A, Cal B, or auto range.

For batch applications where it is known that products with different ranges of concentrations will be presented, configuring the analyzer as dual stream may be useful. This configuration will provide two 4–20 mA signals, one for each range.

If it is desired to monitor only one 4–20 mA signal, then Auto Range can be selected. A contact output indicates which calibration is used by the analyzer so that the device receiving the 4–20 mA signal can scale it correctly to sulfur concentration.

The menu consists of stream setup parameters for Stream 1 and Stream 2.

1. Stream 1 Cal: Select Cal A, Cal B, or Auto Range.

2. Stream 2 Cal: Select Cal A, Cal B, or Auto Range.

4–20 mA Range Setup

Each calibration is configured to use a unique range for the 4–20 mA output. The low end of the range (4 mA) always corresponds to zero sulfur concentration, and the upper end of the range (20 mA) is configurable for each calibration.

1. Calibration A Range: Enter the 20 mA value.

2. Calibration B Range: Enter the 20 mA value.

Diagnostics Display

Viewing parameters in the Diagnostics menu will show the PMT voltage of the selected supply.

1. View Parameters:
    a. Cal A Response Factors
    b. Cal B Response Factors
    c. PMT Voltage (shows only the active supply voltage)

2. Inputs and Outputs Test > Set Outputs > **PMT Supply**: Toggle the supply selection (A or B).

At Line-Grab Sample

When using the At Line-Grab Sample function, either calibration can be selected to measure the sample. If the sample concentration range is unknown, the sample can be measured first on the highest calibration range and, depending on the concentration, measured on the lower calibration range to obtain higher accuracy on low concentration samples.

Installation

The dual PMT supply option can be retrofitted to existing units in the field. The parts in the table below are required for the field retrofit.

Table J–1.

P/N	Description
98-1049-0	SOLA II Dual Cal software
97-1649-0	SOLA II Dual PMT Supply kit

APPENDIX K

Toxic & Hazardous Substances Table – SOLA-II

For Chinese Regulation: Administrative Measure on the Control of Pollution Caused by Electronic Information Products

Names and Content of Toxic and Hazardous Substances or Elements

Parts Name	Toxic and Hazardous Substances or Elements (SOLA-II)					
	Pb	Hg	Cd	Cr6+	PBB	PBDE
Housing	x	o	o	o	o	o
CPU Card	x	o	o	o	o	o
Removable Cards	x	o	o	o	o	o
Gage Assembly	x	o	o	o	o	o
Temperature Control	x	o	o	o	o	o
Band Strap Detector	x	o	o	o	o	o
Sensor Group	x	o	o	o	o	o
Furnace	o	o	o	o	o	o
AC/DC Distribution	x	o	o	o	o	o
Main Power Supply	x	o	o	o	o	o
Cabling	x	o	o	o	o	o

○: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in **GB/T26572-2011**

x: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in **GB/T26572-2011**

有毒有害物质名称及含量的标识格式

部件名称	有毒有害物质或元素 (SOLA-II)					
	铅（Pb）	汞（Hg）	镉（Cd）	六价铬（Cr6+）	多溴联苯（PBB）	多溴二苯醚（PBDE）
外壳	x	o	o	o	o	o
CPU 电路板	x	o	o	o	o	o
可移动的卡片	x	o	o	o	o	o
量具组件	x	o	o	o	o	o
温度控制器	x	o	o	o	o	o
条带监测器	x	o	o	o	o	o
传感器组	x	o	o	o	o	o
熔炉	o	o	o	o	o	o
交流/直流配电	x	o	o	o	o	o
电源	x	o	o	o	o	o
缆线连接	x	o	o	o	o	o

○：表示该有毒有害物质在该部件所有均质材料中的含量均在**GB/T26572-2011**标准规定的限量要求以下

x: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出**GB/T26572-2011**标准规定的限量要求

Appendix L
Connecting to a Sarasota FD910 Density Meter

Purpose

The SOLA II can be connected to a Thermo Scientific Sarasota FD910 density meter for use with live density compensation. This appendix provides information on how to make the connections.

Connections

In the figure below, note that terminals 2 and 4 of the Sarasota FD910 density meter are connected to the return of the SOLA II supply loop. It is acceptable to run three wires between the devices and jumper terminals 2 and 4 together at the density meter and connect either terminal 2 or terminal 4 of the density meter to terminal 3 of the SOLA II 4–20 mA inputs.

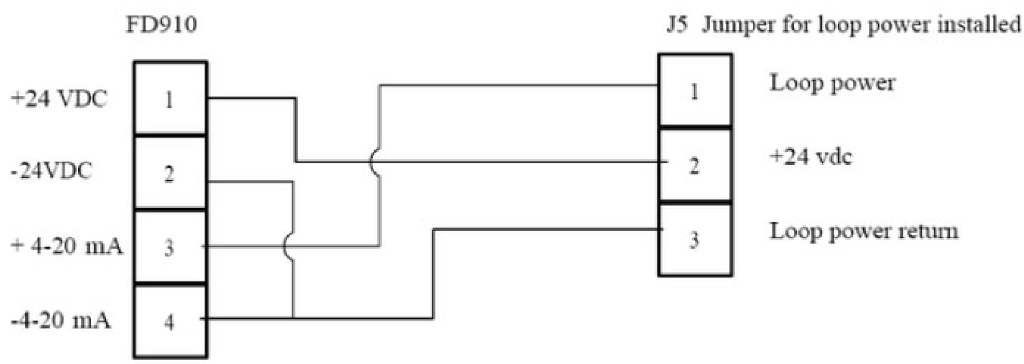

Figure L–1. Sarasota FD910 density meter to SOLA II connections

Figure L–2 shows the density meter headmount assembly terminal connections. These terminals are the ones shown on the left in Figure L–1.

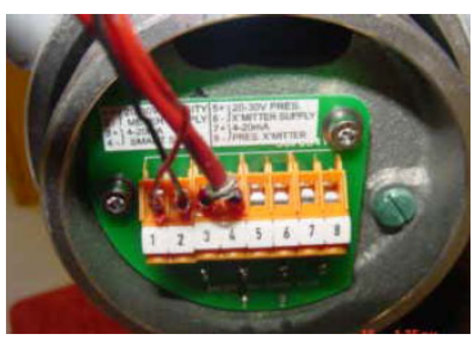

Figure L–2. Sarasota FD910 headmount assembly terminal connections

Figure L–3 is a picture of the SOLA II optional analog input board 89-2896-0. The top terminal block J5 represents the terminals shown on the right in Figure L–1.

Figure L–3. SOLA II optional analog input PCB 89-2896-0

There is a jumper to the right of each three-wire terminal block (four in total). If the jumper is installed, the 24VDC current loop power is supplied by the SOLA II. If the jumper is left open, power is not supplied by the SOLA II. For the Sarasota FD910, an external current loop power supply is required, so the jumper needs to be installed for each channel using the density meter as an input. Figure L–4 is from the SOLA II electrical drawing and shows the terminal numbers and the terminal block connectors J5, J9, J10, and J11.

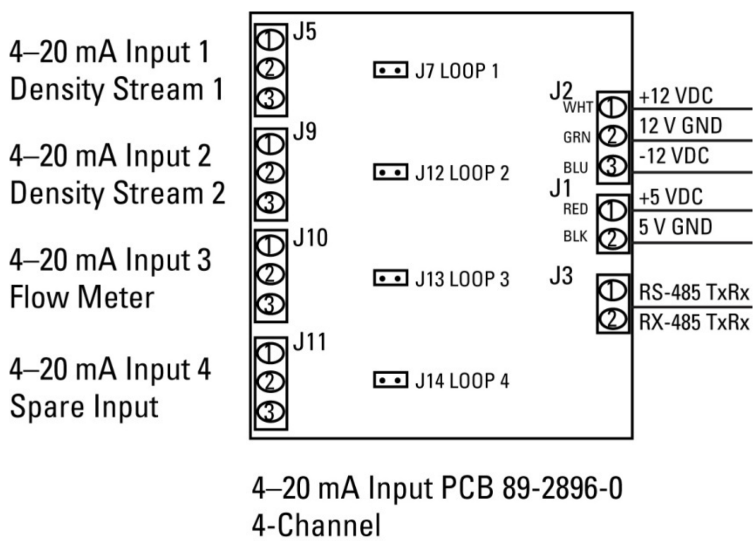

Figure L–4. Terminal block connectors on SOLA II analog input board 89-2896-0

Connecting One Density Meter to a Dual Stream System

Figure L–5 shows the configuration for using one Sarasota FD910 density meter on a dual stream system.

Note The jumper for loop power is NOT installed for stream 2 (J9). σ

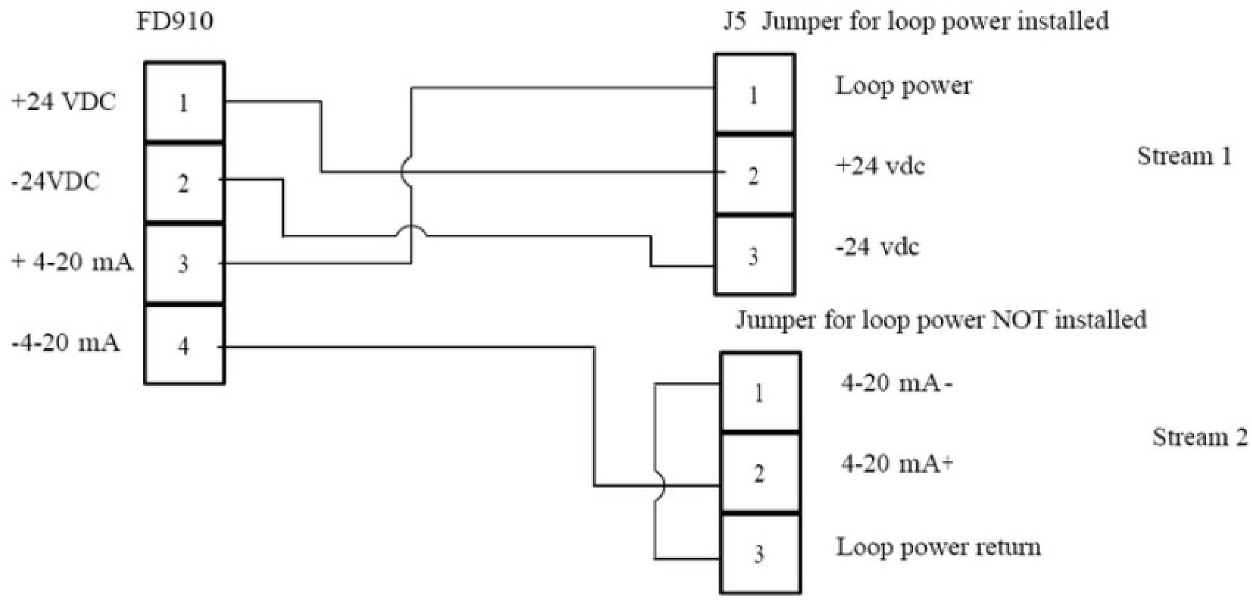

Figure L–5. Sarasota FD910 density meter to SOLA II dual stream system connections

Appendix M
Related Technical Bulletins

This appendix provides a list of technical bulletins related to this product as of the release date of this document revision. For the most current bulletins, please go to thermoscientific.com. Enter the product name (SOLA II) as the search term and click the Resources tab.

Table M–1. Technical bulletins

TB #	Title
TB-0417-001	Replacing a Watlow® Series 93 Temperature Controller with a Watlow EZ-ZONE® PM6 Series Controller
TB-0417-003	Increasing the Lifetime of the Pyrolyzer Heater in a Thermo Scientific SOLA II System
TB-0417-004	Using the Watlow® Series 93 Temperature Controller in a Thermo Scientific SOLA II System
TB-0417-005	Replacing the Pyrolyzer Heater in the Thermo Scientific SOLA II Analyzer

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Appendix N

Trace level measurements

Description of the SOLA II Trace

The SOLA II Trace analyser is a modified version of the standard SOLA II, all characteristics of the SOLA II operation are applicable to the SOLA II Trace, it is available for both liquid and vapour samples; the primary function of the SOLA II Trace is to implement improvements to the limits of detection performance at low concentrations of total sulphur.

The SOLA II Trace utilizes a modified analytical PUVF bench for the determination of total sulphur in liquid and vapour samples, the modification consists of replacing the standard PUVF bench with a version configured with an additional set of reflectance mirrors. The function of the additional set of mirrors is to enhance the selectivity of UV light at wavelengths specific to the excitation of SO2 molecules.

Calibration method

The SOLA II requires a two-point linear calibration. High Calibration is conducted with a standard that is, ideally, close to the full scale range of the analyzer. Low calibration is commonly conducted by zeroing with no injections, for the SOLA II Trace it is recommended that a low concentration standard is used instead of no injections, implementation of the low calibration method is also subject to the combustion gas used with the SOLA II Trace, refer to the next paragraph.

Combustion gas for the SOLA II Trace

Results reported from the field as well as measurements conducted in the factory indicate that, when the sample matrix is combustible and when air (rather than heliox) is used for combustion of the sample in the pyrolyzer, re-zeroing with no injections can lead to significant overestimation of sulfur content of low-level samples on SOLA II Trace. In order to prevent incorrectly reported sulphur levels one of two calibration methods can be selected dependant on the combustion gas.

Method a: the analyzer is calibrated with both low and high calibration standards that are representative of the sample matrix – e.g. to calibrate a SOLA II Trace for an ethylene stream, perform low calibration on pure ethylene and high calibration on standards made up in ethylene.
Recommendation
Method b: heliox (21mol% oxygen in helium, zero grade) is used in place of clean air - this has been observed to give satisfactory results when the analyzer is zeroed with no injections.

Model	Lowest recommended full scale range	Highest recommended full scale range - consult factory for higher ranges	Limit of Detection (2 injections per minute)	Limit of Detection at lowest available range (in ppb)	Repeatability with 2 injections per minute
SOLA II Trace	2ppm (2,000 ppb)	5ppm (5,000 ppb)	1.25% of full scale	25	1% of range

Table N-1 Performance specification table for the SOLA II Trace

Available ranges for the SOLA II Trace

The lowest recommended range is 2ppm full scale, and the published specifications are limited to this lowest range; however some users have calibrated for lower ranges and have scaled the outputs accordingly. The manufacturer recognises this may be a preference of some users but notes that where a user calibrates for a full scale range lower than 2ppm the performance specifications are not altered, that is the repeatability will not be guaranteed to be lower than 1% of 2ppm, similarly the limit of detection also remains 1.25% of 2ppm (25ppb).

The highest recommended range is a full scale of 5ppm, above this range the performance of the standard SOLA II is usually deemed sufficiently good to negate the benefits of the SOLA II Trace and provide a more cost effective solution, however users are invited to consult the factory for the implementation of ranges with the SOLA II Trace higher than 5ppm.

Appendix O: Vapour sample measurements

Additional guidance on the SOLA II for Vapours

This user manual contains information relating to the use of the SOLA II and SOLA II Trace for both liquid and vapour samples, this appendix provides additional guidance on the performance specification, ranges and technical characteristics for vapour samples, in particular samples that have a high dewpoint (Condensable Vapours).

Model	Lowest available full scale range	Highest recommended full scale range	Limit of Detection (1 injection per minute)	Limit of Detection (2 injections per minute)	Limit of Detection at lowest available range (in ppb)	Repeatability with 1 injection per minute	Repeatability with 2 injections per minute
SOLA II Vapour	5ppm	5% - consult factory for higher ranges	2.5% of full scale	1.25% of full scale	62.5	2% of range example range = 200ppm, repeatability = 4ppm	1% of range example range = 200ppm, repeatability = 2ppm

Table O-1 Performance specifications (for SOLA II (CV) Trace level, please refer to Table N-1)

SOLA II for Condensable Vapours (CV)

The SOLA II CV is a modified version of the standard SOLA II for vapour samples, the function of these modifications is to allow for the introduction of high dew point samples to the SOLA II without risk of condensation.

The SOLA II CV version permits the entry of a heated sample line from the secondary sample conditioning panel to enter the SOLA II directly through the underside of the oven enclosure via a heat shrink boot (sample line and heat shrink boot are not in the scope of Thermo Fisher Scientific) but by the owner or system integrator (or other).

Included in the oven are the sample injection valve, the forward and back pressure regulators (where applicable), the sample/calibration valve and the divert valve.

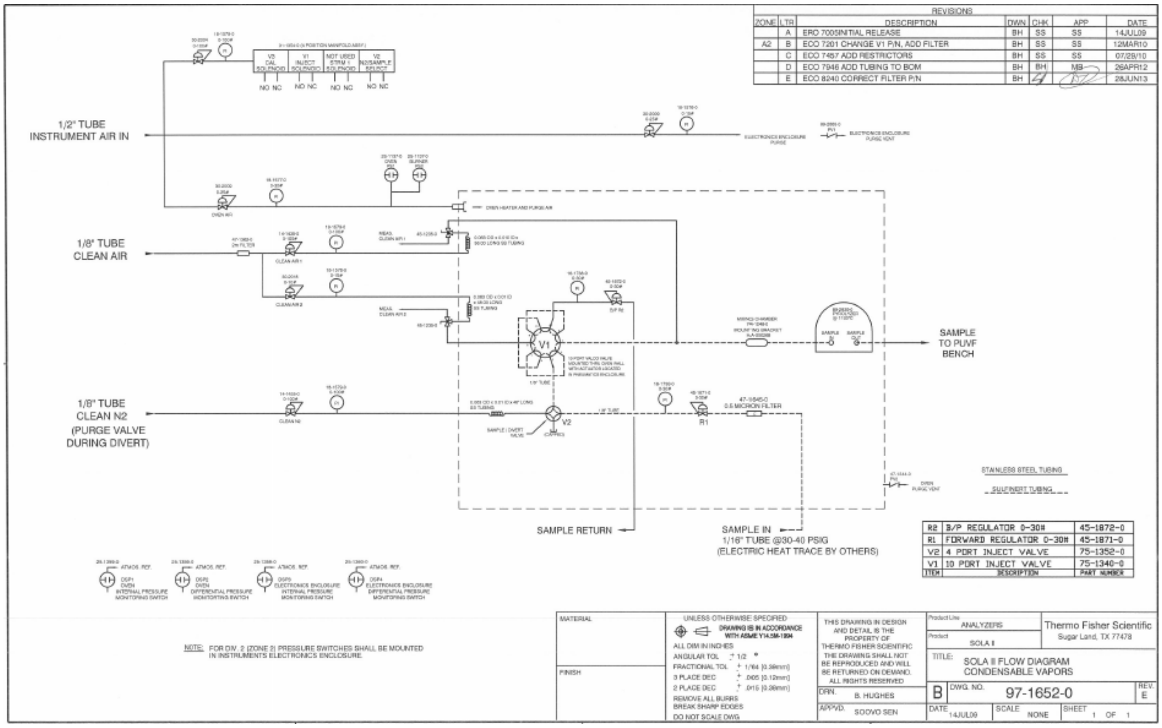

Figure O-1 SOLA II (CV) flow diagram

SOLA II (CV) Hazardous area certifications

Since the SOLA II (CV) is modified from the standard SOLA II analyser the hazardous area approvals may vary; please consult the factory for the latest approvals for installation in hazardous areas.

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