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SOLA iQ Users Guide

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Thermo Fisher SCIENTIFIC

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 guide can lead to equipment damage or injury to personnel.

Any person working with or on the equipment described in this guide 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 guide 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 guide 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 guide 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 guide 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 guide to alert users to potential hazards or important information. **Failure to heed the warnings and cautions in this guide 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. ▲

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

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

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

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.

Warning Work on the SOLA iQ shall not be performed by unskilled and/or untrained personnel. ▲

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

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. ▲

Caution Opening the Oven door while the purge air is operational can expose personnel to elevated noise levels. Take appropriate precautions to prevent injury resulting from exposure to elevated noise levels. ▲

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 from 120/240 VAC 50-60 Hz at a maximum of 2000 watts. The AC power is converted internally 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.

Warning All wiring must be performed by qualified individuals in accordance with all applicable codes and specifications such as the National Electric Code (NEC), ANSI/NFPA70 specifications and/or the Canadian Electric Code (CEC) Part 1. ▲

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. ▲

Warning For SOLA iQ units supplied without a Purge Control Unit (PCU), a loss of purge only creates an alarm condition. In the event of a Purge Alarm, the user must disconnect the electrical power and I/O signals manually to de-power the unit. Not disconnecting the electrical power and I/O signals can result in an electrically active, non-purged device operating in a hazardous area environment. This can be an unsafe operating condition. ▲

Warning For units without a Purge Control Unit: when a purge alarm occurs, the operator shall check the purge air and the backup purge air supplies. Power down the unit if either the purge air supply or backup air supply is not adequate Do not power up until the purge air and backup air supply problems are resolved. ▲

Purge Air Supply

The Purge Air Supply shall be fitted with two regulators in series so that failure of one of the regulators does not cause an excessive over-pressure inside the Electronics and/or Oven purged enclosures. The SOLA iQ is provided with one regulator each for the purge air supply going to the Electronics enclosure and the Oven enclosure. The inlet to the SOLA iQ Electronics purge air regulator and the SOLA iQ Oven purge air regulator is a common header located in the Pneumatics section. The header is fed by a single air inlet via a bulkhead connection.

The user is responsible for the installation of the second air supply regulator which will be exterior to the SOLA iQ. Table 2–4 specifies the SOLA iQ inlet purge air pressure range. The maximum inlet pressure for the user supplied purge air regulator is 100 psig.

Chapter 2
Product Overview

The Thermo Scientific SOLA iQ 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 iQ 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 iQ 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 pressures such as naphthas and gasolines will require sample backpressure regulation 25–35 psig. ▲

- 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.

Total Sulfur Measurement

Total sulfur measurement is based upon the precise measurement of the SO_2 concentration produced via combustion from a wide variety of compounds containing sulfur, such as H_2S, COS, methyl mercaptan, benzothiophenes, dibenzothiophenes, sulfides, disulfides, and thiols. For liquid phase samples, the analyzer periodically injects a very small quantity of sample (1.0 µL) into a hot oven (110°C to 190°C / 230°F to 374°F) where it is vaporized and mixed with air. Analysis of gas phase samples requires typical 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 sample.

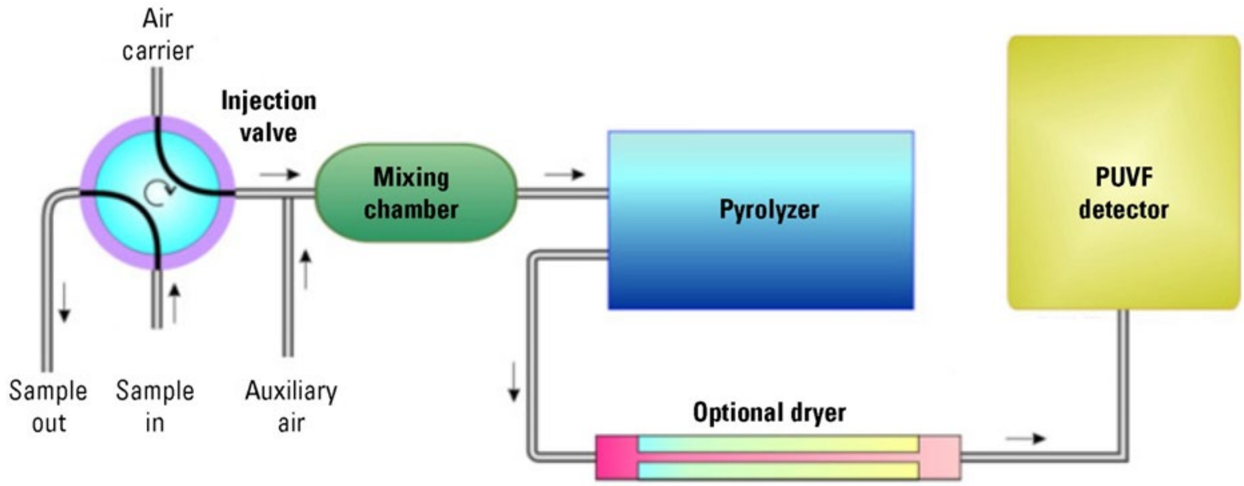


Figure 2–1. Functional Block Diagram

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 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 band pass filters to ensure that only light from SO_2 is measured. Once the proper wavelength of light is selected, its intensity is measured 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). The choice of terms is typically application dependent and is based on the calibration standard units of measure. For gas applications ppm (v/v) and ppb (v/v) terms are typical. For liquid applications, ppm (w/w) and ppb (w/w) terms are typical. Note that the Display will only indicate ppm or ppb.

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 decays 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.

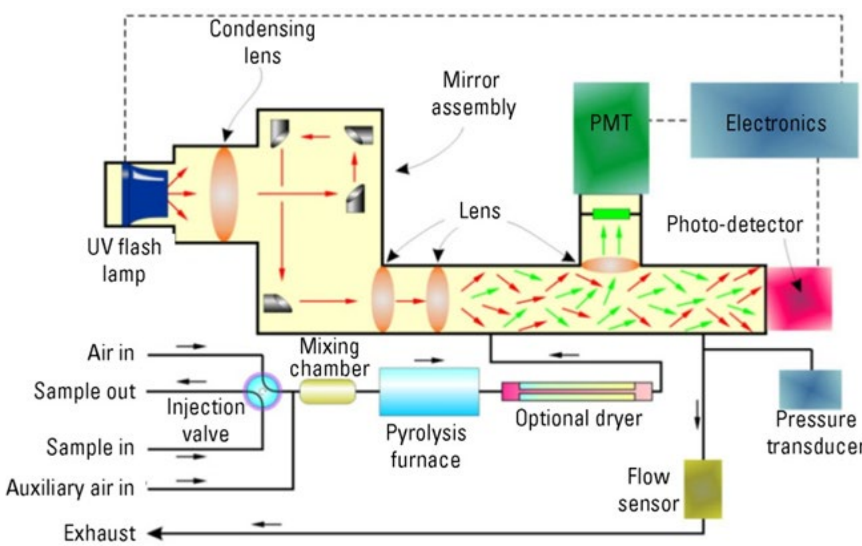


Figure 2–2. Typical functional flow diagram

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 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

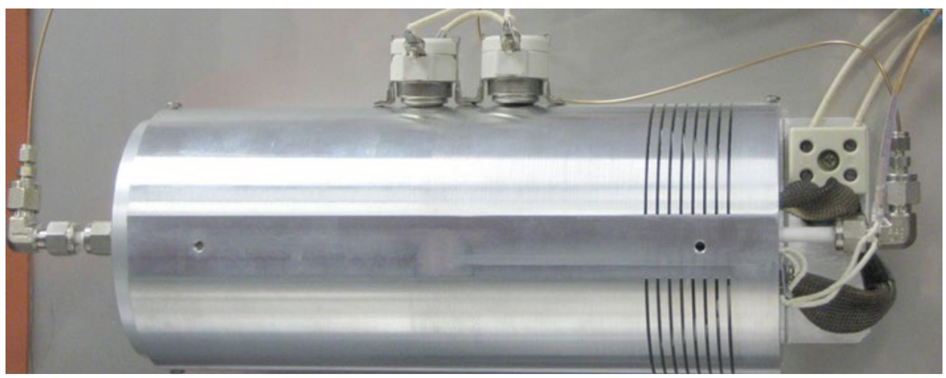


Figure 2–3. Pyrolyzer

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.

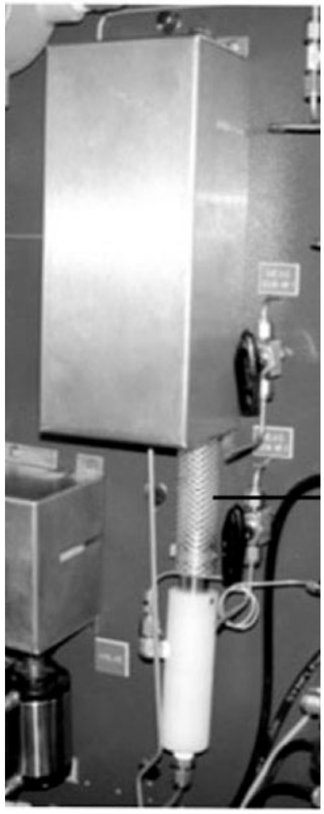


Figure 2–4. Optional dryer

Mixing Chamber

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

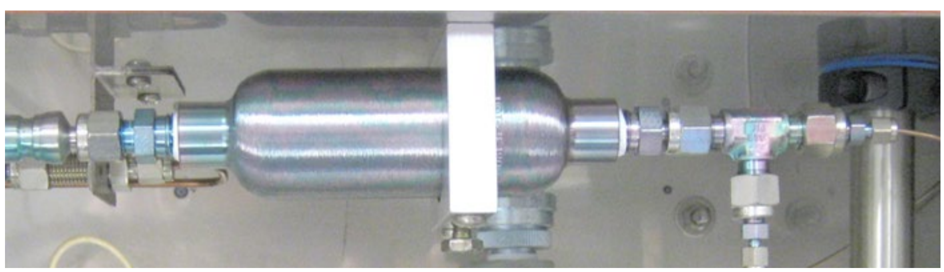


Figure 2–5. Typical mixing chamber

Injection Valve

The injection valve periodically injects precisely measured quantities of the sample stream into a controlled carrier gas flow. An auxiliary airflow is added to this sample and air mixture. The sample/carrier flow then passes to the mixing chamber where it is thoroughly mixed with the air. See Appendix for injection valve service information.

Figure 2–6. Uncovered Injection Valve – Liquid Applications

Warning Samples that are analyzed for Total Sulfur using the SOLA iQ can contain a wide mixture of inert gases and hydrocarbon components as well as a wide range of sulfur containing compounds. Individual sample composition components pose the potential for hazards in the event of an exposure. Hazards include, but are not necessarily limited to, asphyxiation, toxicity, flammability, and explosion. Consult with site Health and Safety personnel, applicable Safety Data Sheets, Safety Manuals and local, state and/or federal regulations for specific details of individual sample constituents and sulfur compound types.

The quantity of sample, and the resulting specific sample component, flowing into the SOLA iQ analyzer is site and application dependent.

Under normal operating conditions, all utility and wet sample lines are checked to ensure that there are no leaks before being placed into service. Additionally, the vent line from the PUVF spectrometer is tubed to a safe location. See Chapter 3 Sample Line Installation for additional details.

Though there is a great variety in the sample composition to the Pyrolyzer, the post Pyrolyzer exit gases are composed of combustion products and excess air, CO_2, H_2O, N_2, O_2, and SO_2. If Heliox is used as a carrier gas the post Pyrolyzer exit gases will contain He instead of N_2. The flow rate of post Pyrolyzer exit gases is typically in the range of 150-300 cm3/min.

The quantity of a particular component in the post Pyrolyzer exit gases is application specific. Component concentration estimates can be made by performing material balance calculations around the Pyrolyzer.

A SOLA iQ analyzer with properly installed utility lines, sweep lines and vent lines that is free of leaks in normal operation does not emit dangerous amounts of poisonous or injurious gases or substances. Consult the system flow diagram for details of a specific SOLA iQ application. Note that others typically supply sample conditioning systems and their associated system drawings. ▲

Backup Purge

All SOLA iQ models are equipped with a backup purge. The air source for the backup purge must be independent of the purge air source used to operate the SOLA iQ on a daily basis. If the backup air purge source is the same as the day to day purge air source, a loss of purge air renders the backup purge non-operational.

In the event of a loss of purge air, the backup purge cools down hot surfaces in the SOLA iQ oven. After a purge loss, the secondary independent purge source holds the pressure inside the SOLA iQ oven above 0.5 mbar. The amount of backup purge is dependent on the T rating of the SOLA iQ. In general, the amount of backup purge is greatest for a T4 System. Details on the time periods required for T2, T3, and T4 Systems can be found on the certification label attached to the SOLA iQ.

The backup purge assembly is mounted in the Pneumatics Section of the SOLA iQ unit (see Figure 2–7). Details related to the tubing and operational pressures can be found on the flow diagram supplied with the analyzer. To ensure that there is an adequate backup purge air flow rate, the minimum pressure at the inlet of the Backup Purge inlet on the SOLA iQ is 20 psig

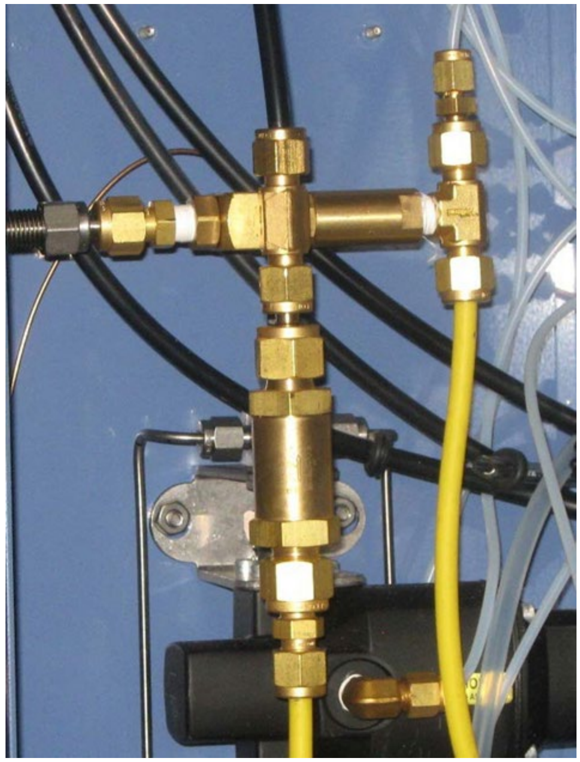


Figure 2–7. Backup Purge

Printed Circuit Boards

AutoPilot Pro Board

The AutoPilot Pro Board, 4-0500-003, is used to control the operation of the SOLA iQ. It is located on the door of the electronics enclosure (see Figure 2–8).

A Lithium backup battery (Panasonic BR2330) is installed on the AutoPilot Pro board in the SOLA iQ to maintain the configuration, memory, and real-time clock when power is removed from the SOLA iQ. The Lithium battery in-circuit connection is set by installing a jumper at J39 pins 11-12 on the AutoPilot Pro board.

The Lithium battery lifetime depends on how long the SOLA iQ is without power. In storage, with no power applied to the SOLA iQ, the expected Lithium battery lifetime is about 5 years. During normal operation, the Lithium battery lifetime is expected to be from 5 to 10 years.

Note SCB firmware version 31955 and higher includes a visual alarm to indicate a low backup battery on the APP board. See appendix H for more details. Loss of configuration or historical data with the backup battery jumper installed may also indicate that the Lithium battery needs to be replaced. ▲

Note The Lithium battery is a field replaceable item. Refer to "Replacing the Backup Battery" in the Appendix for replacement instructions. ▲

Warning The Lithium battery may explode if mistreated. Do not attempt to recharge, disassemble, or burn it. ▲

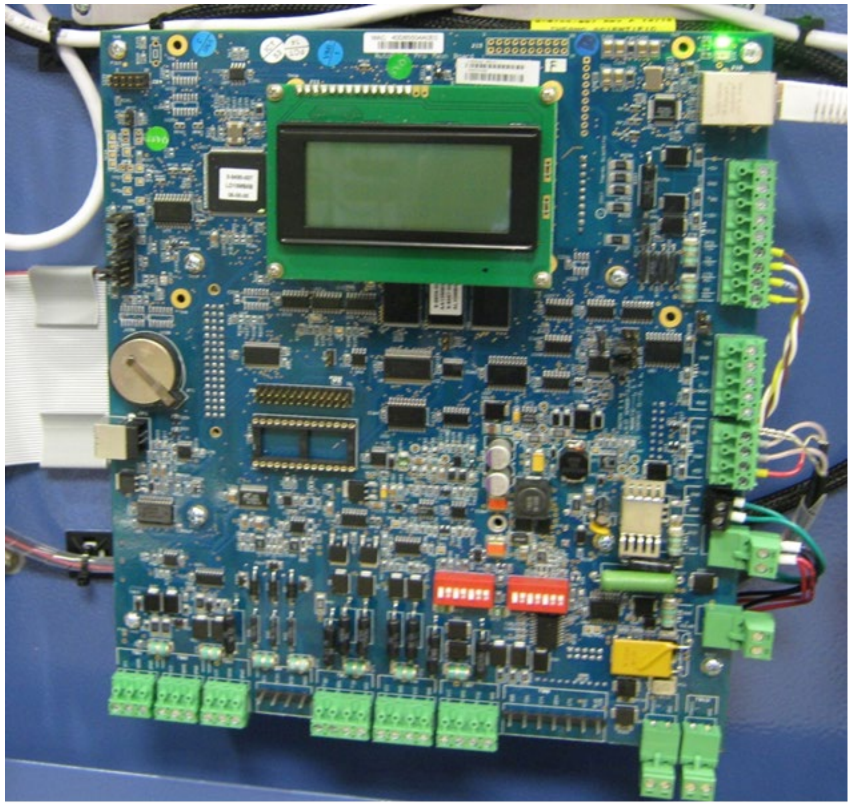


Figure 2–8. AutoPilot PRO Board

Power Control Board

The Power Control Board, 4-0755-009, provides for AC power distribution within the SOLA iQ as well as the power control for the Oven. It supports a wide AC input range.

I/O Board

The I/O Board, 4-0755-003, provides for the following customer connections: 1) Four channel main circuit isolated 12 bit resolution 4-20 mA Analogue Outputs, 2) Four channel main circuit isolated 12 bit resolution 4-20 mA Analogue Inputs, 3) Eight customer channel dry contact Digital Inputs, 4) Eight channel 10 amps at 250 VAC and 10 amps at 30 VDC mechanical plus eight channel minimum 0-60 VDC at 1 amp solid state relay Digital Outputs/Alarm Outputs and 5) Sixteen channel pneumatic relay output. The Analogue Outputs can be either loop powered or externally powered. Each pneumatic relay drives a 24 VDC solenoid. Normally four, and possibly up to eight for special designs, pneumatic outputs are required for the SOLA iQ.

IO board also provides pyrolyser power control for IO firmware versions S13H or later.

Comm Term Board

The Comm Term Board, 4-0500-006, provides the Serial channel interface and the RS-232 and RS-485.

SCB Board

The SCB, System Controller Board, 113370-00, controls the Front Panel Display.

SCB Adapter Board

The SCB Display Adapter Board converts LVDS signals to digital RGB.

Backplane Board

The Backplane Board, 4-0755-006, provides for DC power distribution within the SOLA iQ. It also provides for the routing of the RS-485 from the SCB Board and the DMC Board.

Touchscreen Assembly

The Touchscreen Assembly provides for a color graphical MMI using a touchscreen to access various menu pages related to the day to day operation of the SOLA iQ.

Flow Pressure Board

The Flow Pressure Board, 116275-00, measures the chamber flow rate through the SO_2 spectrometer. It also measures the chamber pressure.

43 DMC Board

The 43 DMC Board, 116485-00, controls the operation of the SO_2 spectrometer.

Specifications

Results may vary under different operating conditions.

Table 2–1. Mechanical Specifications

Mechanical Specifications	
Dimensions, H x W x D	44.5 x 24.0 x 18.1 inch (113 x 61 x 46 cm) (w/o PCU) 63.2 x 24.0 x 18.1 inch (167 x 61 x 46 cm) (w/ PCU)
Weight	Approximately 250 lb (113 kg, typical; with options the estimated maximum weight is 350 lb (159 kg))
Mounting	Wall or rack mount (see Chapter 3 Installation)
Enclosure IP Rating	CP40
Maximum Altitude	2000 meters (6561 feet)
Ambient temperature	12ºC to 40ºC (54ºF to 104ºF)
Incoming purge air temperature	12ºC to 40ºC (54ºF to 104ºF)
Area classification	**CSA:** Class 1, Div. 1, Groups B, C, D, T2, T3, or T4* (optional, X-Purge system) Class 1, Div. 2, Groups B, C, D, T2, T3, or T4* T2 or T3 for SOLA IQ Liquid T2, T3, or T4 for SOLA IQ Vapor, Flare, or CV **ATEX:** Zone 1, II 2 G Ex pxb IIC T2/T3/T4* Gb (optional, X-Purge system) Zone 2, II 3 G Ex pz IIC T2/T3/T4* Gc T2 or T3 for SOLA IQ Liquid T2, T3, or T4 for SOLA IQ Vapor, Flare, or CV **UKCA:** CSAE 22UKEX1264X UKCA 0539 II 2G Ex db pxb IIC T* Gb CSAE 22UKEX1265X UKCA 0539 II 3G Ex pzc IIC T* Gc *Continues Flow at minimum supply pressure of 20 psi after loss of power: T2: 50 Minutes T3: 80 minutes

Mechanical Specifications	
	T4: 130 minutes (Only for VAPOR, VAPOR TRACE, FLARE, AND CONDENSABLE VAPOR (CV) UNITS) **IECEx:** Zone 1, II 2 G Ex pxb IIC T2/T3/T4* Gb (optional, X-Purge system) Zone 2, II 3 G Ex pz IIC T2/T3/T4* Gc T2 or T3 for SOLA IQ Liquid T2, T3, or T4 for SOLA IQ Vapor, Flare, or CV
Input & Output Connections – Tubing & Electrical	Input and Output connections can be located on the system flow and electrical drawings.

Table 2–2. Analytical Specifications

Analytical Specifications	
Detector	Pulsed UV fluorescence (PUVF) with Pyrolyzer for total sulfur measurement
Full scale range	SOLA iQ: Full scale ranges from 0-5 ppm S to 0-100%; application dependent consult Thermo Fisher Scientific Unique ranges may be assigned to Streams 1, 2, 3 and 4. -
Repeatability	Calculated at 1 standard deviation SOLA iQ: ±1% of full scale, two sample injections per minute ±2% of full scale, one sample injection per minute
Linearity	±1% of full scale, two sample injections per minute ±2% of full scale, one sample injection per minute
Response time	Analyzer is semi-continuous; initial response occurs at each injection. Outputs updated every 1 second, typically 5-6 minutes to 90% of new value (application dependent)
Calibration	Remote or Manual
Calibration method	External standard(s), 2-point calibration

Table 2–3. Controller Specifications

Controller Specifications	
Display & User Interface	Full analyser control and configuration via Front mounted 7" touch screen HMI, hazardous area classification remains intact while operating local display. Laptop connection (TCP/IP)
Remote & Local PC Interface and connectivity	Local to the SOLA iQ is a TCP/IP connection for hook up of a laptop for setup and maintenance. Remotely there is the same provision, also via TCP/IP (same SW) for complete remote control and diagnostic functions; Ability to access 30 days of backed up data from the SOLA iQ (analysis results and hardware data)
Streams	Up to four streams optional with auto stream select or DCS control of stream selection
Alarms	Low sample flow alarm (optional); Low detector flow alarm; Oven/Pyrolyzer temperature fault; Injection valve fault; Purge failure; Calibration fault; Detector temperature fault: Detector lamp voltage fault One Out of Service dry contact triggered by: Analyzer in calibration; Suspension of analyzer.
Alarm relays/indicators	SPST, 2 A at 240 Vac or 10 A at 24 Vdc; 8 total
Analog signal output	Isolated, 4–20 mA; 4 total; loop or external powered
Analog signal load	≤ 700 ohms using 24 Vdc loop power supply
Inputs	Dry contact; remote suspend, remote calibration, remote range select, remote stream select
I/O ports	Standard: RS485 Modbus RTU; RS485/RS232 Modbus RTU
Modbus Remote Interface	Provides complete remote control; Automatic logging of analysis results and analyzer parameters; Communication to SOLA iQ analyzer via serial or TCP/IP encapsulated Modbus enables remote diagnostics

Table 2–4. Other Specifications

Other Specifications	
AC power	Standard: 120/240 VAC 50-60 Hz, maximum 2000 watts
Fuses	Power Control Board fuses F1 & F2 – 10 A 220 VAC SloBlo 5x20 mm I/O Board fuses F1, F2, F3, & F4 – T-LAG 0.050 A 250 V TR5
Purge Air (Oven and Electronics)	Instrument air: 60–100 psig, water and oil free; -40ºC (-40ºF) dew point, particles ≤ 5 microns, ISA grade hydrocarbon free, Refer to tag for Minimum Purge Flow Rates, estimated maximum 450 SLPM (16 SCFM)
Back-up Purge Air	Minimum 20 psig supply pressure at the Back-up Purge inlet on the SOLA iQ; Back-up purge air supply shall be independent of the Oven and Electronics purge air supply
Optional Dryer Air	Instrument air: 60–100 psig, water and oil free; -40ºC (-40ºF) dew point, particles ≤ 5 microns, ISA grade hydrocarbon free, 6 SLPM (0.2 SCFM) (maximum)
Carrier and auxiliary gasses (Actual flow rates are application specific. Refer to analyzer calibration data sheet for actual flow rates)	Zero grade air: 80 psig, 300 sccm (maximum) Zero grade nitrogen: 80 psig, 300 sccm (maximum) application specific option Heliox (79% helium, 21% oxygen): 80 psig, 200 sccm (typical), application specific option
Sample tubing	Sulfinerted 316 stainless steel, cleaned and free from oils, moisture, and debris
Sample wetted components	Sulfinerted 316 stainless steel, Teflon®, and graphite (ferrules); others application dependent (Kalrez, Viton)
Vent gasses	All gasses entering the SOLA iQ exit as vents at nominally atmospheric pressure. Refer to Chapter 3 Installation - Sample Line Installation for details related to vent line installation.
IEC 60079-2:2014 Clause 18.4(d)	The flammable substance oxygen concentration shall not exceed 2%
IEC 60079-2:2014 Clause 18.4(d)	The flammable substance oxygen shall not have a UFL higher than 80

Warning Not all fuses are operator replaceable. For reliable operation and to maintain safety approval validity, only replace fuses with approved fuses. ▲

Storage

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

Chapter 3
Startup & Shutdown

Initial Startup

Perform this procedure when starting up a new installation or when major service work is performed.

See the instrument system drawings and application data that shipped with the instrument and the specifications in Chapter 2. The installation instructions can be found in the Installation Guide, P/N 1-0755-016. This guide provides the information necessary for 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 the amount of time specified on the analyzer tag affixed to the analyzer. Set the pressure as documented in the application data sent with instrument.

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

4. Apply power to the instrument.

Note If the Purge Control Unit option is installed, you must follow the instructions included in Chapter 10.▲

   a. Verify that Pyrolyzer and Oven temperature limits in the Alarms screen 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.

   b. Verify that the display is functioning. The screen in Figure 3–1 appears, which displays the Home Page of the display.

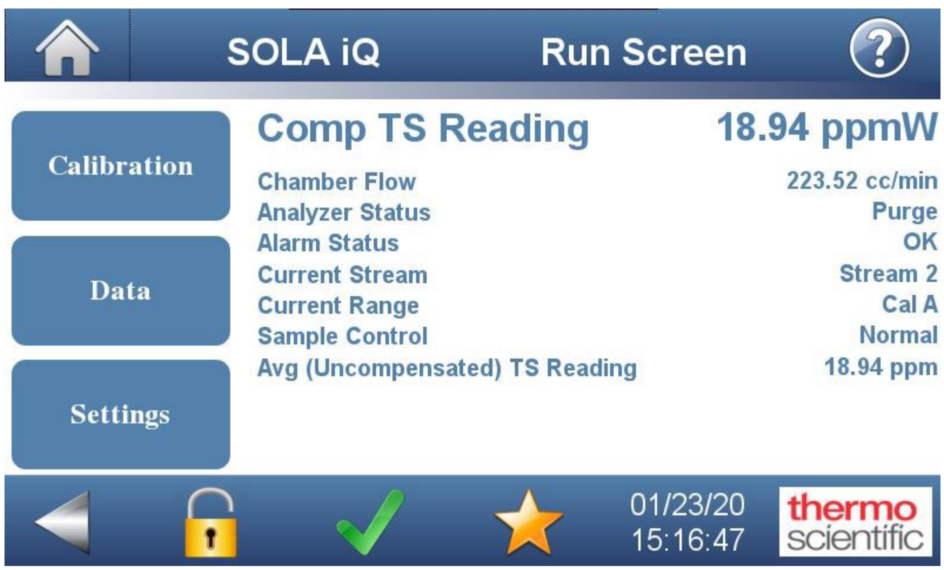


Figure 3–1. SOLA iQ Display Home Screen

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

   d. Turn off the injection valve by engaging the Stop Injection button. The Stop Injection button can be reached from the Home Page by touching the Calibration button (see Figure 3–2). Doing this will prevent accidental injection of sample while setting up the instrument.

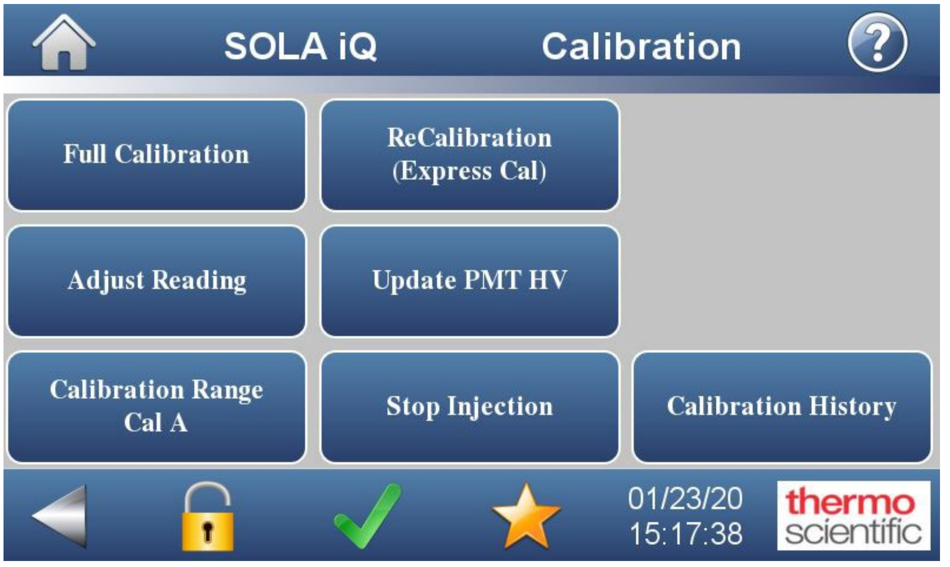


Figure 3–2. Display – Calibration Screen

5. Apply carrier air to the instrument, and set the flows. See Calibration Data Sheet 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 starting injections from the Calibration Screen (see Figure 3–2). The unit begins injecting and analyzing sample when the instrument temperatures reach operating levels. Prior to the instrument temperatures reaching their operating levels, the SOLA iQ will indicate that it is in an alarm condition. The Alarms screen is directly accessible using the third button from the left at the bottom of any Display page status of the Pyrolyzer and Oven temperatures can be seen on the Alarms screen (see Figure 3–6) of the Display. This button will be a green check mark when there is no alarm condition and a red triangle border around a black exclamation point (!) on a white background when there is an alarm condition (see Figure 3–3 and Figure 3–4). The button is located at the bottom of the Display. Additionally, the State on the Run Screen of the AutoCONFIG software will indicate Divert. When the unit is

performing an analysis, the State on the Run Screen of the AutoCONFIG software SOLA iQ Params pre-configured page will indicate Measure (see Figure 3–5).

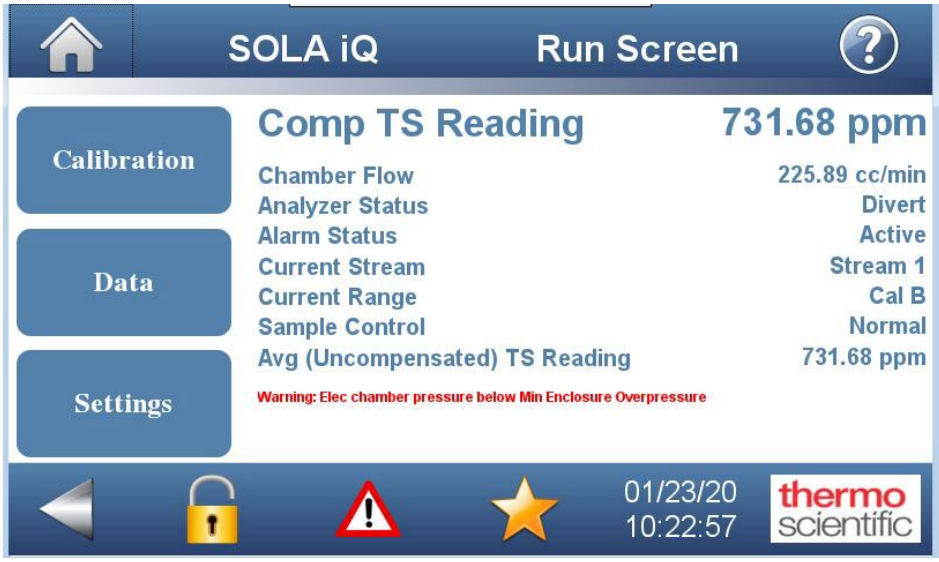


Figure 3–3. Display – Alarm Condition (note red triangle icon

Figure 3–4. Display – No Alarm Condition (note green checkmark)

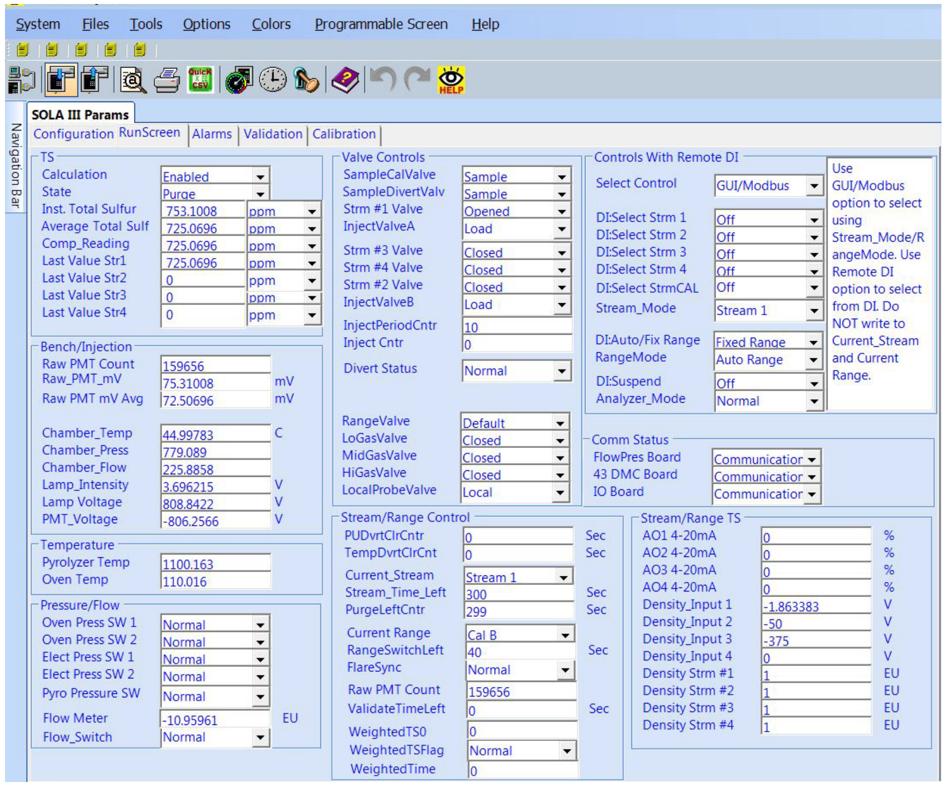


Figure 3–5. AutoCONFIG – SOLA iQ Params_xx RunScreen

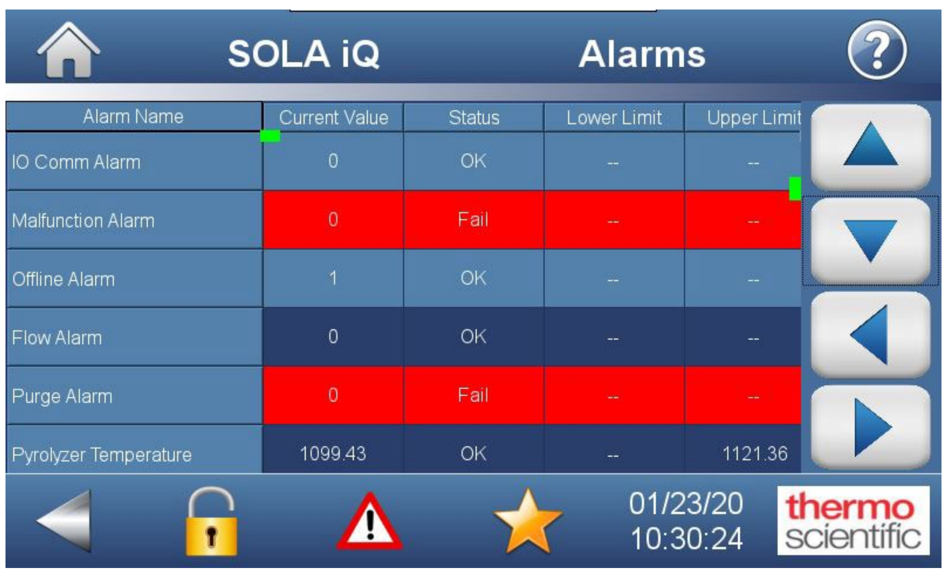


Figure 3–6. Display – Alarms Screen

8. Allow the analyzer system to stabilize. Monitor the measured values on the front panel display or by the Historical Average data collection feature of the AutoCONFIG software (see Figure 4–21 to Figure 4–25) for consistent analysis readings to determine when the analyzer system has stabilized. A graphical representation of the previous 24 hours of

data can be viewed from the front panel display. From the Home Page, follow the path Data-Data Log-View Datalog (Last 24 hours) to the Tabular Data screen (see Figure 3–7). The graph is created by touching the word Graph below the parameter of interest (see Figure 3–8). The Tabular Data screen does not automatically refresh itself. To refresh the Tabular Data, return to the Data Screen page using the backwards arrow on the bottom left hand side of the display and touch the Data Log button to refresh the data. Graphs can also be made utilizing the User Defined Time button on the Data Log page (see Figure 3–9).

Graphs of the following parameters are available:

(1) Current Engineering Unit

(2) Average Total Sulfur, TSR

(3) Oven Temperature, ºC

(4) PMT Voltage, V

(5) PMT Out, mV

(6) Pyrolyzer Temperature, ºC

(7) Lamp Voltage, V

(8) Pressure (Chamber), mmHg

(9) Flow (Chamber), cc/min

(10) Bench Temperature, ºC

(11) Lamp Intensity, (I), V

Parameters and time periods displayed in graphical representations can be configured specific to user requirements by following the path Data-Data Log-Advanced Data Setup.

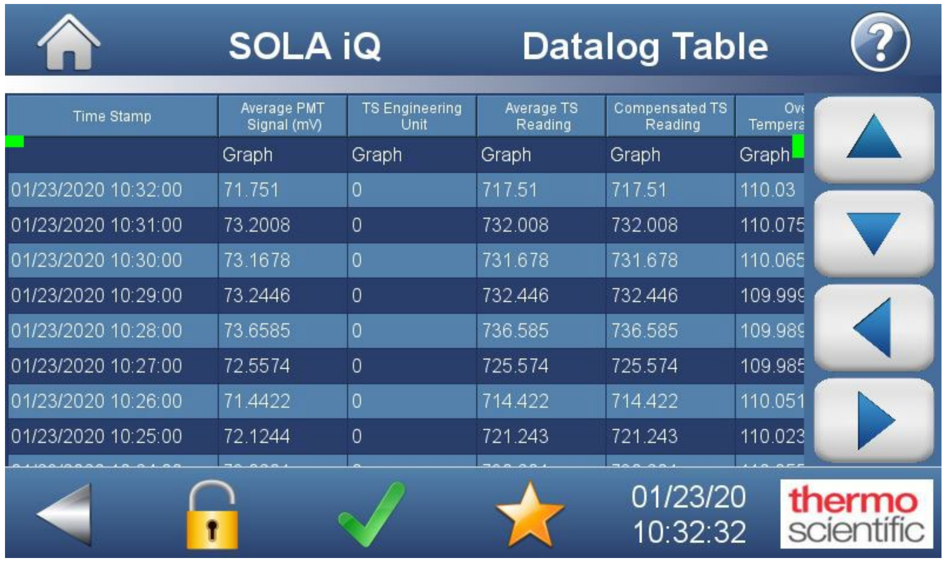


Figure 3–7. Display – Datalog Table

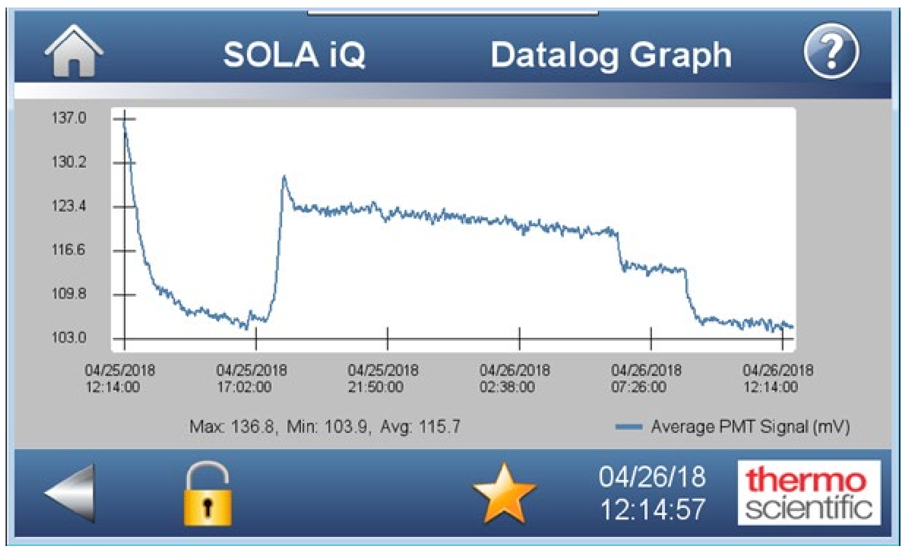


Figure 3–8. Display – Datalog Graph

Figure 3–9. Display – Datalog

9. Calibrate the analyzer according to "Calibration" in Chapter 5. There are two ways to calibrate the SOLA iQ. The first way is to conduct a Full Calibration (see Figure 3-10). During a Full Calibration, the SOLA iQ collects data for the normal analysis period, which is normally 240 seconds, and then assigns the Raw PMT mV value to the appropriate Calibration Standard total sulfur concentration value. The Raw PMT mV value is generated every second and is the average of ten (10) PMT mV readings. If a Cal Hi is being performed the Raw PMT mV value will be assigned to the high (span) concentration value. Similarly, if a Cal Low is being performed the Raw PMT mV value will be assigned to the low concentration value. Typically, the Cal Low is performed by not injecting sample into the analyzer. Accordingly, for no injections the low concentration value is 0. Doing a Full Calibration requires a Purge cycle to displace the sample in the analyzer with the calibration standard. The second way to calibrate the SOLA iQ is to perform an Express Cal (ReCal) (see **Figure 3–11**). When an Express Cal is performed the Raw PMT mV value for the existing analysis period is immediately assigned to the appropriate Calibration Standard total sulfur concentration value. An Express Cal requires that the calibration standard be analyzed by the SOLA iQ and that the analysis has attained a steady state before the Express Cal is initiated.

   Allow ample time for the initial calibration to stabilize. Subsequent calibrations proceed more quickly than the initial calibration.

Figure 3–10. Display – Full Calibration

Figure 3–11. Display – Express Cal (ReCal)

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 Purge Control Unit option is installed, you must follow the instructions included in Chapter 10. ▲

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.

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 (zero) psig. Doing so blocks sample flow to the injection valve and purges sample from the injection valve. The pressure setting on the Injection Purge regulator must be at its specified value (refer to the Calibration Data Sheet) in order for the sample to purge from the analyzer. The purged sample exits the analyzer through the Atmospheric Vent connection on the left hand side of the analyzer. The Atmospheric Vent line must be tubed to a

sample recovery system to prevent the purged sample from escaping into the local atmosphere or falling to the ground.

2. Observe reported sulfur value.

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

Warning The Oven contains surfaces at elevated temperatures. These surfaces must be allowed to cool so that they do not act as an ignition source when the Oven door is opened. The rating purge time requirements are specified on the tag affixed to the analyzer. ▲

Note Sample is purged automatically by 3-way diverter valves when power is removed from the instrument for Liquid and Vapor units. Note that the Flare and CV units are not equipped with a 3-way diverter valve. ▲

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. Refer to the tag on the unit for the required cool down periods.

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

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. ▲

Emergency Shutdown

1. Close the sample supply to the system.

2. Turn off the main power to the system.

Chapter 4
Operation

The Interface

There are two interface methods which allow the user to configure the SOLA iQ analytical system:

1. Front Panel Display

2. AutoCONFIG Software

Warning Do not operate the Front Panel Display and the AutoCONFIG software screens at the same time. Doing so will cause the two systems to become unsynchronized. It can also potentially cause the two systems to lock up. ▲

The Front Panel Display is the interface used for the normal operation of the SOLA iQ. It is physically mounted to the SOLA iQ and can be used in the local environment in which the SOLA iQ is located.

Using the AutoCONFIG software requires a laptop interface. The laptop interface can occur in the local environment of the SOLA iQ but this requires that the area be certified as non-hazardous. Access to the lap top interface connection requires that the door to the Electronics section be opened. Alternatively, the lap top computer can be located in a safe area with the connection to the SOLA iQ being done by a network cable and an IP address.

Using the AutoCONFIG software package as the day-to-day operational interface for the SOLA iQ is not anticipated or recommended. The AutoCONFIG software is a very powerful and flexible tool that can be used to create configurable pages permitting such functions as, but not limited to, viewing and changing the analyzer setup, viewing alarm logs, collecting and downloading historical data, and initiating calibration, A set of specific pages have been pre-configured to perform SOLA iQ related operational and diagnostic functions. The description and use of these pre-configured pages is included in the Users Guide.

The Users Guide does not cover modification of the pre-configured pages or how to create new pages. Users interested in pursuing modification of existing pages and creation of specialized pages are referred to the following documents available for purchase from Thermo Fisher Scientific:

1. Software for AutoEXEC & AutoPILOT PRO Systems Startup Guide P/N 1-0485-068

2. User Configurable Screen Function User Guide P/N 1-0485-070

3. Six-Run Gas Flow Computer & _Remote Telemetry Unit User Guide P/N 1-0500-005

Assistance by Thermo Fisher Scientific with the modification the pre-configured pages and/or creation of specialized configurations is subject to consultation fees. The analyzer utilizes a touch activated Front Panel Display. All day-to-day operational adjustments and alarms are accessible using the touch screen Display. Display menu trees can be found in Appendix B, "Display Menu Map". Details regarding the use of the Front Panel Display are located in Chapter 5, "Configuration".

AutoCONFIG

Seven pre-configured pages have been established for the operation of the SOLA iQ using the AutoCONFIG software program. These pages, in the order they appear as short-cut icons from left to right, are as follows:

1. Analog Output Cal_XX (Figure 4–1)

2. DMC_screen_revXX (Figure 4–2)

3. Flare_Advanced_Params_XX (Figure 4–3)

4. FlowP_screen_revXX (Figure 4–4)

5. SOLA_III_ParamsXX
   a. Configuration (Figure 4–5)
   b. RunScreen (Figure 4–6)
   c. Alarms (Figure 4–7)
   d. Validation (Figure 4–8)
   e. Calibration (Figure 4–9)

6. SOLAIO_XX (Figure 4–10)

7. TemperatureControl_XX (Figure 4–11)

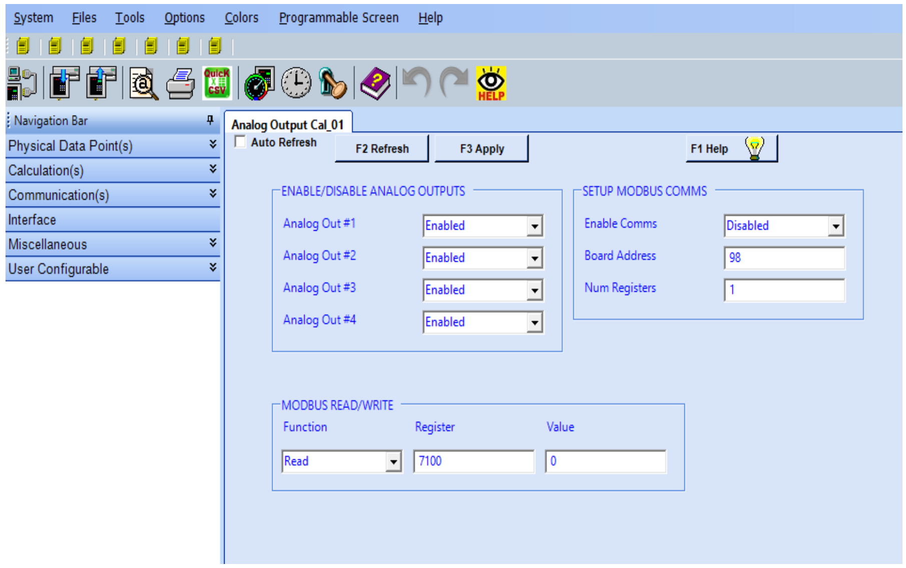


Figure 4–1. Analog Output Cal XX Pre-Configured Screen

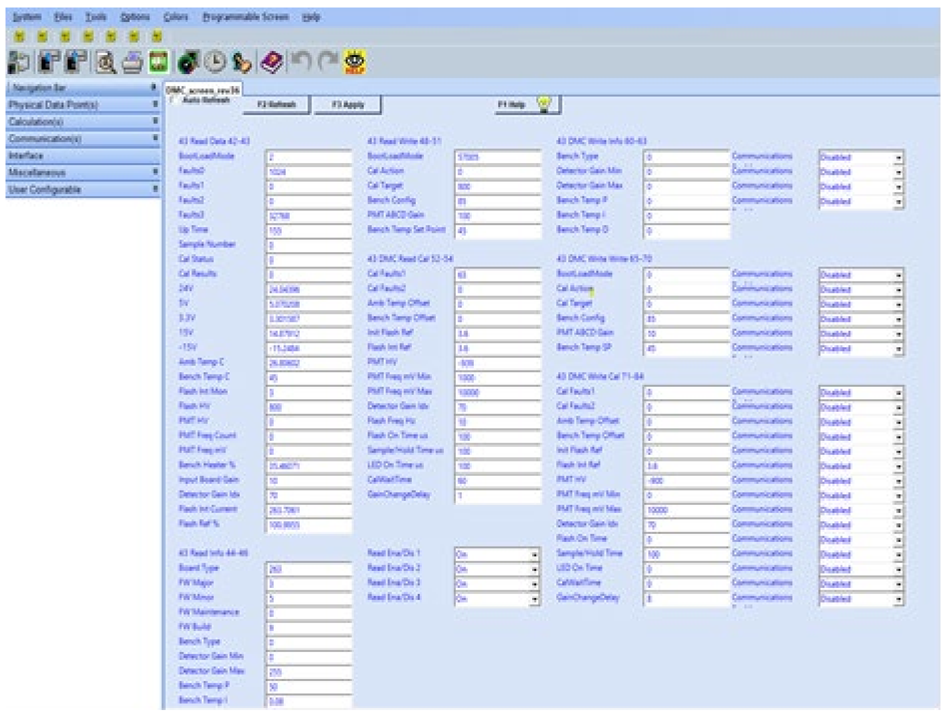


Figure 4–2. DMC screen revXX Pre-Configured Screen

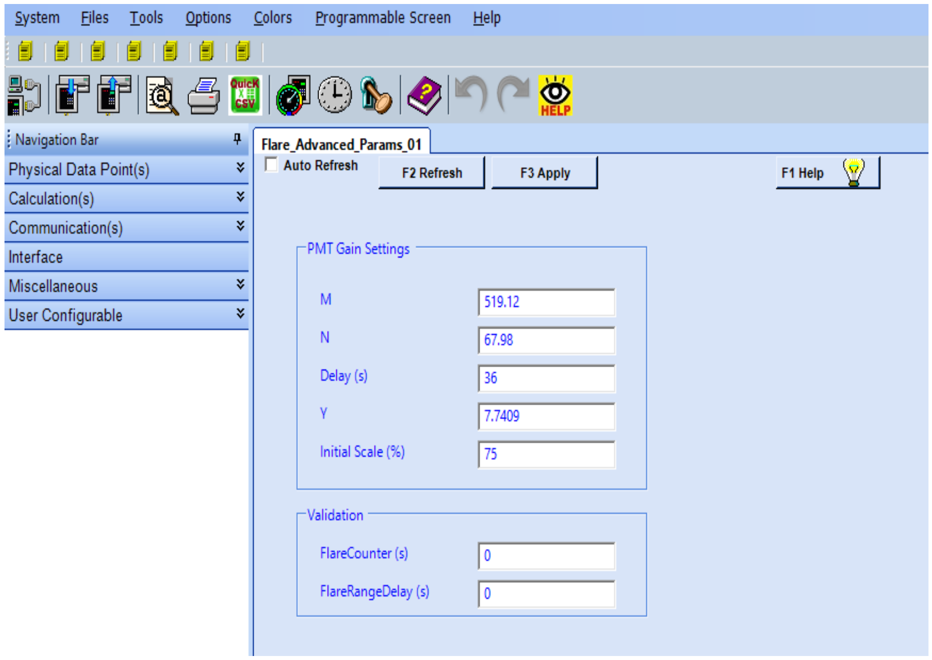


Figure 4–3. Flare Advanced Params XX Pre-Configured Screen

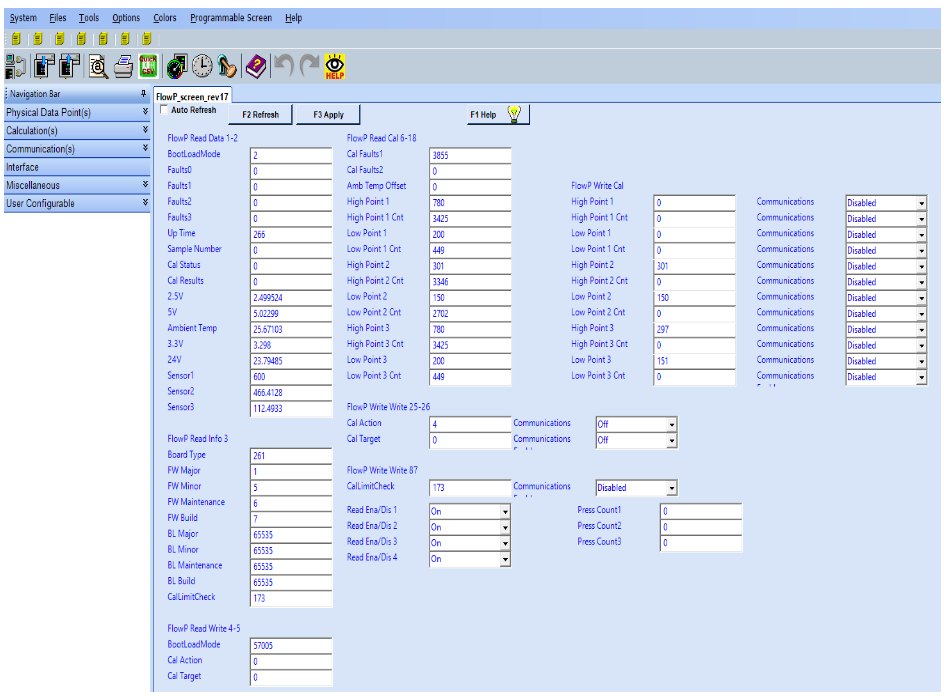


Figure 4–4. FLowP screen revXX Pre-Configured Screen

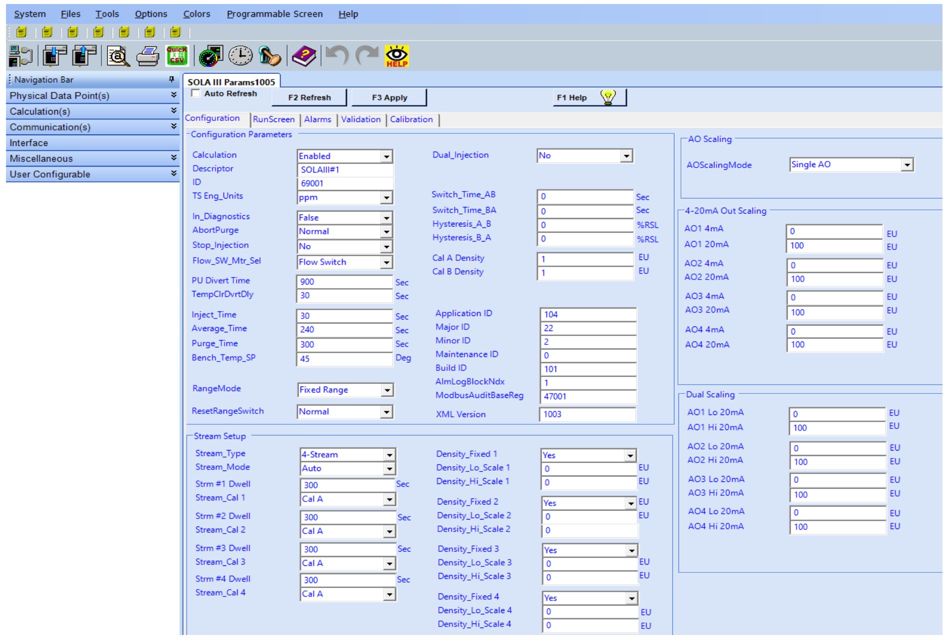


Figure 4–5. SOLA III ParamsXX Configuration Pre-Configured Screen

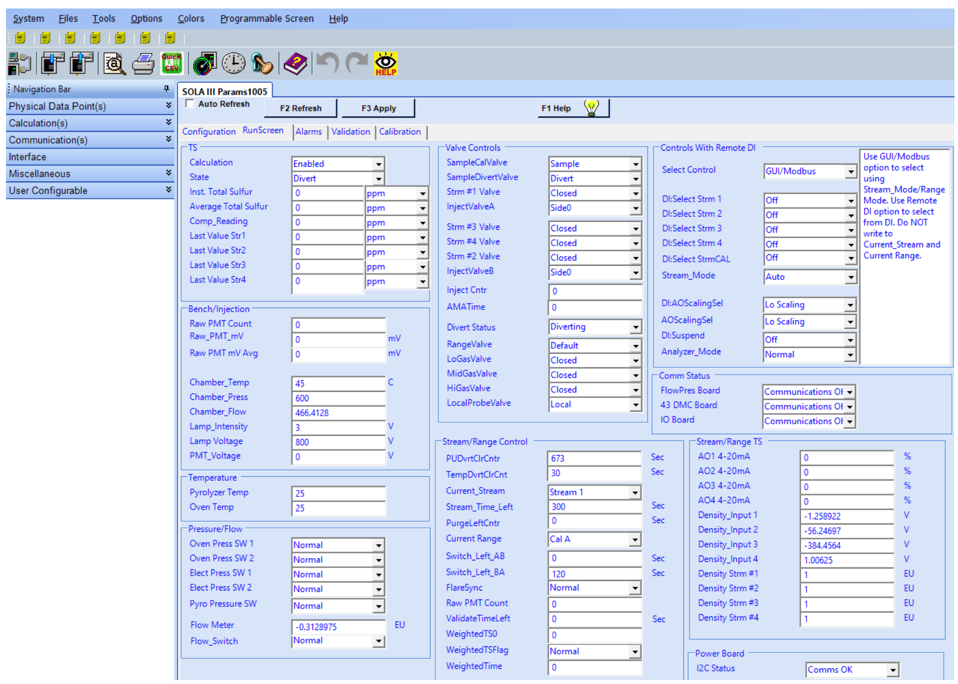


Figure 4–6. SOLA III ParamsXX RunScreen Pre-Configured Screen

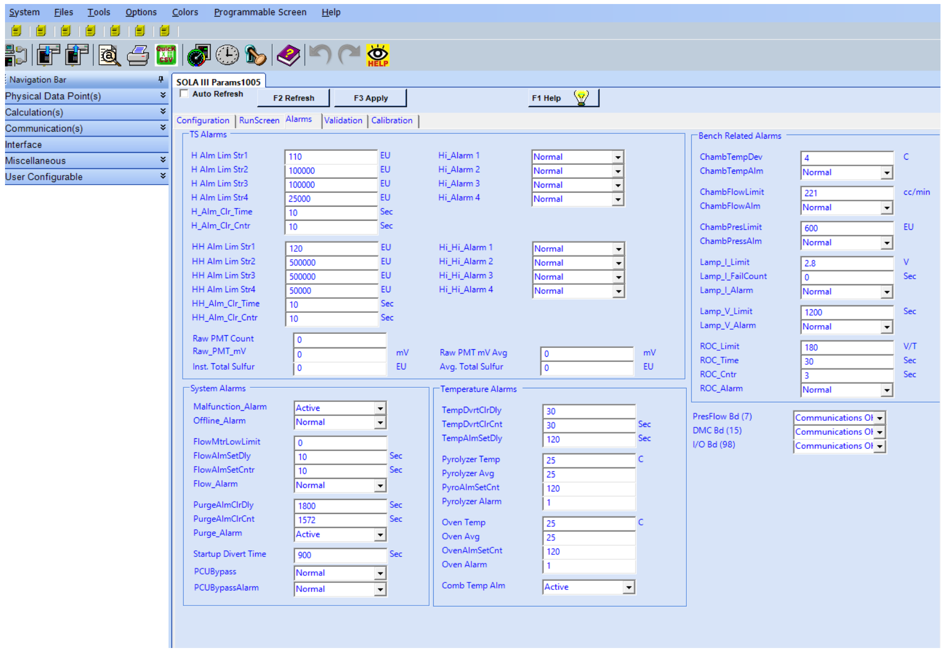


Figure 4–7. SOLA III ParamsXX Alarms Pre-Configured Screen

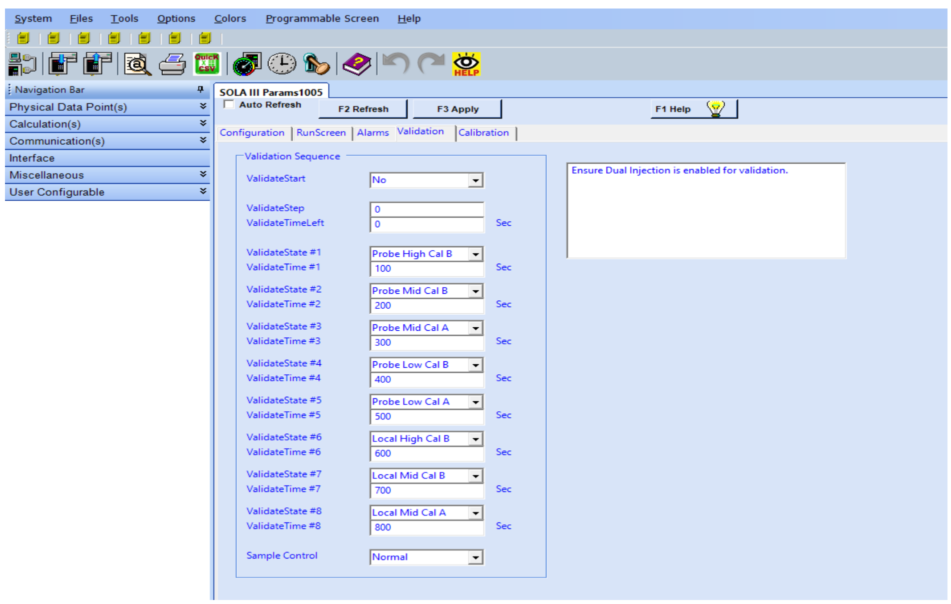


Figure 4–8. SOLA III ParamsXX Validation Pre-Configured Screen

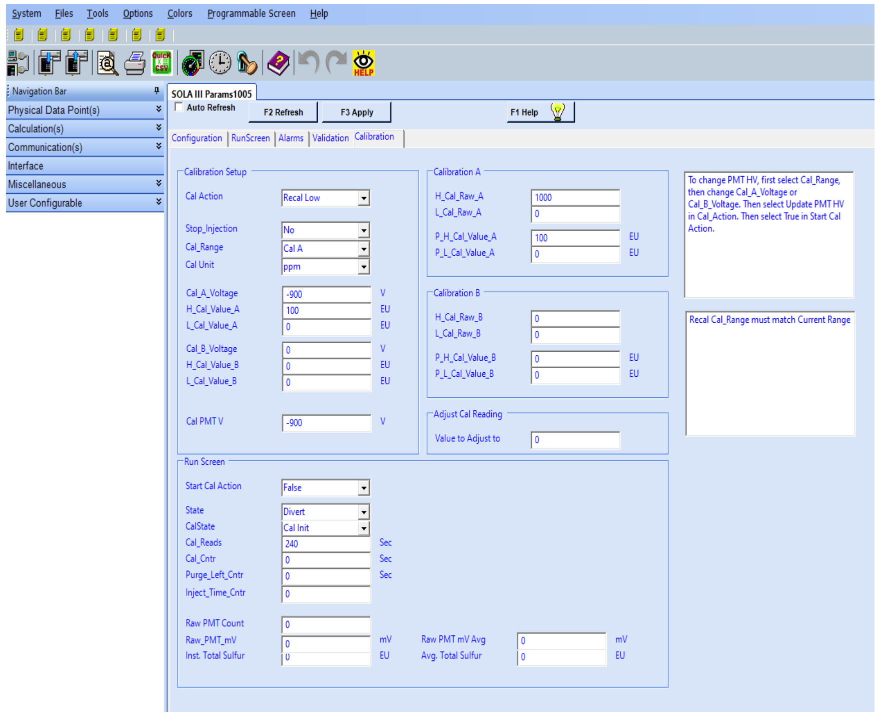


Figure 4–9. SOLA III ParamsXX Calibration Pre-Configured Screen

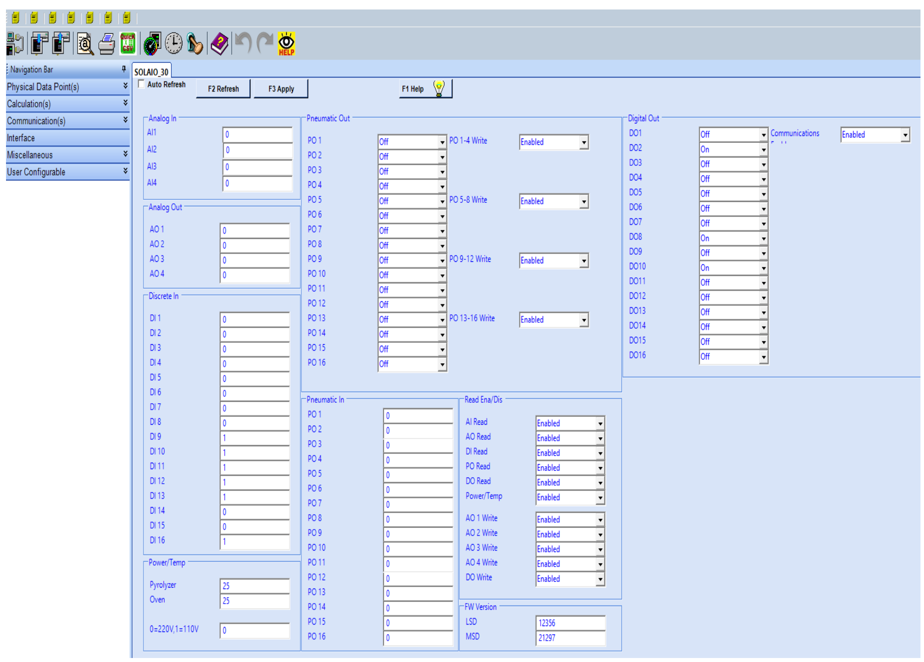


Figure 4–10. SOLAIO XX Pre-Configured Screen

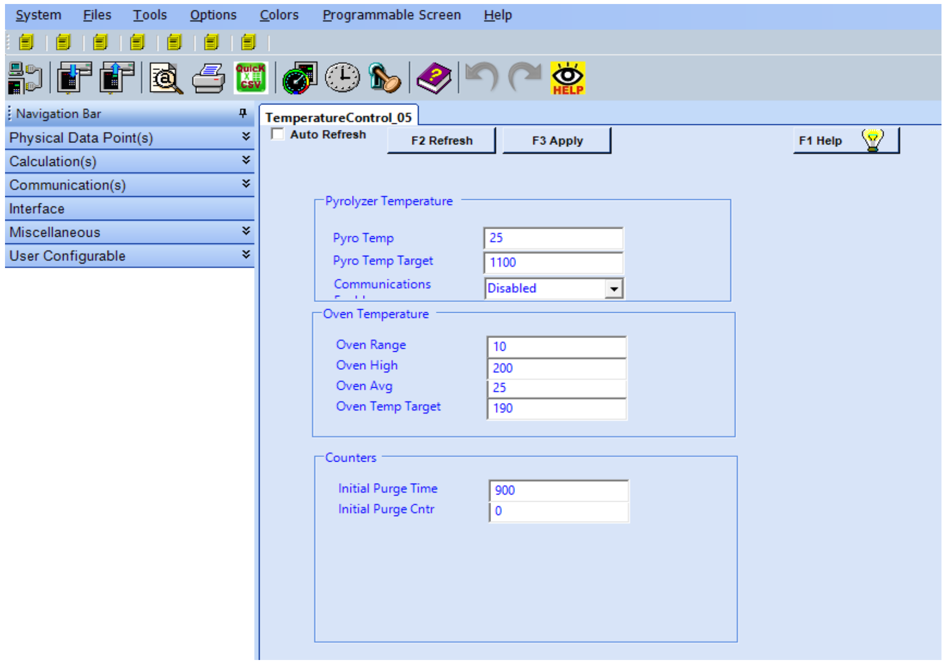


Figure 4–11. TemperatureControl XX Pre-Configured Screen

Shortcuts to the pre-configured pages are located just below the Menu Bar at the top of the laptop display. (See Figure 4–12 and Figure 4–13)

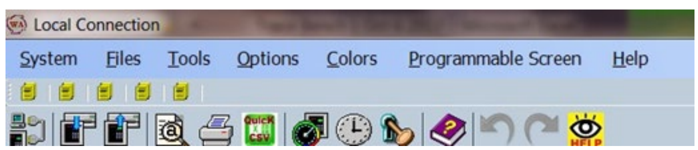


Figure 4–12. Shortcut icons

Figure 4–13. SOLA iQ Pre-configured page tabs (pages opened up in the left to right order of the shortcut icons)

The pre-configured page revision numbers, which are located at the end of the page tab names, are unique to each individual page. The order in which the tab names appear is the order in which the pages are opened up. The appearance order includes the SOLA iQ pre-configured pages as well as other pages of the AutoCONFIG software package.

Parameter value changes are made by typing in the desired new value into the appropriate field and clicking the Apply button. To confirm that the changed value is incorporated into the setup, click the Refresh button to update the page. There is an Auto Refresh option that will update the page being viewed automatically. This option is activated by clicking the box to the left of the Auto Refresh title. Continuously operating in the Auto

Refresh mode is not recommended as this can interfere with the Oven and Pyrolyzer temperature control stability. The Auto Refresh can be used for short term monitoring during transitory operating states. If, while operating with the Auto Refresh option engaged, the Oven and/or Pyrolyzer stability begins to degrade, the SOLA iQ should be immediately be taken out of the Auto Refresh operating mode. Long term monitoring of specific parameters can be achieved using the Historical Average Calculation – History Avg #1 page.

The version of AutoCONFIG in use is determined by clicking the About tab under the Help button on the Menu Bar. (See Figure 4–14)

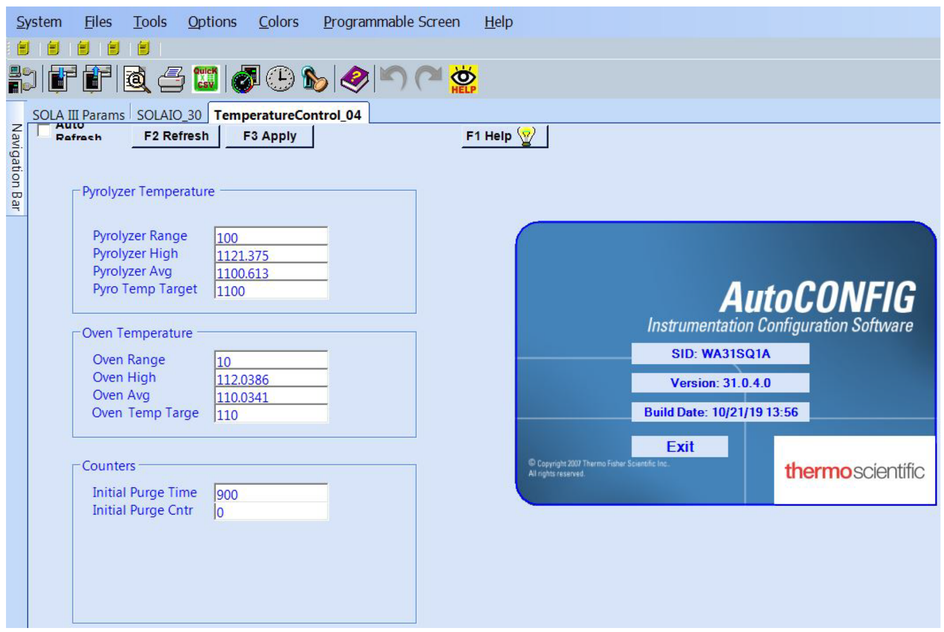


Figure 4–14. AutoCONFIG Version Screen

In addition to the pre-configured SOLA iQ AutoCONFIG page short cuts, one can access the pre-configured pages, as well as other AutoCONFIG functions, using the Navigation Bar. The Navigation Bar is located on the left hand side of each pre-configured page. The five (5) major Navigation Bar categories are as follows: (See Figure 4–15)

1. Physical Data Point(s) (Figure 4–16)

2. Calculation(s) (Figure 4–17)

3. Communication(s) (Figure 4–18)

4. Interface

5. Miscellaneous (Figure 4–19)

6. User Configurable (Figure 4–20)

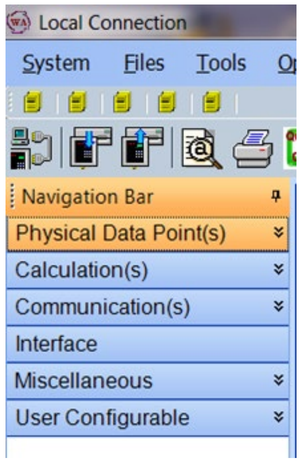


Figure 4–15. Navigation Bar Selections

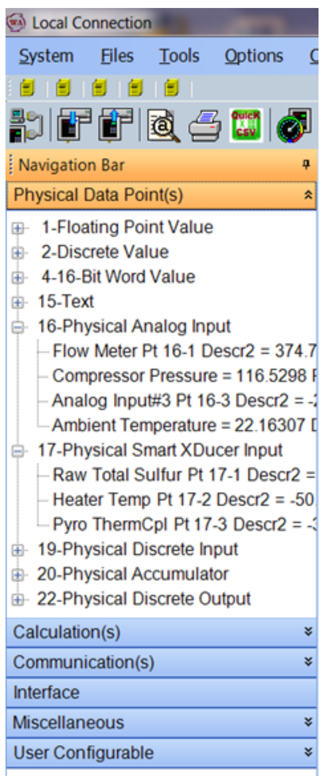


Figure 4–16. Navigation Bar – Physical Data Point(s) Selections

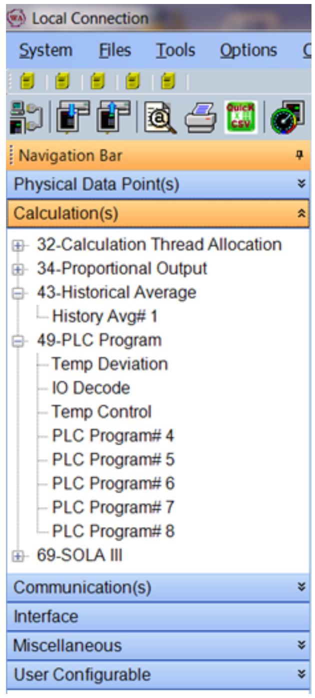


Figure 4–17. Navigation Bar – Calculation(s) Selections

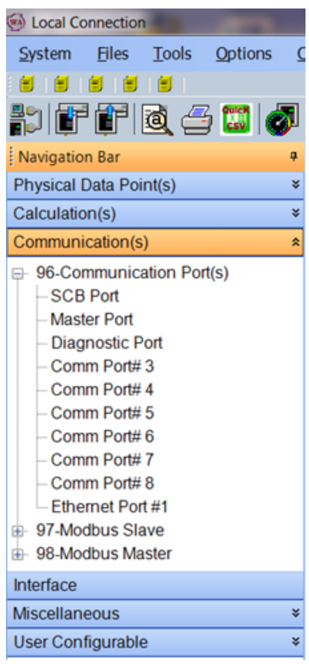


Figure 4–18. Navigation Bar – Communication(s) Selections

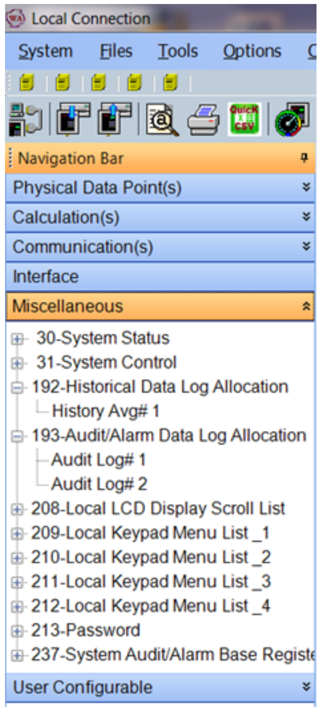


Figure 4–19. Navigation Bar – Miscellaneous Selections

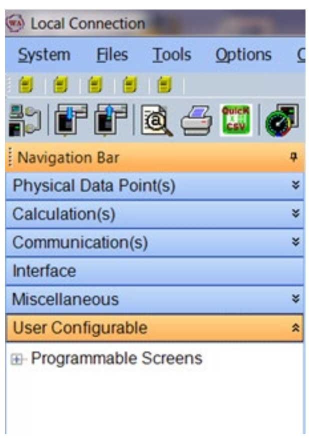


Figure 4–20. Navigation Bar – User Configurable Selections

Monitoring the historical data of the SOLA iQ using the AutoCONFIG Software program is accomplished using the following two AutoCONFIG pages:

1. Historical Average Calculation – History Avg #1

2. Audit/Alarm Data Log – Audit Log #1

Customizable Historical Data reports can be created using the Historical Average Calculation – History Avg #1 page. Access to the Historical Average page is done by opening the Calculation(s) tab in the Navigation

Bar at the left-hand side of the laptop display (see Figure 4–20 and Figure 4–22). Open Table 43-Historical Average tab and click on History AVG #1 to reach the Historical Average Calculation – History Avg #1 page.

The page contains the following three selections: 1) General, 2) Historical Average Calculation and 3) History (see Figure 4–23). The data collection frequency is set on the Record Time Period drop down menu of the General tab. (See Figure 4–21) Data collection periods from 1 second to Daily as well as Continuous are available. Up to twelve (12) data point assignments, called items, can be made on the Historical Average Configuration tab. (See Figure 4–24). The assignment is made by pasting the point into the Historical Point field. Data retrieval is performed on the History tab by clicking on the Retrieve Data button. An example of data retrieval can be seen in Figure 4–25. Data in the retrieval report can be copied and pasted into an Excel spreadsheet. This is accomplished by clicking the far left column at the desired starting point. Clicking will result in the row becoming highlighted. Hold the click down and use the Page Up or Page Down key to highlight the additional data rows of interest.

Repeat use of the Page Up and Page Down keys to highlight all of the desired data. Click Control C to copy the data in the desired cell of the Excel spreadsheet, click Control V to paste the data. Note that there is a limited amount of retrievable records. The more items in the report and the shorter the data collection period (faster frequency of data collection) the shorter the total time span over which data can be retrieved before item values become overwritten.

Each line of the History, identified by an Index number, is a record, R. Each column of the History, except the Date/Time column, contains the historical value of an item, I. The number of columns, except the Date/time column, containing data in the History is the number of items. The product of the number of records times the number of items as a maximum value of 10,800 (R * I = 10,800). If the number of items is 10, then the maximum number of records that can be retrieved before fields become overwritten is 1,080 (1,080 = 10,800/10). The length of time represented by the maximum number of records is determined by the frequency at which the data is collected. If the data collection frequency is one (1) data point per second and the number of items for which data is collected is ten (10), then the length of time covered by the History report is 1,080 seconds (18 minutes). If the data collection frequency is one (1) data point every four (4) minutes, then the period of time covered by the 1,080 records becomes 4320 minutes (72 hours).

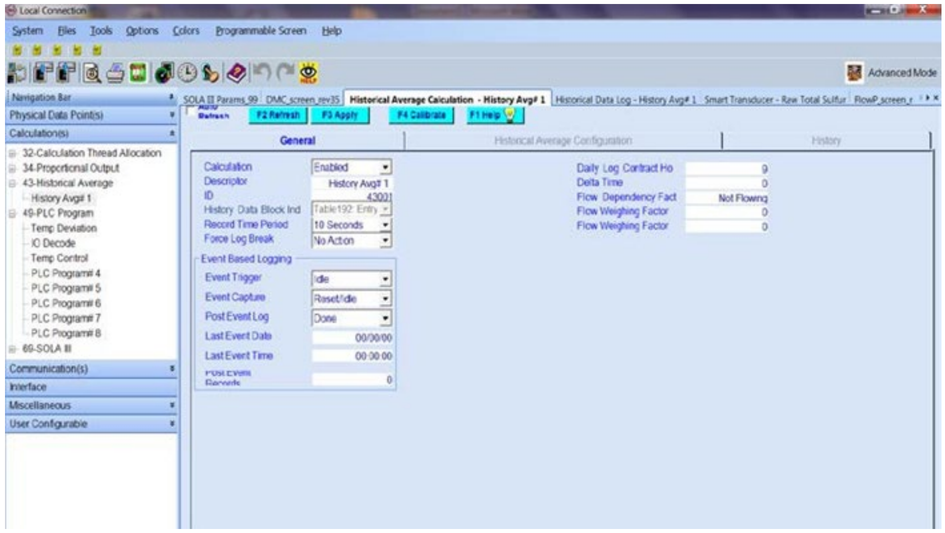


Figure 4–21. Table 43 General tab to set Record Time Period

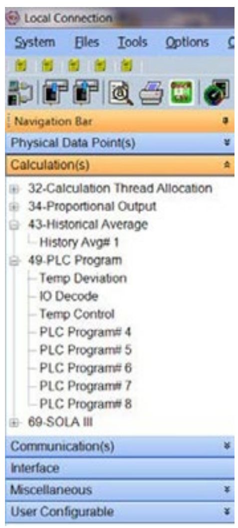


Figure 4–22. Table 43 access

Figure 4–23. Top of Historical Average Page

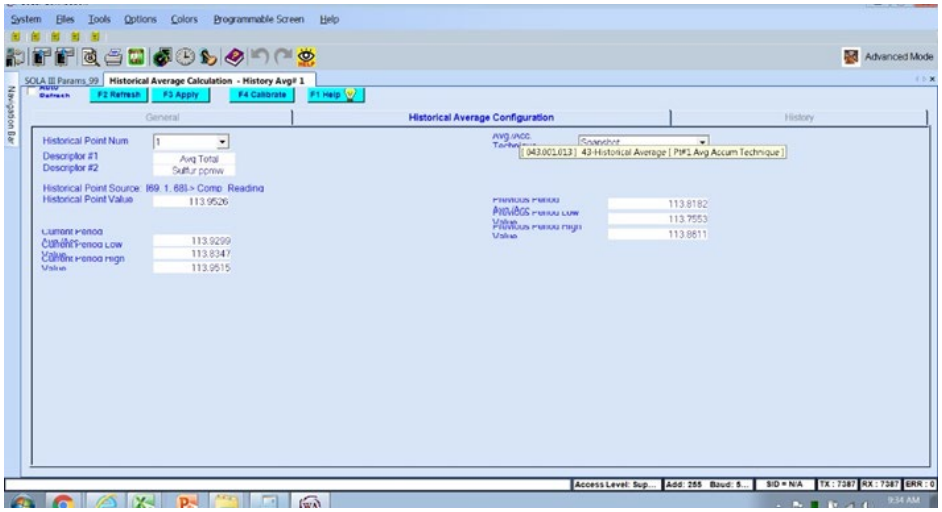


Figure 4–24. Historical Average Configuration Screen of Historical Average Calculation Page

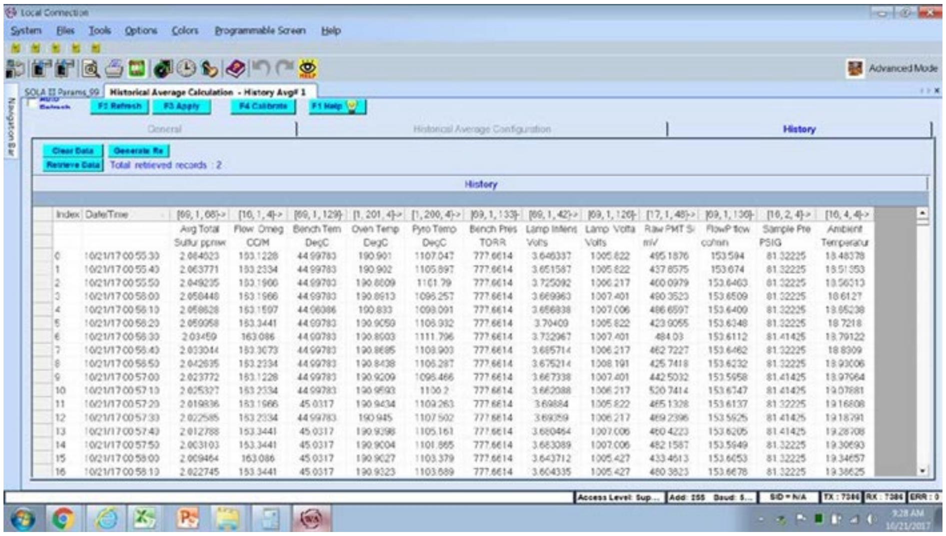


Figure 4–25. History Screen of Historical Average Calculation Page

Pyrolyzer & Oven Temperature Control

Controlling the Pyrolyzer and Oven temperature is independently accomplished by pulsing the power to their respective heater elements. The maximum length of the power pulse can be 100% of 1 second (1000 milliseconds/second) but has been limited to a smaller value. A typical limited maximum is around 80% or about 800 milliseconds/second. The actual length of the power pulse can vary from 0 seconds to the limited maximum and is determined by the Temperature Target (set point), the measured temperature, and the Range. All three of these values have units of temperature. Specifically, for the SOLA iQ the temperature unis are in degrees Celsius, °C.

The Range sets the Top and Bottom temperature values of the control band. The Top temperature value is the Temperature Target value plus

50% of the Range value. The Bottom temperature value is the Temperature Target value minus 50% of the Range value. If the measured temperature exceeds the Top temperature value, then the power pulse duration is 0 seconds. If the measured temperature is below the Bottom temperature value, then the power pulse duration is 1 second, assuming that there is no limited maximum pulse duration.

The length of the pulse duration varies linearly between the Top and Bottom temperature values. When a limited maximum power pulse duration is established, required pulse durations between the limited maximum and the 1 second maximum pulse duration are forced to 0 seconds. When the Pyrolyzer or the Oven achieves steady state operation, the pulse duration is about 200-300 milliseconds.

The Pyrolyzer and the Oven will attain a steady state operating temperature that may be different from the Temperature Target value. Once per hour the SOLA iQ system measures the difference between the actual Pyrolyzer Avg and Oven Avg temperatures and their respective Temperature Target values. This difference can have either a positive value or a negative value. The difference is then added to the appropriate Top temperature value while maintaining the Range value. The result is that new Top and Bottom temperature values are established whose difference is the Range value.

The Pyrolyzer and Oven temperature control values are found on the Temperature Control pre-configured AutoCONFIG screen (see Figure 4–26). Current values of the average Pyrolyzer and Oven temperatures can be read from the Front Panel Display, Data > Pressure, Flow, Temperature, Valves (see Figure 4–27).

Figure 4–26. Pyrolyzer and Oven Temperature Control Page

Figure 4–27. Pyrolyzer and Oven Temperature Display Values

Begin Analyzing

1. If the analyzer is shut down, start up the instrument by following the appropriate set of instructions in Chapter 2.

2. If the system power is off, open the instrument and carrier airflows 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, access the appropriate Front Panel display or the AutoCONFIQ software pages.

Stop Injections

Stopping injections only stops the injection of sample into the SOLA iQ analyzer. All other functions of the SOLA iQ remain active when the injections are stopped. Stopping Injections can be done either from the Front Panel Display or via the AutoCONFIG Software.

Stopping Injections from the Front Panel Display:

1. From the Home page, press the Calibration button.

2. On the Calibration page, press the Stop Injection button.

3. Button turns yellow when injections are stopped.

To restart injections, press the yellow Stop Injection button to return it to its normal blue color.

Stopping Injections from AutoCONFIG:

4. From the SOLA III Params page click on the Configuration tab.

5. On the Calibration tab under Calibration Parameters, access the drop down menu for Stop_Injection.

6. Select Yes from the drop down menu.

7. Click on the F3 Apply button to Stop Injections of the SOLA iQ. Access is obtained by opening the door to the Pneumatics section.

8. To confirm that the proper selection has been made click on the F2 Refresh button and observe the Stop_Injection field setting.

To restart Injections select No from the Stop_Injection drop down menu and click the F3 Apply button.

It is also possible to Stop Injections by reducing the pressure on the Solenoid Air pressure regulator to 0 psig. The Solenoid Air pressure regulator is the bottom regulator when looking at the front of the Pneumatics section.

Note Turning off the Solenoid Air pressure turns off the pressure to the Solenoid Air Manifold. This, in turn, removes air from all of the Pneumatic Outputs (PO). ▲

Note Turning off the Solenoid Air pressure forces the SOLA iQ into the Divert mode of operation. The Divert Valve is a spring return valve that is opened by using the Solenoid Air pressure (see Figure 4-28). ▲

Suspend Mode

In the Suspend mode, all counters in the SOLA iQ system software stop functioning. Additionally, the measurement activity is stopped and the SOLA iQ goes into the Divert mode. In Divert mode, the carrier gas sweeps through the injection valve and the sample flow to the injection valve is blocked. Sample in the injection valve is swept out through the

Atmospheric Vent bulkhead fitting on the left hand side of the SOLA iQ (see Figure 4–30).

The SOLA iQ can be placed in the Suspend mode from the Front Panel Display or via the AutoCONFIG software. Follow these steps to place the SOLA iQ in the Suspend mode:

Suspend mode from the Front Panel Display:

1. From the Home page, press the Settings button.

2. On the Settings page, press the Suspend button to access the Confirmation page.

3. On the Confirmation page, press Suspend.

To take the SOLA iQ out of Suspend, press the Clear Suspend button on the Confirmation page.

Suspend mode from AutoCONFIG:

1. Access the RunScreen from the SOLA iQ Params pre-configured page.

2. Under the Controls with Remote DI section select Suspend from the drop down menu to the right of Analyzer_ Mode.

3. Press F3 Apply button to place the SOLA iQ in Suspend mode.

4. To confirm that the proper selection has been made, click on the F2 Refresh button and observe the Stop_Injection field setting.

To take the SOLA iQ out of the Suspend mode, select Normal from the drop down menu and then press the F3 Apply button.

Injection Valve Failure & Divert

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 Lamp Rate of Change (ROC) alarm and switches the sample diverter valves to flow carrier gas air through the injection valve rather than sample.

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 ROC alarm is typically set to go into an alarm state when a 100 V lamp voltage change in 30 seconds or less occurs. A fast lamp voltage change occurs when there is a combustion problem in the Pyrolyzer. The counter counts down from the ROC Time to zero and then resets to the ROC time and starts counting down all over again.

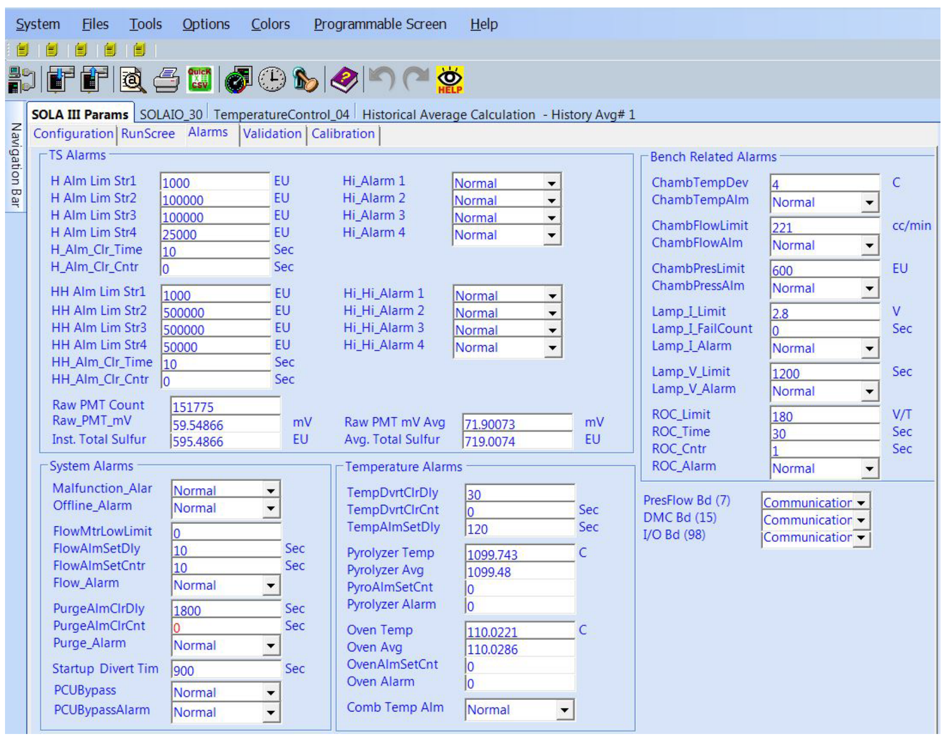


Figure 4–28. Bench Related Alarms - Lamp ROC Parameters (far right column)

In Liquid and Vapor SOLA iQ units, when the ROC or the Chamber Flow alarm activates, a pair of sample diverter valves switches position to allow the flow of carrier air through the injection valve instead of sample. (See Figure 4–29 and Figure 4–30) This prevents excess sample and incomplete combustion products from further contaminating the system. Note that the Flare and CV units do not have a Diverter Valve. The diverter valves switch carrier gas to the injection valve under the following conditions:

- Suspend
- Chamber Flow Alarm (lower limit)

- Lamp Rate of Change (ROC) Alarm
- Oven Temperature Alarm
- Pyrolyzer Temperature Alarm
- Purge Alarm

Figure 4–29. Sample diverter valves

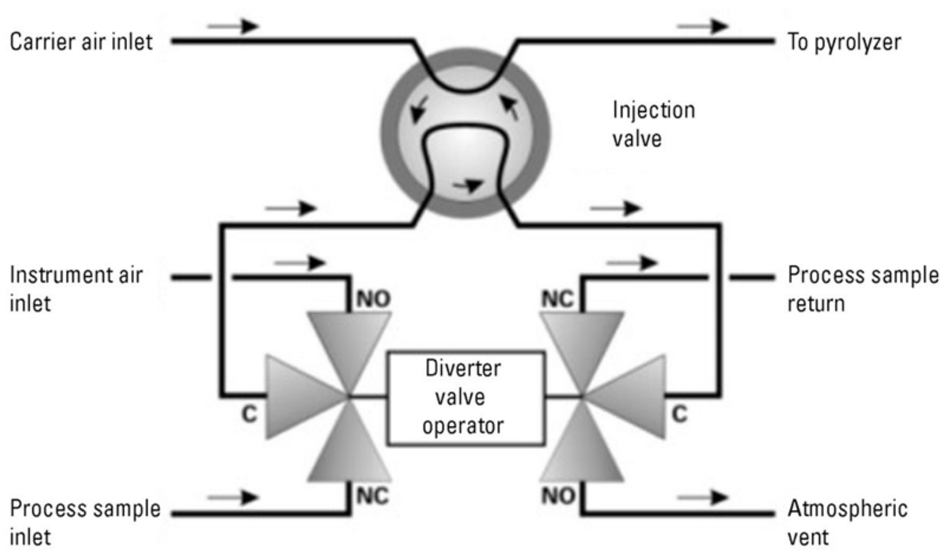


Figure 4–30. Sample diverter valves functional diagram (Instrument air inlet is Carrier gas)

Flow Pressure Board Calibration

The SOLA iQ Flow Pressure board contains a differential pressure sensor that is used to measure the pressure drop across a capillary tube. The capillary tube is located downstream of the SO_2 spectrometer (bench) and is used to measure the flow of gasses through the bench (Chamber Flow). The differential sensor is calibrated as part of the factory calibration. The differential sensor can be recalibrated in situ using the AutoCONFIG software should the need arise, such as replacing the capillary tube. Because the differential sensor calibration involves using different airflow rates, the in situ calibration must be done when the SOLA iQ is in the Stop Injection mode of operation.

The Flow pressure board differential pressure sensor calibration is a linear calibration performed using two different flow rate settings. Because the flow rate through a capillary tube is a non-linear function of the supply pressure, the two flow rate settings need to bracket the normal Chamber Flow rate. Additionally, if the flow rates chosen for calibrating the differential sensor are reasonably close to the normal Chamber Flow rate then the linear calibration approximation provides a reasonable representation of the actual flow in the Chamber. The bracketed flow rates should be around 50 cm3/min above and below the normal Chamber Flow rate.

Note that the Chamber Flow rate value information is used to ascertain the Chamber Flow rate stability and, in the event of a drop in Chamber Flow, place the SOLA iQ in Divert mode. The typical low flow set point is about 25 cm3/min below the normal Chamber Flow rate. The normal Chamber Flow rate is determined during the factory calibration of the SOLA iQ and is set based on the appropriate Carrier Gas flow rates for the application. A drop in the Chamber Flow rate can lead to undesirable carbon formation in the Pyrolyzer.

For an in situ calibration of the Flow Pressure board, the following system requirements and equipment apply:

1. A SOLA iQ equipped with a Flow Pressure board P/N 117612-00 programmed with firmware version 1.5.6.7 and above.

2. A tubed capillary assembly with capillary tube mounted on the side of the SO_2 spectrometer.

3. An airflow source. This can be the carrier gas since the SOLA iQ must be in the Stop Injection mode of operation.

4. A host laptop computer running Microsoft Windows.

5. The AutoCONFIG executable file installed on the laptop computer connected to and communicating with the SOLA iQ.

6. The associated AutoCONFIG configuration files and user pre-configured screens installed.

7. An operational familiarity with the AutoCONFIG software.

8. An appropriate calibrated flow measurement device.

Follow these steps to determine if Calibration Procedure Part A or Calibration Procedure Part B is to be performed.

1. Open the AutoCONFIG software program to the SOLA iQ FlowP_screen_rev17 or higher.

2. Under Flow Read Info 3 in the left hand column observe the value of the CalLimitCheck field. If the value is 250, use Calibration Procedure Part A. If the value is 173, use Calibration Procedure Part B.

Calibration Procedure Part A

1. From the Navigation bar on the left hand side of the AutoCONFIG screen, click on Communications.

2. Click on 98-Modbus Master

3. Scroll down to Entry#88 and double click on it to open it up

4. For the Master Comm field, select Enabled from the drop down menu

5. Click on the F3 Apply button

6. For the Master Comm field select Disabled

7. Click on the F3 Apply button

8. On the FlowP_screen_17 screen, enter the value 173 in the field to the right of CalLimitCheck of the FlowP Write Write 87 section

9. Click on the F3 Apply button

10. Select Enabled in the Communications field to the right of the CalLimitCheck field

11. Click on the F3 Apply button

12. In the FlowP Read Info 3 section, confirm that the field to the right of CalLimitCheck reads 173

13. If 173 is shown in the CalLimitCheck field of the FlowP Read Info 3 section, then the change was successful. Change the Communications field to right of the CalLimitField to Disabled and click on the F3 Apply button.

14. Proceed to Calibration procedure Part B

15. If 173 does not appear, repeat the procedure from step 1

Calibration Procedure Part B

Flow should be calibrated when the SOLA iQ is at steady state running temperature. Start with recommended pressure settings on the factory calibration data sheet.

Warning Make sure sample is diverted before starting this test! If possible, purge sample lines with nitrogen after sample is diverted. Follow all standard industrial safety practices and any site-specific requirements while performing this test! ▲

1. Establish a steady Low flow around 100-150 ml/min through the spectrometer

2. In the FlowP_screen_17 screen under the FlowP Write Cal section, change the value of the field Low Point 2 to match the flow reading obtained from an external flow meter

3. Click on the F3 Apply button

4. To the right of the Low Point 2 field, select Enabled in the Communications field

5. Click on the F3 Apply button

6. Confirm that the value in the Low Point 2 field under the FlowP Read Cal 6-18 section matches the input flow value. If the value matches, then the write has been successful

7. Select Disabled in the Communications field to the right of the Low Point 2 field

8. Click on the F3 Apply button

9. Observe the Sensor 2 reading under the FlowP Read Data 1-2 section for 3 minutes or until the reading is stable by clicking on the F2 Refresh button periodically

10. In the FlowP Write Write 25-26 section change the value in the Cal Action field to 5

11. Click on the F3 Apply button

12. Select On in the Communications field to the right of the Cal Action field

13. Click on the F3 Apply button

14. Observe the value in the Sensor 2 reading under the FlowP Read Data 1-2 section. If the value in this field is within 10 ml/min of the measured PUVF Vent Flow, then the write was successful. Click F2 Refresh or select Auto Refresh to see new value.

15. Select Off in the Communications field to the right of the Cal Action field

16. Click the F3 Apply button

17. This concludes the low calibration point

18. Change the flow rate through the spectrometer until the external flow meter reads 250-300 ml/min

19. In the FlowP_screen_17 screen under the FlowP Write Cal section, change the value of the field High Point 2 to match the flow reading obtained from an external flow meter

20. Click on the F3 Apply button

21. To the right of the High Point 2 field, select Enabled in the Communications field

22. Click on the F3 Apply button

23. Confirm that the value in the High Point 2 field under the FlowP Read Cal 6-18 section matches the inputted flow value. If the value matches, then the write has been successful

24. Select Disabled in the Communications field to the right of the High Point 2 field

25. Click on the F3 Apply button

26. Observe the Sensor 2 reading under the FlowP Read Data 1-2 section for 3 minutes or until the reading is stable by clicking on the F2 Refresh button periodically

27. In the FlowP Write Write 25-26 section change the value in the Cal Action field to 4

28. Click on the F3 Apply button

29. Select On in the Communications field to the right of the Cal Action field

30. Click on the F3 Apply button

31. Observe the value in the Sensor 2 reading under the FlowP Read Data 1-2 section. If the value in this field is within 10 ml/min of the measured PUVF Vent Flow, then the write was successful. Click F2 Refresh or select Auto Refresh to see new value.

32. Select Off in the Communications field to the right of the Cal Action field

33. Click the F3 Apply button

34. This concludes the high calibration point.

Return unit to recommended pressure settings on factory calibration specification sheet. If measured flow is more than 10 ml/min different from factory calibration specification with the recommended pressure settings, make a note of the new flow measurement reading and contact your Thermo Fisher Scientific representative to see if additional action is required.

Warning Follow standard industrial safety practice and site-specific requirements to return the unit to operation. ▲

Chapter 5
Configuration

There are two ways to configure the SOLA iQ: 1) using the Display and 2) using the AutoCONFIG software. The home page of the Display provides access to the following: 1) Calibration menu, 2) Data menu, 3) Settings menu, 4) Access Levels menu, 5) Alarms page, and 6) Favorites page (See Figure 5–1). The Calibration, Data, and Settings menus are accessed using the buttons on the left hand side of the Display. The Access Levels menu as well as the Alarms and Favorites pages are accessed using the icons, from left to right, along the bottom of the Display.

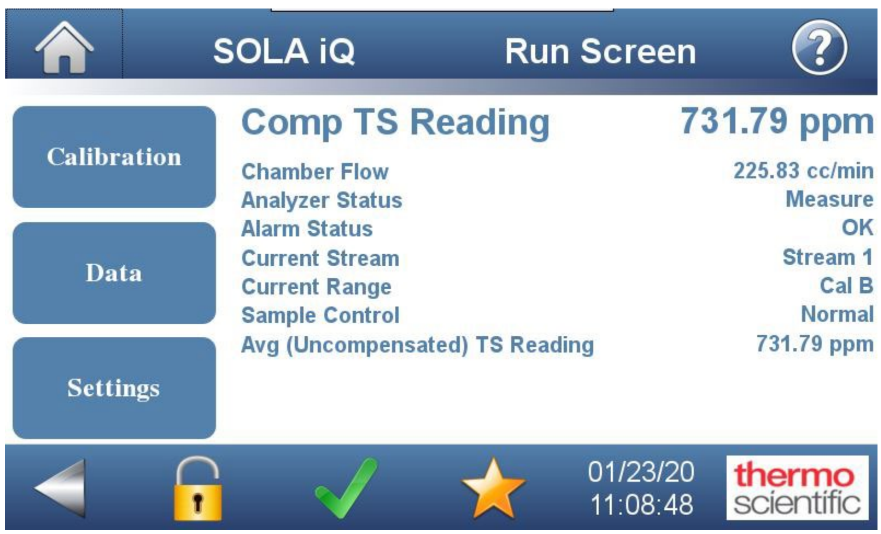


Figure 5–1. Display home page configuration menu

Analyzer Setup

1. Access the submenus from the Display home page by pressing the appropriate button or icon.

Figure 5–2. Display Access Levels Page

2. The Access Levels (Figure 5–2) page can be reached by touching the Padlock icon at the bottom of the Display. Passwords for Standard Access and Advanced Access can be changed from this page. Change the passcode to prevent unauthorized access to the menus.

   The default instrument password format is an alternating combination of instrument serial number and installed firmware build number. For example if your instrument serial number is 123456789 and the instrument firmware version is 1.6.10.ABCDE where the last five digits are the build number, then the default instrument password number will be 1A2B3C4D5E6789. Instrument password is recorded on the test certificate provided by the factory. The SCB Firmware version and Instrument Serial Number can be found on the Factory Settings Screen (Settings>Instrument Settings>Factory Settings).

   If you are upgrading your instrument to the security enhanced firmware, the instrument password will be left blank after the upgrade. When you execute the Change Instrument Password function in the GUI security access levels menu, the instrument will prompt for the current instrument password. If there is no current instrument password, continue through that GUI page to set your personalized instrument password.

   To change the Instrument Password perform the following steps using the graphical user interface only (do not use an external USB keyboard):

a. Enter the Current Instrument Password and then press Continue. If there is no Current Password then press Continue.

b. Enter the New Instrument Password and then press Continue.

c. Confirm the New Instrument Password.

d. Commit the New Instrument Password Change. An Automatic Instrument Reboot will be initiated when password is changed.

e. Press YES to proceed. If NO is pressed, it will go back to the Security Access Levels screen and you'll need to start the password process from the scratch again.

If you encounter any issue when upgrading the firmware or resetting your password, please contact Technical Support.

Note To clear the Instrument Password, follow the steps above using blank values for the New Password. ▲

3. Return to the Display home page by touching the reverse arrow located in the bottom left hand corner of the Display. Alternatively, one can press the house icon at the top left hand corner of the Display to return to the Home page.

Figure 5–3. Display Alarms page

4. Press the icon to the right of the Padlock icon to reach the Alarms page. (See Figure 5–3) This icon is either a green checkmark if there are no alarm conditions of a red triangle bordering an exclamation mark (!) on a white background if an alarm condition exists. The Alarms page indicates the Current Value, Status, Lower Limit, Upper Limit and Deviation for the various alarms listed in the column entitled Alarm

Name. The available alarms are Communication Alarm, Bench Temperature, Bench Pressure Sensor, Bench DP Pressure Sensor, Lamp Intensity, Lamp Voltage, Lamp ROC, Purge Alarm, Pyrolyzer Alarm, Oven Alarm, Flow Pressure Comm alarm, 43 DMC Comm Alarm, and IO Comm Alarm. The Lower Limit, Upper Limit, and Deviation values can be changed by touching the box containing the displayed value. (See Figure 5–4) Type in the new value. The top button on the right hand side of the screen is a backspace button. The second button from the top is an erase button that clears the entry field when used. Touch the return button, bottom button on right hand side, to change the value. The button above the return button returns the user to the Alarms page without making any changes.

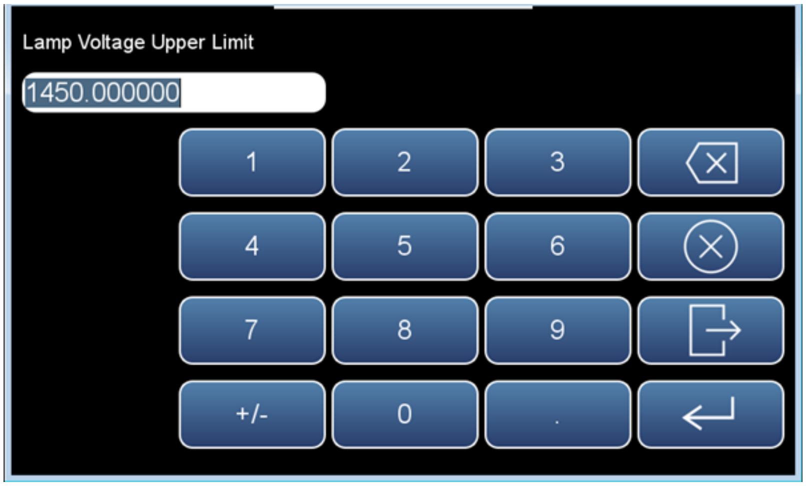


Figure 5–4. Display Alarm Set Point Change Screen

Figure 5–5. Display Figure Favorites Page

5. The Favorites Page (Figure 5–5) allows the user to create shortcuts to frequently used Display features without having to use the menu tree. It is accessed by touching the Star icon on the bottom line of the

Display. Up to nine (9) favorites can be saved on this page. Adding an entry to the Favorites page requires the identification of the button to be added. For example, to add the Adjust Reading button to the Favorites Page first navigate to the Calibration Page (Home > Calibration). The Adjust Reading button is the second button in the first column. Touch and hold the Adjust Reading button. In about 10 seconds, the display will automatically change to the Favorites page. After the page change has occurred, touch the destination box on the Favorites Page to create the link. The destination box will now indicate the words Adjust Reading within the borders of the box.

Validation Setup

Validation Setup can be performed using the Front Panel Display or the AutoCONFIG software.

From the Front Panel Display, press the Settings button (see Figure 5–6). Access the Validation Setup screens by pressing the Validation button on the Settings screen (see Figure 5–6 and Figure 5–7).

Figure 5–6. Settings Screen

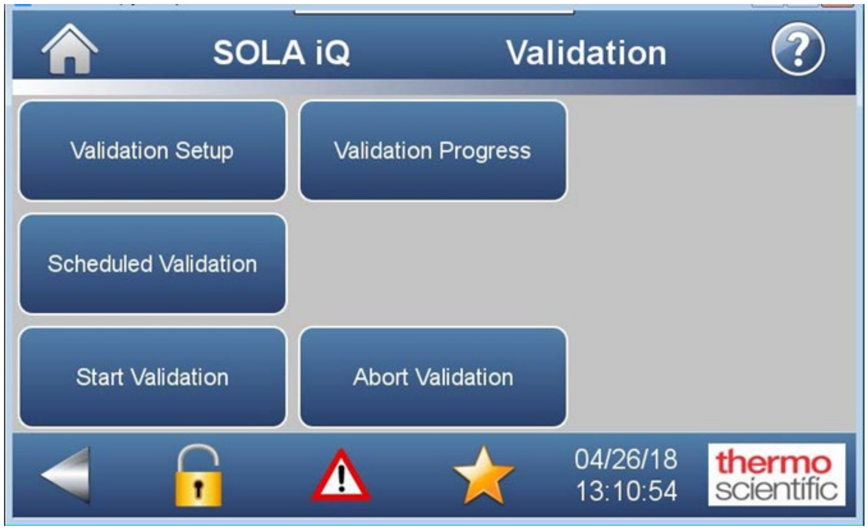
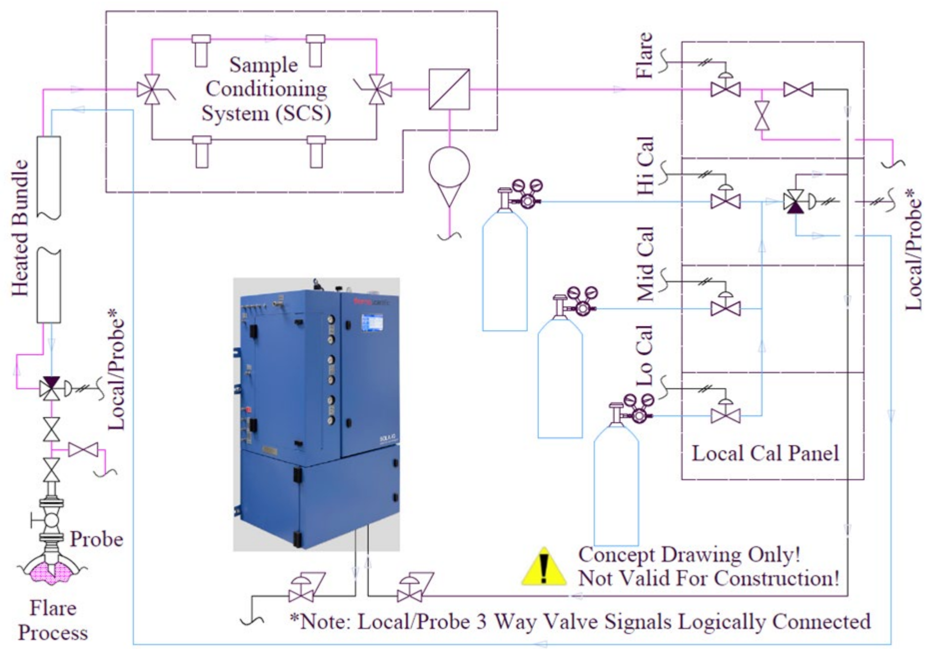


Figure 5–7. Validation Page

Flare Sampling Concept: Not shown in the drawing below is a nitrogen purge system which is required for safety when sampling toxic gas. The nitrogen purge must clean out any toxic gas in the plumbing before opening connections for maintenance.



During normal operation, the Probe samples the Flare Process and flows the sample through a heated bundle to the analyzer sample conditioning system. The sample next flows through filters and valves and a forward pressure regulator to the injection valve inside the oven of the SOLA iQ. The sample then flows through the injection valve and out through the back pressure regulator.

During validation, the system can flow test gas either directly from the gas cylinders to the SOLA iQ (Local) or indirectly from the cylinders down to the Probe and back, following the same path a Flare Process sample would take.

When validation is disabled, the SOLA iQ is in normal operation measuring the Flare Process with Auto Range enabled.

There are five (5) pneumatic valve controls available for measurement, calibration and validation. The valves actuate according to the table below depending on the validation/measurement state:

	Pneumatic Signal					Calibration
Validation State	**Flare**	**Local/Probe**	**Lo Cal**	**Mid Cal**	**Hi Cal**	**Range**
Local Low Cal A		Local	X			A
Local Low Cal B		Local	X			B
Local Mid Cal A		Local		X		A
Local Mid Cal B		Local		X		B
Local High Cal B		Local			X	B
Probe Low Cal A	X	Probe	X			A
Probe Low Cal B	X	Probe	X			B
Probe Mid Cal A	X	Probe		X		A
Probe Mid Cal B	X	Probe		X		B
Probe High Cal B	X	Probe			X	B
Disabled	X	Local				Auto Range

The following functions are available on the Validation Page:

1. Validation Setup (for Flare Unit)
   a. Up to eight (8) validation steps can be defined

2. Scheduled Validation (for single stream validation)
   a. Enable/Disable stream validation (stream 1,2,3, or 4), define start time, duration and time interval between validations.

3. Validation Progress

a. View the validation step, the amount of time remaining in the step, and the average total sulfur reading

4. Start Validation

5. Abort Validation

The Validation Setup is typically used in SOLA iQ Flare applications. Each state can be set up for a specific local or probe calibration, high, low or mid plus Cal A and Cal B (see Figure 5–8). The state selection is identified by the yellow field color.

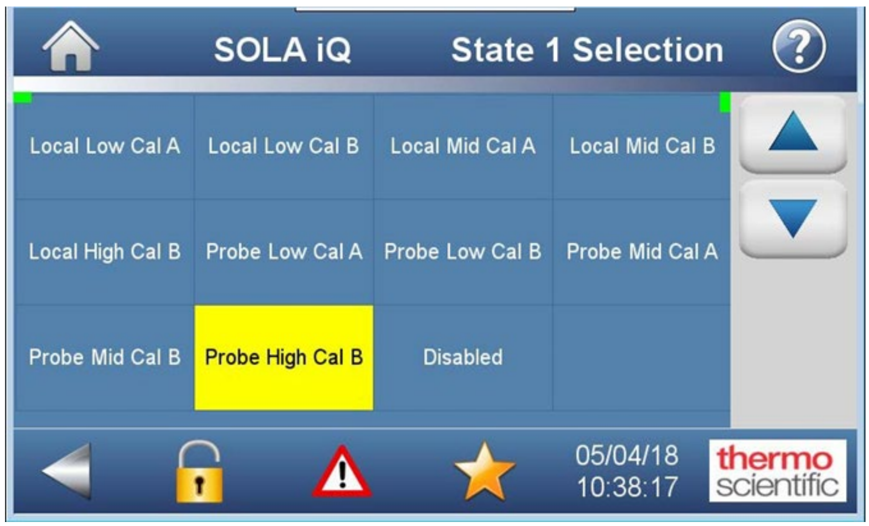


Figure 5–8. State Selection page

Scheduled Validation is applicable to a particular stream (see Figure 5–9). The SOLA iQ can monitor up to four streams. These applications are typically Flare Units since a Flare Unit is normally a single stream analyzer. Multiple stream systems include applications such as the inlet and outlet of a reactor or absorption bed.

Figure 5–9. Validation Schedule page

Validation stream values available are 0, 1, 2, 3 and 4. Zero disables the Scheduled Validation function. The values 1, 2, 3 and 4 are the various sample streams. The Validation Schedule for each stream can be individually disabled/enabled. The Period defines the interval between validation in units of hours. The maximum Period is 999 hours. The Duration defines the time allotted to flowing validation sample to the SOLA iQ in units of minutes. The maximum Duration is 99 minutes. The start time defines when the Scheduled Validation begins.

The date and time, based on a 24 clock, are entered using the buttons on the Calibration Menu (see Figure 5–10). Entered values are retained by pressing the Save button. The Save button field color changes to yellow during the save operation. Once the save operation is completed, the button returns to its normal blue color.

Figure 5–10. Calibration Menu

Use the Validation Sequence block of the Validation screen of Sola iQ_Params preconfigured AutoCONFIG page (see Figure 5–11) to setup the Validation cycle. Up to eleven (11) validation steps are available. The Validation sequence is initiated by selecting Yes from the ValidateStart drop down menu and clicking on the Apply button at the top of the screen. The next two fields in the block identify which Validation step is active and how much time is left to complete the step.

The following states are available for each step in the Validation sequence:

1. Disable
2. Local Low Cal A
3. Local Low Cal B
4. Local Mid Cal A
5. Local Mid Cal B
6. Local High Cal B
7. Probe Low Cal A
8. Probe Low Cal B

9. Probe Mid Cal A

10. Probe Mid Cal B

11. Probe High Cal B

After the state for each validation step is selected from the individual drop down menus, the time associated with each step is entered into the Validate Time field. After all the states and times have been selected and entered, the validation sequence is saved by clicking on the Apply button at the top of the screen. Once this is done, clicking on the Refresh button will confirm that the desired states and times are shown on the screen. When setting up the validation sequence the ValidateStart drop down menu must show No. If Yes is in the drop down menu the system will initiate the Validation cycle when the Apply button is clicked.

The following choices are available for the Sample Control drop down menu:

1. Normal

2. Local Low Gas Cal A

3. Local Low Gas Cal B

4. Local Mid Gas Cal A

5. Local Mid Gas Cal B

6. Local Hi Gas Cal B

7. Probe Low Gas Cal A

8. Probe Low Gas Cal B

9. Probe Mid Gas Cal A

10. Probe Mid Gas Cal B

11. Probe Hi Gas Cal B

After making the desired Sample Control selection, click on the Apply button to accept the choice. Click next on the Refresh button to confirm the selection has, in fact, been made.

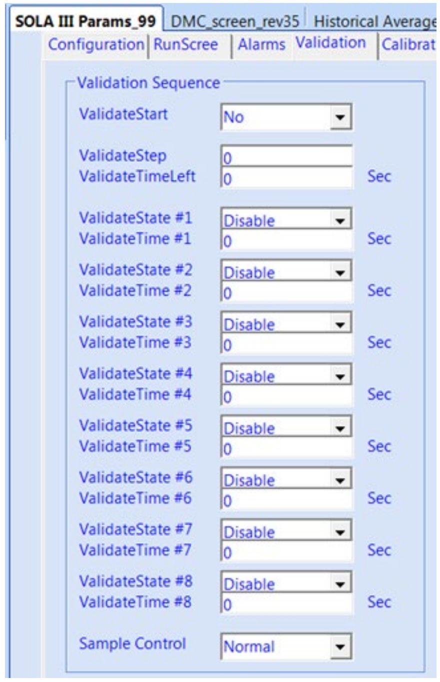


Figure 5–11. Validation Setup Screen

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.

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).

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. You can 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).

4. 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.

Clock Setup

1. Access the Clock setup menu to change the time and date. The Clock setup is accessed from the Home Page>Settings>Instrument Settings Path (see Figure 5–12).

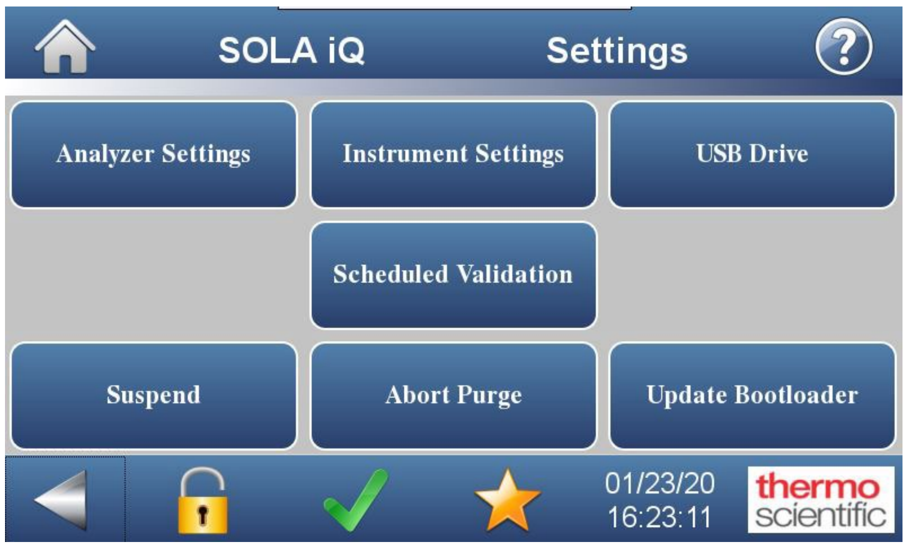


Figure 5–12. Settings menu

Figure 5–13. Clock button access via the Instrument Settings menu

2. Enter the time in date and time using the month, day, year, hours, minutes, and seconds buttons of the Date and Time screen (see Figure 5–13 and Figure 5–14).

Figure 5–14. Date and Time submenu of Clock menu

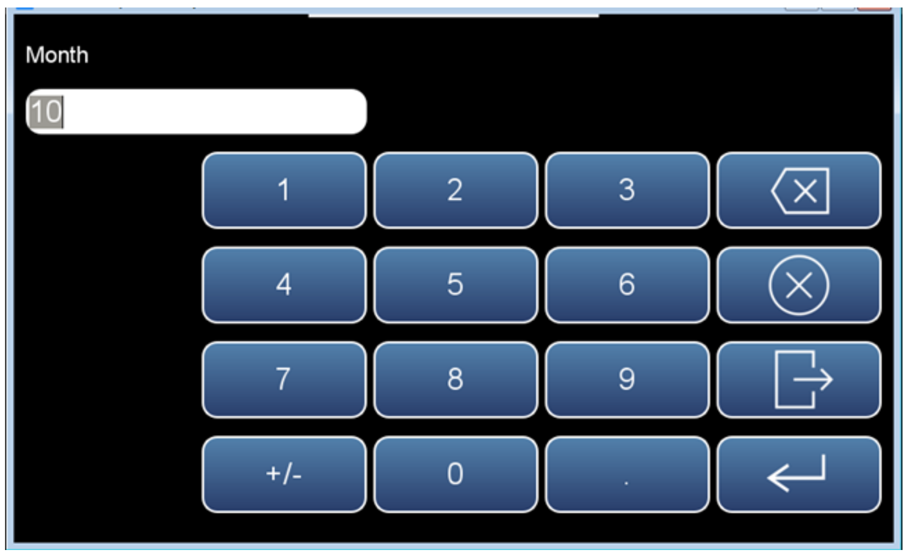


Figure 5–15. Month Entry Screen – other date/time parameter value entry screens are similar in look

3. Select the Time Zone and the Date Format using the buttons on the Date and Time screen.

Figure 5–16. Time Zone and Date Format button screen

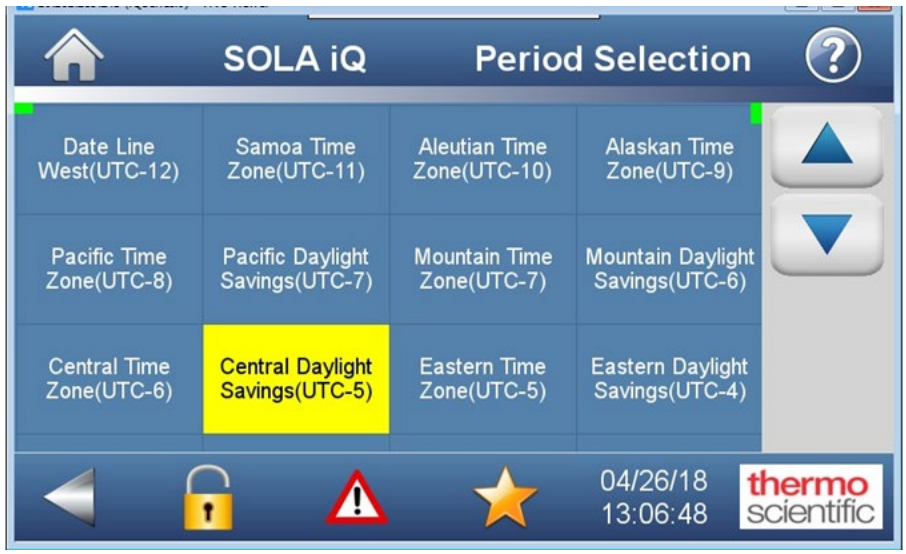


Figure 5–17. Time Zone selection screen

Figure 5–18. Date Format selection screen

Modbus Setup

The SOLA iQ supports a user configurable MODBUS. For a full description of MODBUS for the SOLA iQ, please refer to Appendix J, "Modbus for SOLA iQ". Access to the configuration capability is via the AutoCONFIG software only.

From the AutoCONFIG Navigation Bar, open Table 96 from the Communications menu Comm Port #2 (shown as Diagnostic Port) which has been preprogrammed for user Modbus connection. Double click Diagnostic Port and open a screen as shown below:

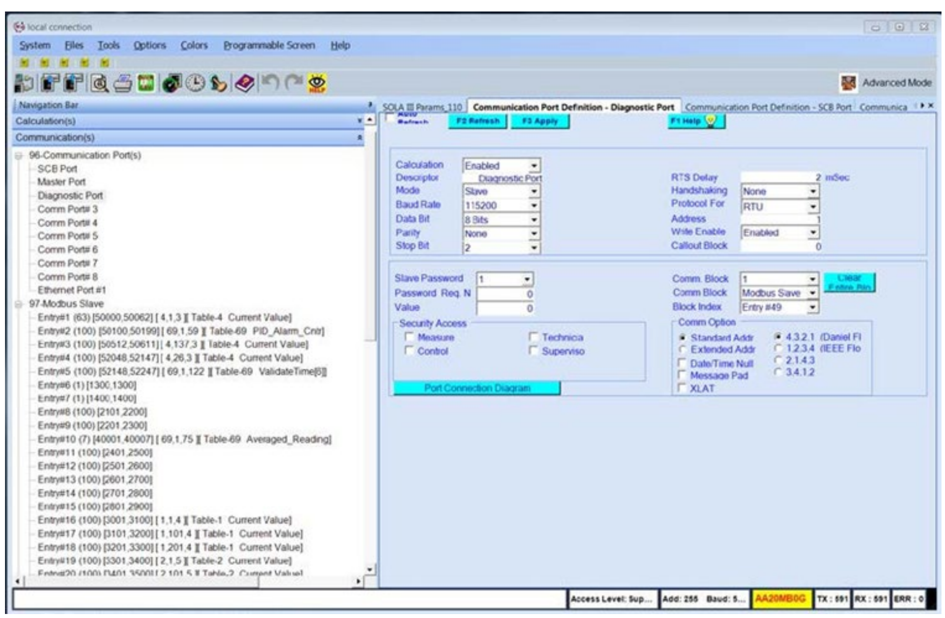


Figure 5–19. SOLA iQ Communication Port Definition – Diagnostic Port

The port is defined as Slave port, with slave address of 1, baud rate of 115200, 8 data bits, non parity, and 2 stop bits. Comm Block defines the Entry #49 as the user packet in the Block Index field.

From the Communications Menu in the Navigation Bar, open Entry #49 under Table 97 as shown below. The packet defined in this entry serves as a template and can be customized by the user as required. The template defines Modbus starting address at 4001, and reads 50 data points from SOLA. Press the F2 Refresh button to update the field values. The data in the template are defined as Point Numbers. The Point Number can be obtained by hovering the mouse over the parameters of interest in the various pre-configured User Programmable Screens in AutoCONFIG.

To customize the packet, change the starting address, the number of data to be read by external master, and perform copy and paste by copying the point number from User Programmable Screens to this table.

A recommended external Modbus master is Simply Modbus that runs on the Windows system. The Comm Terminal board supports up to seven user RS485/RS232 connections (see Figure 5–20).

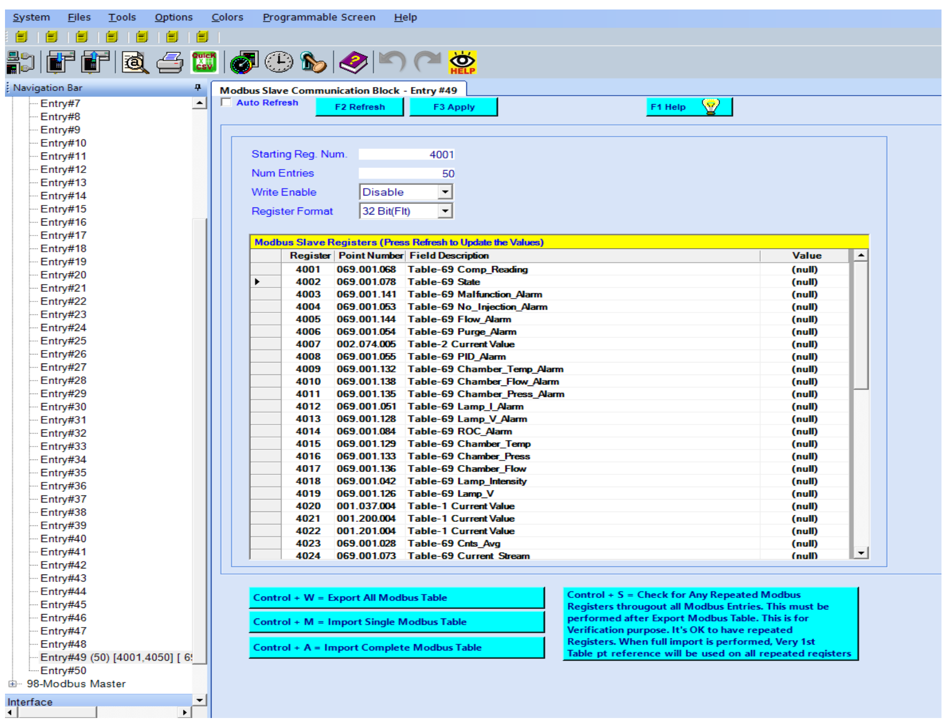


Figure 5–20. Table 97 Entry # 49 Modbus Slave Communications

Consult the SOLA iQ Installation Guide for information related to connections and The SOLA iQ Users Guide for information related to jumper settings. An example connection is shown below.

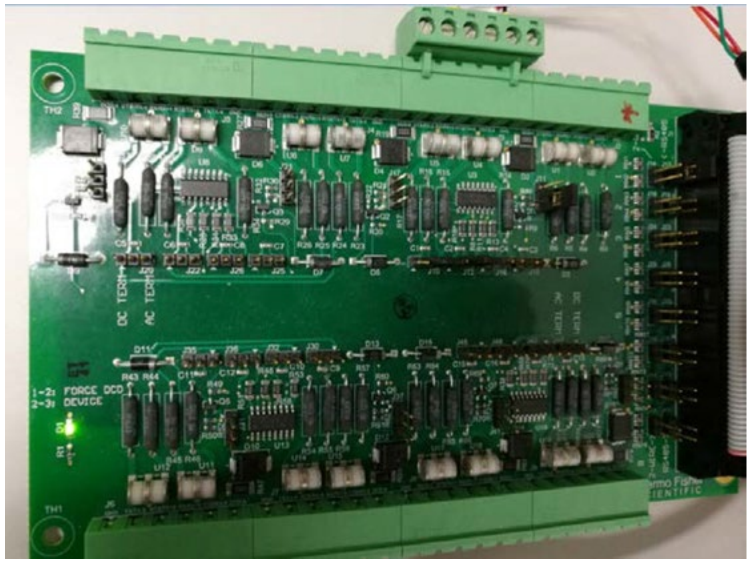


Figure 5–21. SOLA iQ Serial Termination Board

Figure 5–22, Simply Modbus Master screen shot, demonstrates the results when polling for the 10 data points defined in the above slave packet (see Figure 5–20). Identify the COM port used on your host connection, and update in the COM port field accordingly.

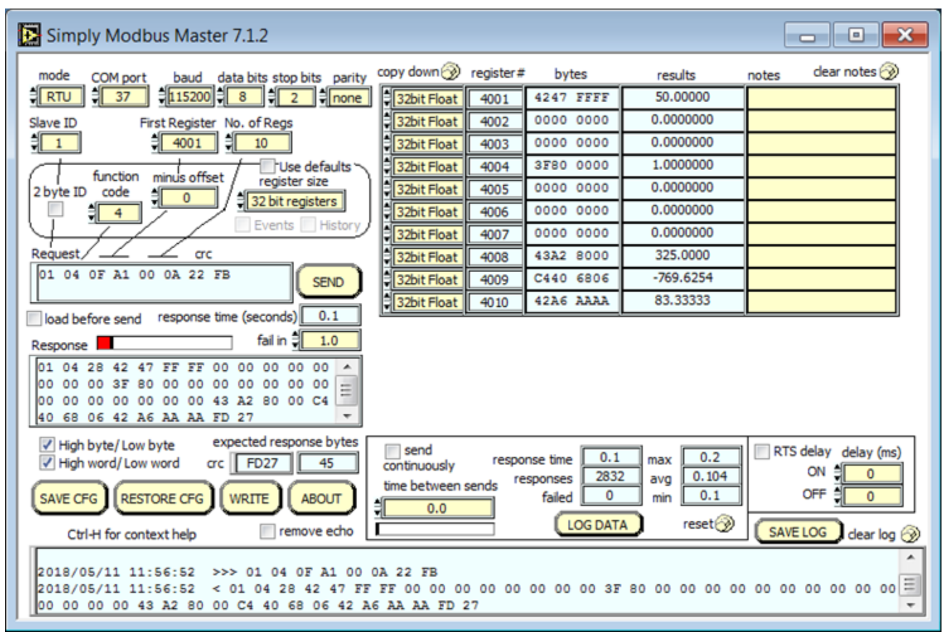


Figure 5–22. Simply Modbus Master Screen Shot

In addition, AutoPilot PRO supports user Modbus from TCP/IP. Using Simply Modbus TCP/IP client, the same data is polled as shown below.

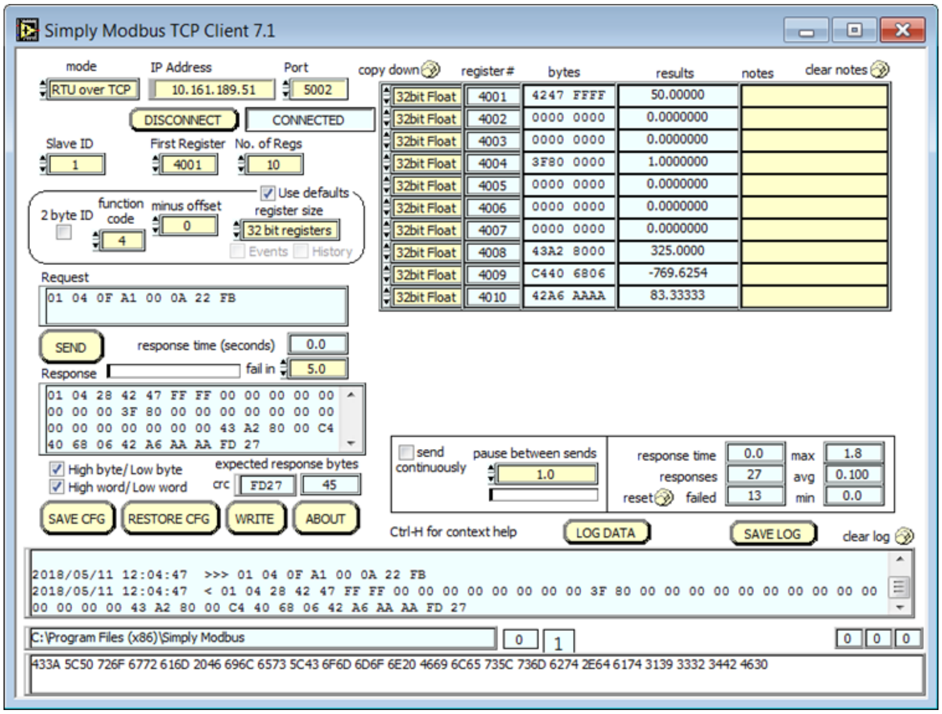
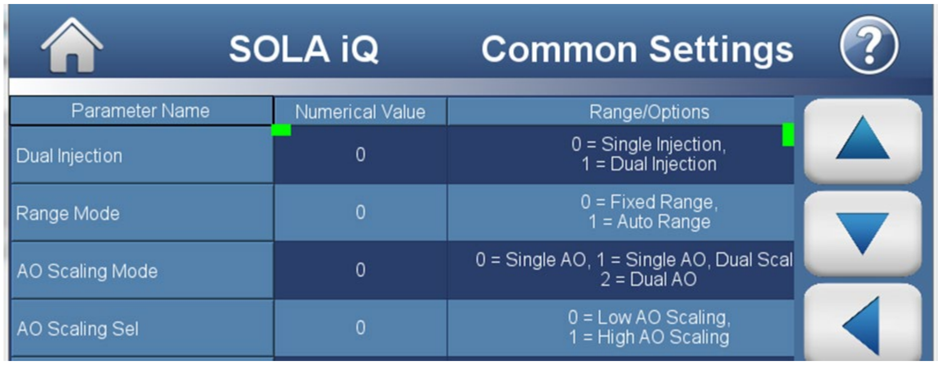


Figure 5–23. Simply Modbus TCP/IP Client Screen Shot

Range Mode Setup

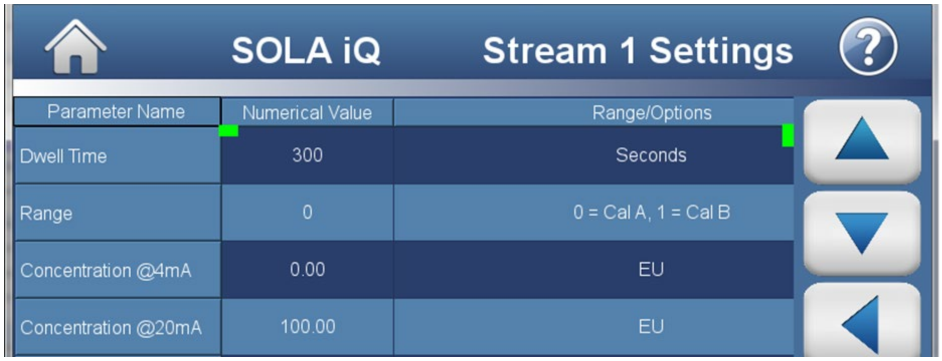


The SOLA iQ may have up to two calibration ranges available. These are designated as CAL A and CAL B. The Range Mode option allows each stream to be assigned a calibration range in Fixed Range Mode or lets the SOLA iQ automatically select the range in Auto Range Mode.

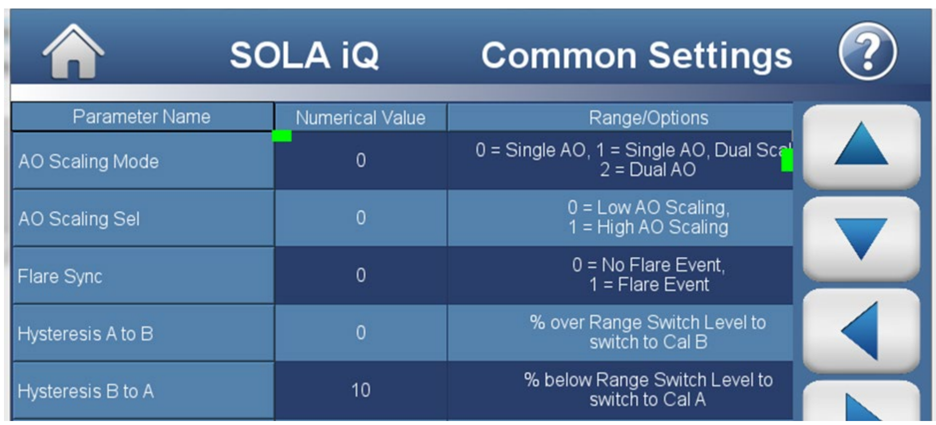
Single Range: For a Single Range system, the Range Mode should be Fixed Range and all streams should use CAL A. Up to 4 streams are supported and each stream has an associated analog output.

Dual Range: For a Dual Range system, the Range Mode may be either Fixed Range or Auto Range. The number of streams supported and the analog output mapping depend on the Range Mode and the AO Scaling Mode (refer to the mode descriptions below).

Fixed Range Mode: Each stream can be assigned CAL A or CAL B and the SOLA iQ will select that calibration range when that stream is selected. Up to 4 streams are supported and each stream has an associated analog output. Note that CAL B is only meaningful if the SOLA iQ is a Dual Range system. A Single Range system measuring with CAL B will yield a zero result.



Auto Range Mode: The SOLA iQ selects CAL A for a stream if the result is below the AO1 Hi 20mA setting (shown above as Stream 1 Concentration @20mA) and selects CAL B if the result is **above** the AO1 Hi 20 mA setting.



Hysteresis: Typically some hysteresis is added to prevent switching back and forth between ranges when the value is close to the range switch setting. In the example screen setting above, the SOLA iQ may immediately switch to CAL B when the result is more than the AO1 Hi 20 mA setting but will not switch back to CAL A until the result is 10% less than the AO1 Hi 20 mA setting.

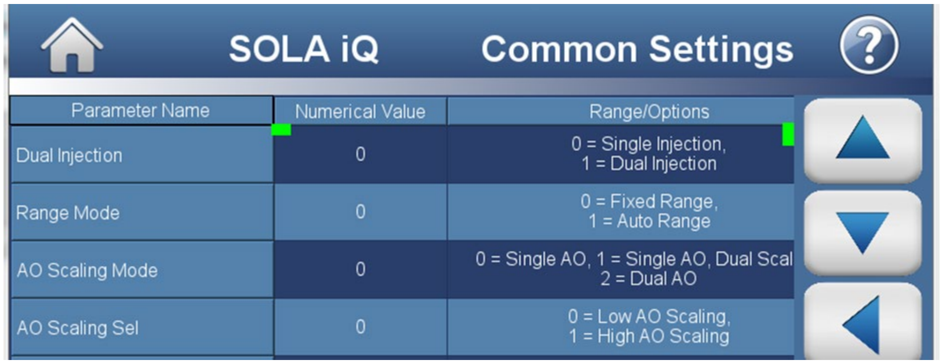
Up to 2 streams are supported and each stream has 1 or 2 associated analog outputs depending on the Analog Output Scaling Mode (refer to AO Scaling Mode Setup below).

Note that Auto Range is only meaningful if the SOLA iQ is a Dual Range system. A Single Range system measuring with CAL B will yield a zero result.

Direct remote selection of a calibration range is only available on the SOLA iQ Flare model, which will select CAL B whenever a remote signal is sent to indicate a Flare event (Flare Sync). The other SOLA iQ models do not directly change the calibration range through a remote signal except as noted for each stream in Fixed Range Mode.

A discrete output is available to indicate which calibration range (CAL A or CAL B) is active. Please refer to the SOLA iQ Installation Guide p/n 1-0755-016 or the drawings supplied with the SOLA iQ for more details regarding the inputs and outputs.

AO Scaling Mode Setup



The SOLA iQ has three Analog Output Scaling Mode options:
Single AO, Single AO Dual Scaling and Dual AO.

Single AO Mode: Up to 4 streams are supported. Each stream has one associated Analog Output (Stream 1 =AO1, Stream 2 = AO2, Stream 3 = AO3, Stream 4 = AO4). Each AO has 4mA and 20mA scaling accessible via the user interface. Analog Output Scaling Selection (Lo Scaling or Hi Scaling) is ignored in Single AO Mode.

Single AO Mode can be used for Single Range systems in Fixed Range Mode or for Dual Range systems with either Fixed Range Mode or Auto Range Mode.

Single AO Dual Scaling Mode: Up to 4 streams are supported. Each stream has one associated Analog Output (Stream 1 = AO1, Stream 2 = AO2, Stream 3 = AO3, Stream 4 = AO4). Two 20mA scaling's for each AO are accessible by the user, one for **Low Scaling**, one for **High Scaling**. Note the Low 20mA scaling will be labeled "Concentration @4mA" but in this mode will actually be the concentration @20mA when Low Scaling is selected. The actual 4mA setting is implied as zero in this mode. An AO Scaling Selection (Lo Scaling or Hi Scaling) for all streams is accessible via the user interface or by remote signal (Modbus or Discrete Input).

Single AO Dual Scaling Mode can be used for Single Range systems in Fixed Range Mode or for Dual Range systems with either Fixed Range Mode or Auto Range Mode.

Dual AO Mode: For 1 or 2 stream systems only. Each stream has 2 associated Analog Outputs (Stream 1 Cal A = AO1, Stream 1 Cal B = AO2, Stream 2 Cal A = AO3, Stream 2 Cal B = AO4). Each Analog Output has 4mA and 20mA scaling accessible via the user interface. AO Scaling Selection (Lo Scaling or Hi Scaling) is ignored in Dual AO Mode.

Dual AO Mode can be used for Dual Range systems with either Fixed Range Mode or Auto Range Mode.

Dual AO Mode for Single Range systems is not recommended. The AO mapping is enforced so that the outputs for Stream 1 CAL A = AO1 and Stream 2 CAL A = AO3. In that configuration AO2 and AO4 would not give meaningful results since CAL B is not available in Single Range.

Please refer to the SOLA iQ Installation Guide p/n 1-0755-016 or the drawings supplied with the SOLA iQ for more details regarding the inputs and outputs.

Inject Setup

The injection time is the amount of time until activation of the injection valve. The injection valve has a load position and an injection position. During the load cycle, sample is filling the sample loop. During the injection cycle, sample is transferred from the injection valve into a carrier gas to be transported to the Pyrolyzer. The injection valves used on the SOLA iQ are provided with two sample loops per valve. As one loop is filled, the other loop is being injected and then repeats the process. Thus, every time the injection valve is actuated, sample is being injected for analysis.

Three different sample injection valves may be used in the SOLA iQ:

1. A 6 port valve.

2. A 10 port valve.

3. A slider (Dinfa) valve.

The sample loops are internal on the 6 port valve and slider valve and external on the 10 port valve. The 6 port valve is used for high range gas samples and liquid samples. The slider (Dinfa) valve is used only for liquid samples. The 10 port valve is used for gas samples only.

The injection time can be set from the Front Panel Display or the AutoCONFIG software. From the home page of the Front Panel Display, press Settings>Analyzer Settings>Common Scroll to the Injection Time table entry (see Figure 5–24).

Figure 5–24. Common Settings page of the Front Panel Display

Pressing the Numerical Value field to the right of the Injection Time parameter opens the Numerical Value screen where a new value can be entered using the display keyboard. Pressing the arrow button at the bottom of the far right column inputs the new Injection Time Value and returns the display to the Common Settings page. The new value is indicated in the Numerical Value field.

The Common Setting page also permits setting the SOLA iQ for Single or Dual Injection modes of operation. Enter 0 for Single Injection and 1 for Dual Injection by Numerical Value field to the right of the Dual Injection button. Dual Injection is used for the SOLA iQ Flare Unit. Single Injection is used for all other applications.

The Injection Time and Dual Injection parameters can also be set using the AutoCONFIG software (see Figure 5–25).

Warning The Injection Time and Dual Injection settings are application dependent and are set during factory calibration. Changing these parameters changes the analyzer's calibration. During normal operation, there should not be a need to change the values of these parameters. Contact Thermo Fisher before changing the Injection Time or the Dual Injection settings. ▲

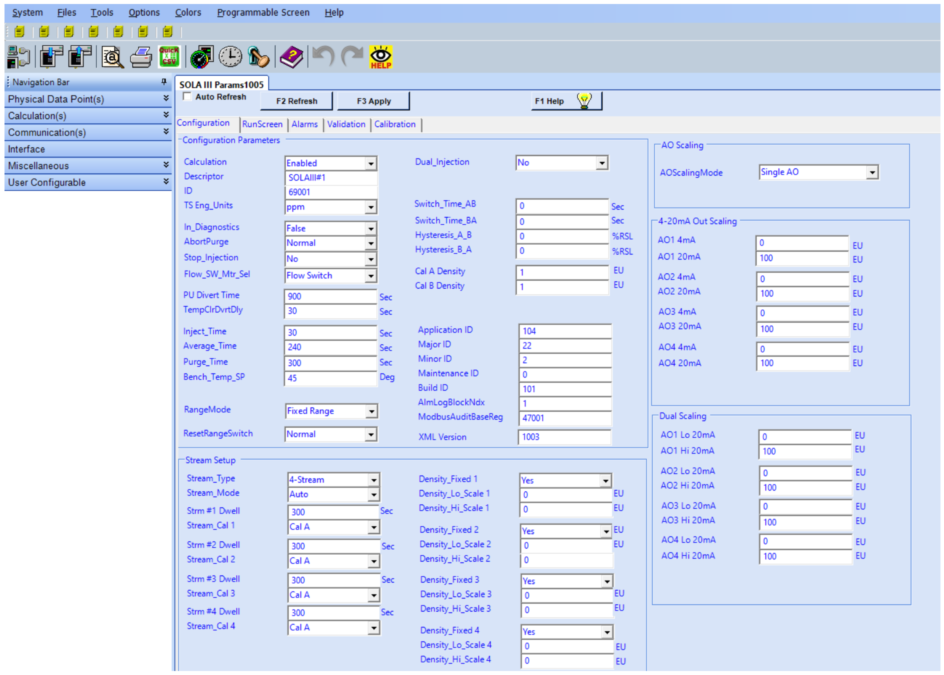


Figure 5–25. SOLA iQ Params Configuration Pre-Configured Screen

Access the Configuration page of the SOLAIII Params pre-configured screen in the AutoCONFIG software. The Injection Time (Inject_Time) and Dual Injection fields are located in the Configuration Parameters of the Configuration page. To change the Injection Time, type the new value in the field and press the F3 Apply button. Press the F2 Refresh button to confirm that the change has been made. For Dual Injection, select Yes or No from the drop down menu. Press the F3 Apply button and then the F2 Refresh Button to confirm the change has been made.

Warning The Injection Time and Dual Injection settings are application dependent and are set during the factory calibration. Changing these parameters changes the analyzer's calibration. During normal operation, there should not be a need to change the values of these parameters. Contact Thermo Fisher before changing the Injection Time or the Dual Injection settings. ▲

Calibration

Overview

The analyzer requires a two-point linear calibration. During the calibration procedure, the analyzer latches the average of the raw PMT mV values corresponding to two known sulfur concentrations. The SOLA iQ can support two distinct calibrations: 1) Cal A and 2) Cal B.

There are two ways to calibrate the SOLA iQ. One method is to use the Cal function. The second method is to use the ReCal function. Both methods use the boxcar of total sulfur concentration values established by the length of the Read Time. For a typical Read Time of 240 seconds, the boxcar of values consist of the latest 240 data points. As a new data point is generated and added to the boxcar of values the oldest value of the boxcar is dropped.

When using the Cal function, the SOLA iQ collects the per second Raw PMT mV response data for a time period equal to the Read Time. This fills the boxcar with the most recent values generated after initiating the Cal function. Therefore, if the Read Time is 240 seconds, the Raw PMT mV signal is latched to the calibration standard concentration at the end of the 240-second interval.

When using the Recal function, the SOLA iQ immediately latches the Raw PMT mV value to the calibration standard concentration when the Recal function is initiated.

Both the Cal and Recal function require that the SOLA iQ achieve a steady state operation using the appropriate calibration standard before initiating any action.

During normal operation, the Raw PMT mV reading is linearly interpolated on the calibration line to derive the sulfur concentration reported. The Instantaneous total sulfur concentration is based on the Raw PMT mV value. The reported Average Total Sulfur concentration is calculated using the boxcar of total sulfur values calculated from the Raw PMT mV value.

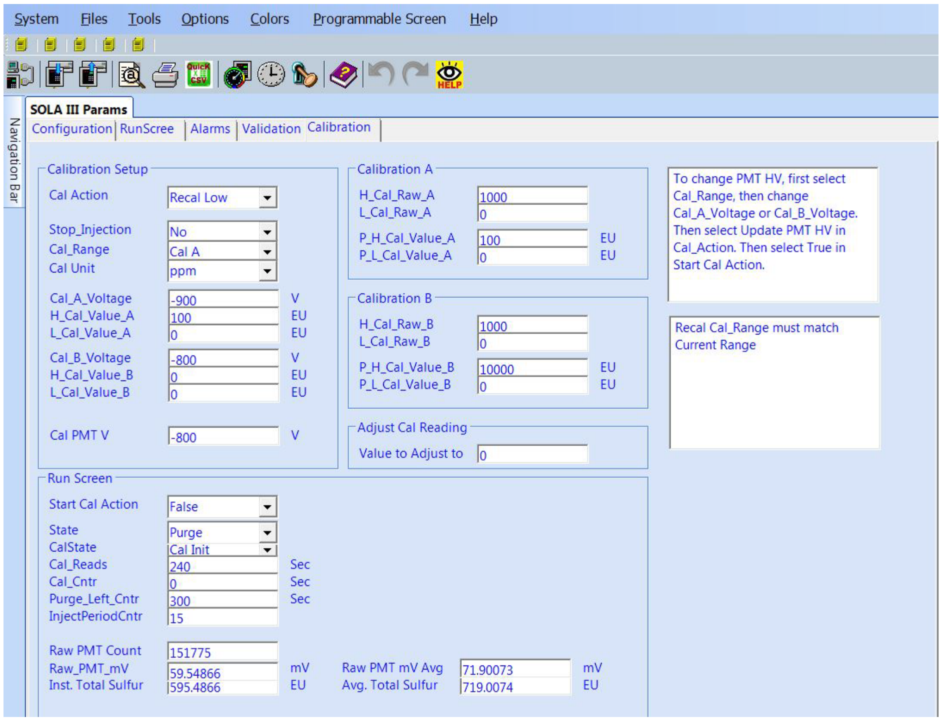


Figure 5–26. Calibration page of SOLA_III_Param preconfigured screen in Auto CONFIG

The calibration function can be accessed from the AutoCONFIG software and via the Front Panel Display. In the AutoCONFIG software, go to the Calibration page of the SOLA_III_Params preconfigured screen (see Figure 5–26). From the Front Panel Display, touch the Calibration button to access the Calibration Menu (see Figure 5–27). Display screens for a Full Calibration are shown in Figure 5–28 and Figure 5–29.

Figure 5–27. Calibration Menu

Figure 5–28. Full Calibration

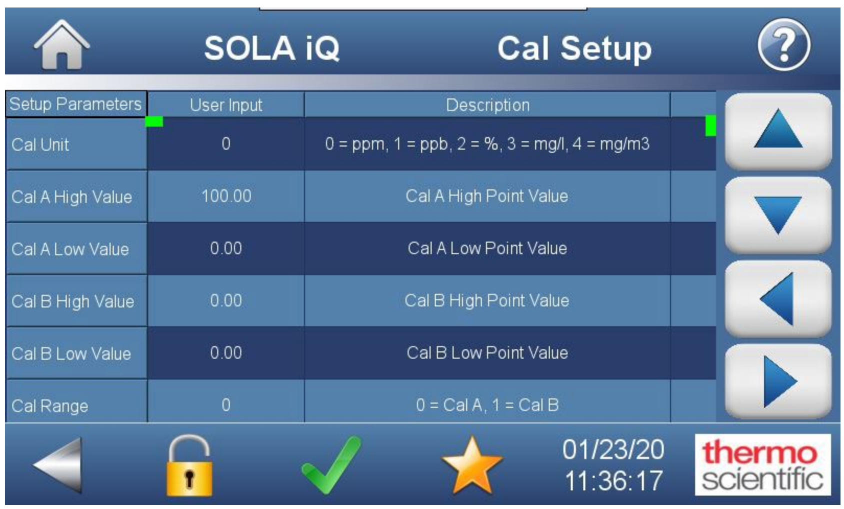


Figure 5–29. Cal Setup

Figure 5–30. View Cal Progress

Prior to calibrating the instrument, the sulfur concentration expected at the two points must be entered in the calibration setup menus. This can be done using the Front Panel Display or the AutoCONFIG software. On the Front Panel Display, these points are referred to as Cal A (or B) High Value and Cal A (or B) Low Value. In the AutoCONFIG software, these points are referred to as P_H_Cal_Value_A (or B) and P_H_Cal_Value_A (or) B calibration values.

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

Low cal value = 0 ppm	Low cal = 13.6347 mV
High cal value = 100.00 ppm	High cal = 378.0316 mV

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.

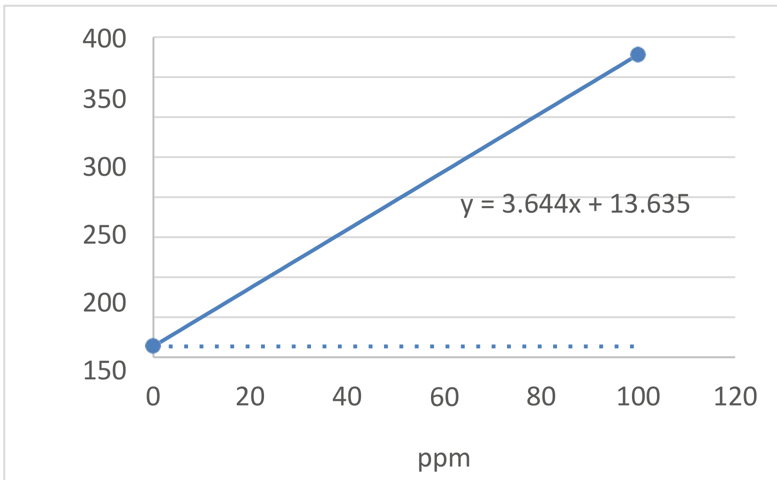


Figure 5–31. Typical SOLA iQ calibration

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.

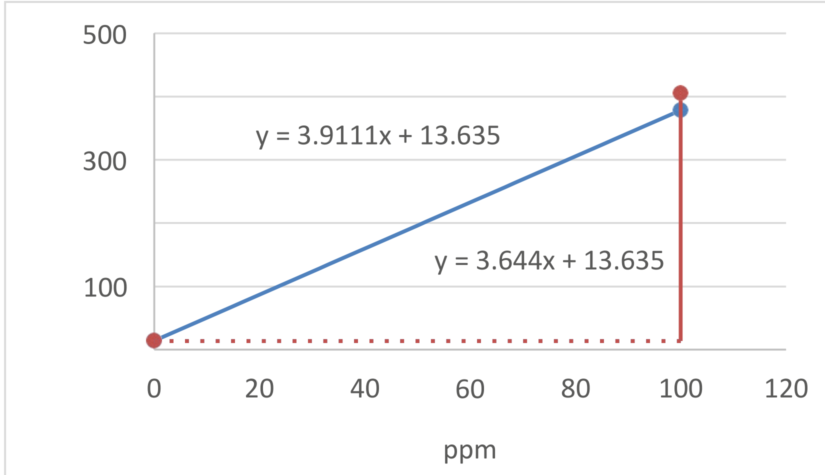


Figure 5–32. High calibration

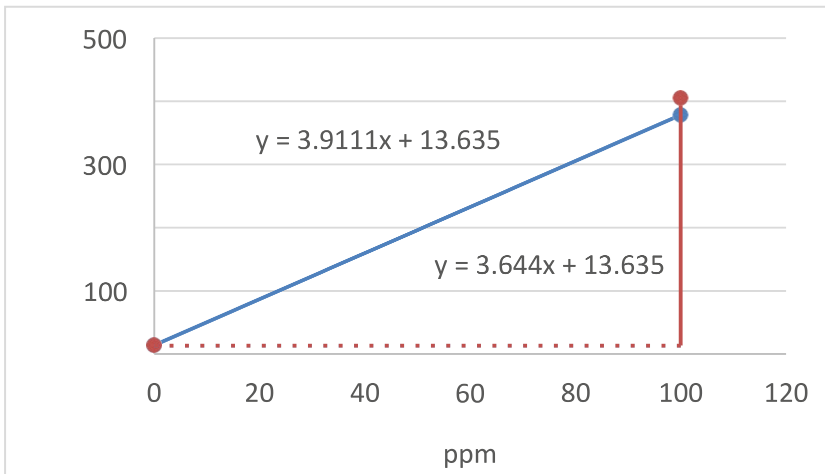


Figure 5–33. Low calibration

If necessary, the Adjust Reading page in the Calibration submenu of the Front Panel Display can be used to correct the calibration by moving the line without changing the slope. The Adjust Reading page displays the Current Average Total Sulfur Reading (Current Avg TS Reading) and allows the user to specify the Adjust To value. Once the average total sulfur reading stabilizes, the calibration line correction is performed by pressing the Commit Adjust Reading button (see Figure 5–35).

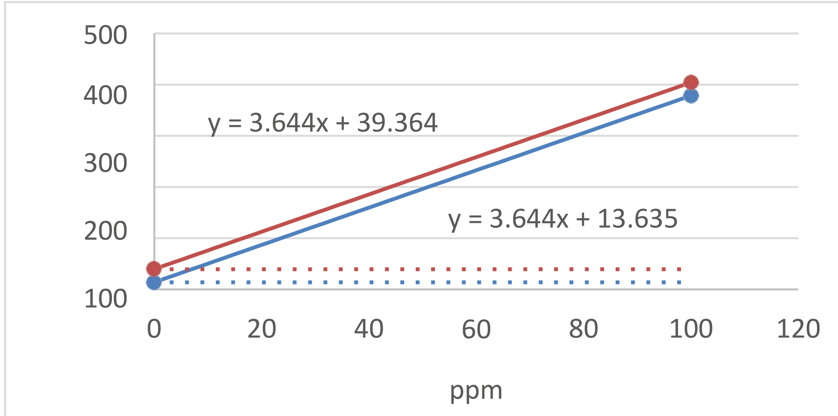


Figure 5–34. Corrected calibration

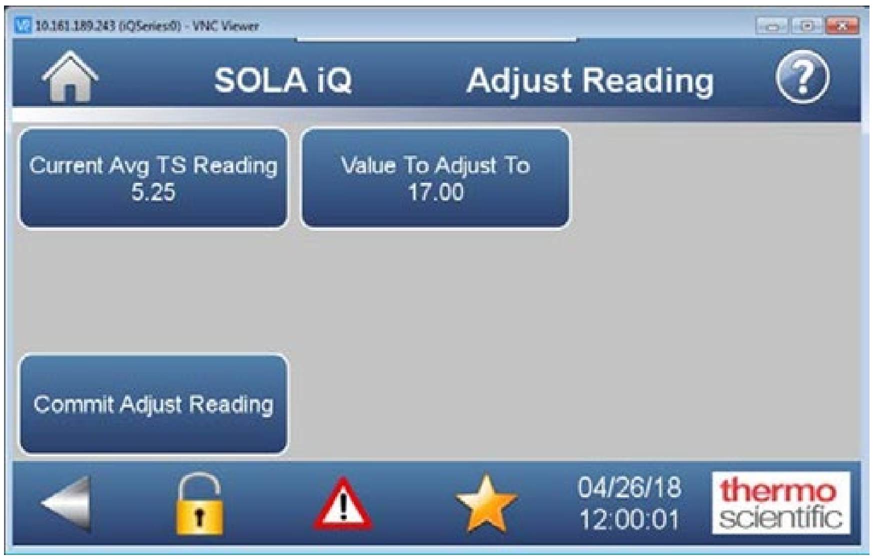


Figure 5–35. Adjust Reading

Performing a Low Calibration at Zero*

*No injections or blank matrix of span standard

The ReCal Low Function

Note This is the most common form of low calibration that requires only one standard. For SOLA iQ Trace, it is recommended that either a low concentration standard or the blank matrix of the span standard be used. ▲

To perform a low calibration with no injections from the Front Panel Display, follow the steps below.

1. From the Home page of the front panel display go to Calibration > Full Calibration > Cal Setup. Set the Cal A Low Value to zero.

2. Exit the Cal Setup page and return to the Calibration page.

3. Engage the Stop Injection button. This will stop the injection valve from actuating.

4. As an alternative to the Stop Injection button on the Display, one can 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. Note that CV and Flare units do not have a divert valve.

   b. The injection valve will stop injecting, letting only the carrier gas run through the system.

   Note that if the Injection Purge pressure regulator gauge has a positive pressure displayed, the preferred operating mode, then the sample is flushed out of the injection valve when the SOLA iQ is in the Divert position. The sample exits the SOLA iQ via the Atmospheric Vent bulkhead connection. If there is no pressure downstream of the Injection Purge pressure regulator, then the sample is retained inside of the injection valve when the SOLA iQ is in the Divert mode.

5. Let the unit run until the sulfur concentration reported is stable. Note that the length of time of the stable reading must be longer than the analysis read time in order to use the ReCal function.

6. Go to Calibration > Recalibration Express Cal> Start ReCal Low. Once the Start ReCal Low button is pushed the SOLA iQ accepts the new low calibration.

7. To start injections press the Stop Injection button (see step 3)

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

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

1. From the Sola iQ_Params preconfigured page, access the Calibration screen (see Figure 5–22).

2. From the Stop_Injection drop down menu in the Calibration Setup box select Yes.

3. Click on the Apply button and then click the Refresh button to confirm that the Yes selection is displayed.

4. Let the unit run until the sulfur concentration reported is stable. Note that the length of time of the stable reading must be longer than the analysis read time in order to use the ReCal Low function.

5. In the Calibration A box, set the P_L_Cal_Value_A value to zero. To perform the zero calibration for Cal B, set the P_L_Cal_Value_B value to zero in the Calibration B box.

6. Click the Apply button and then click the Refresh button to confirm that the zero value is displayed.

7. From the Cal Action drop down menu in the Calibration Setup box, select Recal Low. Note before initiating the ReCal Low action be sure that the length of time of the stable reading is longer than the analysis read time.

8. To initiate the ReCal Low action, select True from the Start Cal Action drop down menu of the Run Screen box.

9. At this point, the Raw PMT mV value detector signal is latched to correspond to a zero sulfur concentration. The new no injection detector value can be observed as L_Cal_Raw_A in the Calibration A box. If the no injections were done for Cal B, the new detector value can be observed as L_Cal_Raw_B in the Calibration B box.

10. Reinitiate the injection valve by selecting No from the Stop_Injection drop down menu. Click the Apply button and then click the Refresh button to confirm that the No value is displayed.

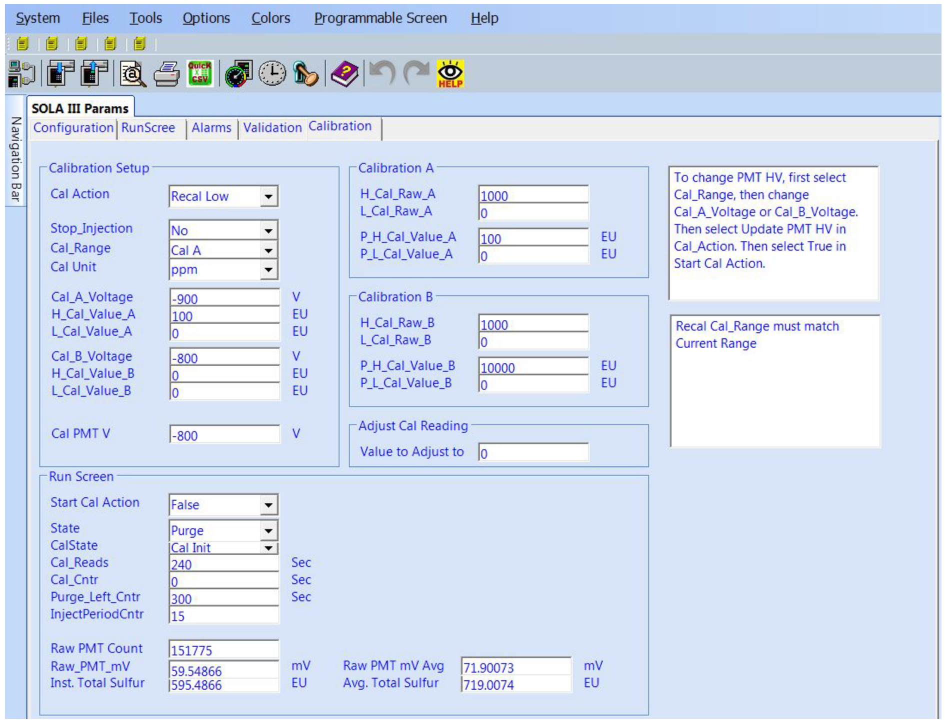


Figure 5–36. SOLA iQ Params preconfigured page – Calibration Screen

The Cal Low Function

Though the Cal Low function achieves the same end result as the ReCal Low function in that the low (or zero) calibration of the SOLA iQ is achieved, there are differences between these two functions. The Cal Low function typically is used as part of a routine recalibration of the SOLA iQ. Use of a low calibration standard or a blank matrix sample is recommended for Trace applications. For non-Trace applications the low calibration can be done using no injections. When using a low calibration standard or a blank matrix sample, a purge cycle is required to displace sample with calibration standard before the Cal Low function can be employed. The purge cycle is required to transition from process sample to calibration standard as well as from calibration standard back to process sample. The purge cycle must be long enough to ensure that the SOLA iQ is responding to only the calibration standard and not some mixture of process sample and calibration standard. For a No Injections zero calibration there needs to be a sufficient time interval for the SOLA iQ to accurately display its zero value.

Once the purge cycle (or the time to zero) is completed and a stable value of the calibration standard (or zero) is being reported, the Cal Low function can be initiated. Upon initiating the Cal Low function, the SOLA iQ collects data for the Read Time length which is normally 240 seconds. At the end of the Read Time, the Raw PMT mv signal is latched to correspond to the low total sulfur concentration or to the zero value if No Injections is utilized. The Read Time in units of seconds is displayed as Cal_Reads on the SOLA iQ_Params page of the AutoCONFIG software.

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 menu offers two functions:

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

The ReCal High Function

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

To perform a ReCal High calibration from the Front Panel Display, follow the steps below.

1. From the Home page of the front panel display, go to Calibration > Full Calibration > Cal Setup. Set the Cal A High Value to the total sulfur concentration of the calibration standard.

2. Introduce the high calibration standard into the SOLA iQ injection valve and inject the standard into the analyzer.

3. Let the unit run until the sulfur concentration reported is stable. Note that the length of time of the stable reading must be longer than the analysis read time in order to use the ReCal function.

4. Go to Calibration > Recalibration Express Cal> Start ReCal High. Once the Start ReCal Low button is pushed the SOLA iQ accepts the new high calibration.

5. At this point, the Raw PMT mV detector signal is latched to correspond to a high (span) total sulfur concentration.

To perform a ReCal High calibration using the AutoCONFIG software, follow the steps below.

1. From the Sola iQ_Params preconfigured page access the Calibration screen.

2. Introduce the high calibration standard into the SOLA iQ injection valve and inject the standard into the analyzer.

3. Let the unit run until the sulfur concentration reported is stable. Note that the length of time of the stable reading must be longer than the analysis read time in order to use the ReCal High function.

4. In the Calibration A box, set the P_H_Cal_Value_A value to the total sulfur concentration of the calibration standard. To perform the high calibration for Cal B set the P_H_Cal_Value_B value to the total sulfur concentration of the calibration standard in the Calibration B box.

5. Click the Apply button and then click the Refresh button to confirm that the zero value is displayed.

6. From the Cal Action drop down menu in the Calibration Setup box, select Recal High. Note before initiating the ReCal High action, ensure that the length of time of the stable reading is longer than the analysis read time.

7. To initiate the ReCal High action, select True from the Start Cal Action drop down menu of the Run Screen box.

8. At this point, the Raw PMT mV detector signal is latched to correspond to the high (span) total sulfur concentration. The new high detector value can be observed as H_Cal_Raw_A in the Calibration A box. If the no injections were done for Cal B, the new detector value can be observed as H_Cal_Raw_B in the Calibration B box.

The Cal High Function

Though the Cal High function achieves the same end result as the ReCal High function in that the span calibration of the SOLA iQ is achieved, there are differences between these two functions. The Cal High function typically is used as part of a routine recalibration of the SOLA iQ. As such a purge cycle is required to displace sample with calibration standard before this function can be employed. The purge cycle is required to transition from process sample to calibration standard as well as from calibration standard back to process sample. The purge cycle must be long enough to ensure that the SOLA iQ is responding to only the calibration standard and not some mixture of process sample and calibration standard.

Once the purge cycle is completed and a stable value of the calibration standard is being reported the Cal High function can be initiated. Upon initiating the Cal High function the SOLA iQ collects data for the Read Time length which is normally 240 seconds. At the end of the Read Time, the Raw PMT mv signal is latched to correspond to the high (span) total sulfur concentration. The Read Time in units of seconds is displayed as Cal_Reads on the SOLA iQ_Params page of the AutoCONFIG software.

Adjusting the Reading

If the reported value of the SOLA iQ does not match a known sample value or the standard flowing through the instrument, you can adjust the reading. From the Home page of the Front Panel Display, select Calibration (see Figure 5–23). From the Calibration screen select Adjust Reading (see Figure 5–23). The Current Average Total Sulfur reading will be displayed. Also displayed is the Value to Adjust to which is the desired reading. The Value to Adjust to can be modified as required using the input screen. The Current Average Total Sulfur reading is modified to match the desired reading by touching the Commit Adjust Reading button.

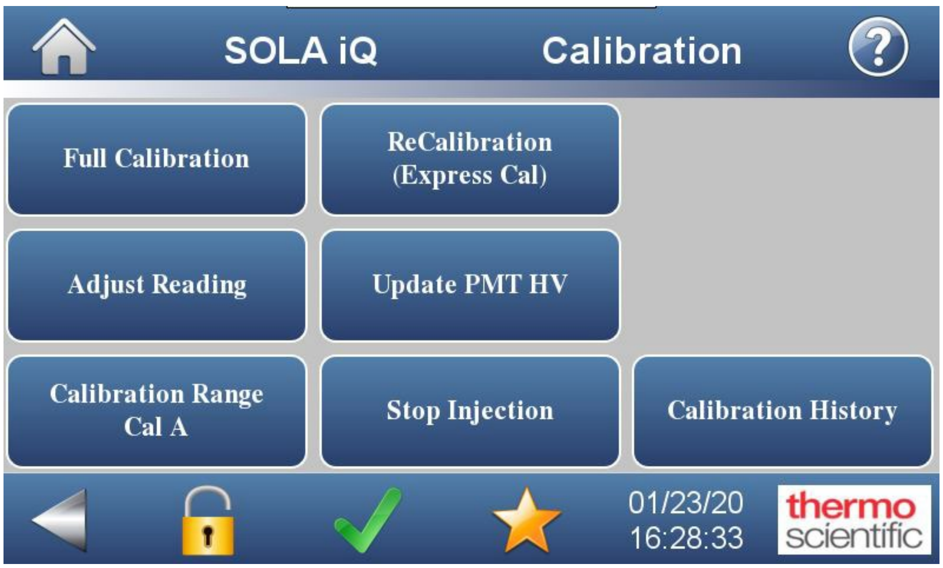


Figure 5–37. Calibration Menu

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 hide malfunctions in the unit that need to be corrected. ▲

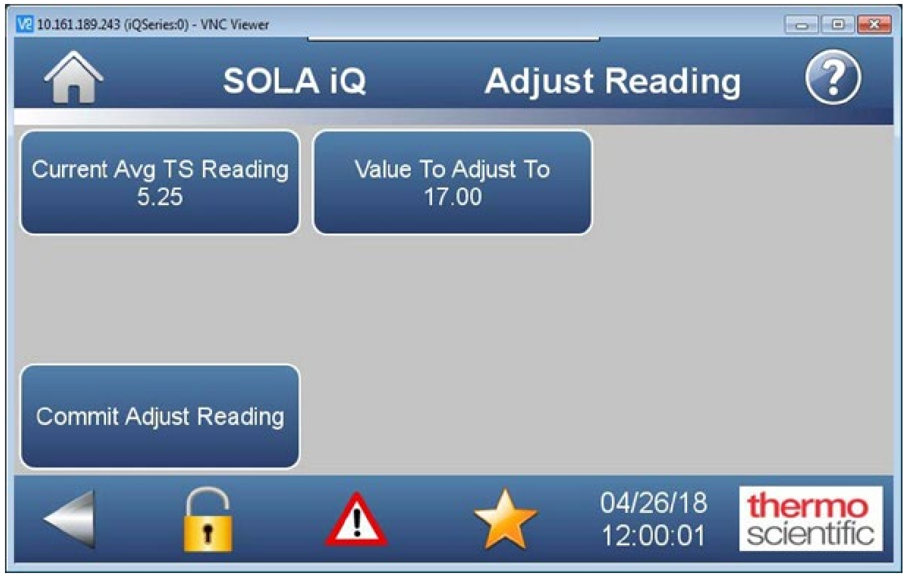


Figure 5–38. Adjust Reading screen on Front Panel Display

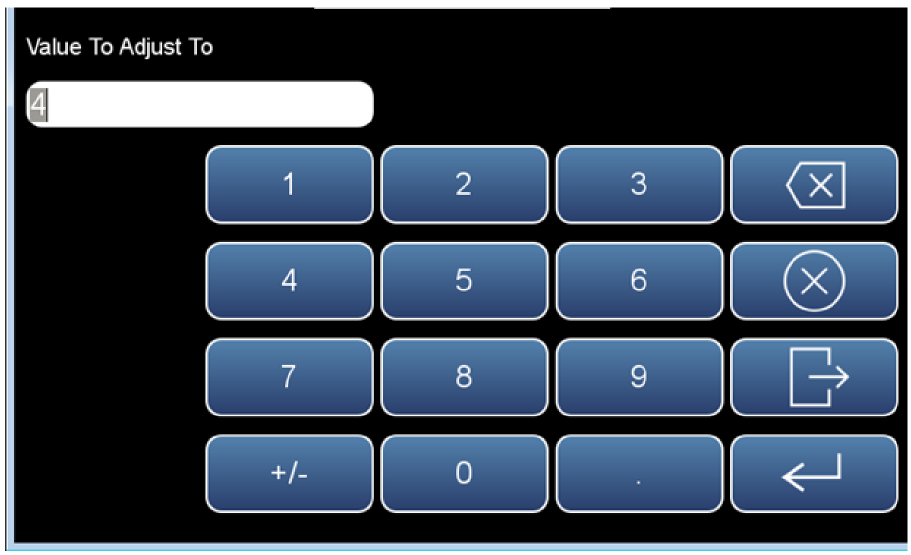


Figure 5–39. Value to Adjust to Input Screen

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. Density compensation is typically of concern for liquid samples.

The need to perform a density compensation derives from the fact that the sample injection valve is a fixed volume device. As the density of the sample changes, so too will the mass of the sample injected change. Differences in the amount of mass being injected using a fixed volume device translate into output signal variations that are not caused by variations in the sample total sulfur concentration. Mass injection differences, due to density differences, can also exist because the sample density differs from the density of the calibration fluid.

The ratio of the calibration standard density to the sample density is used to perform the density compensation. These densities are functions of temperature. In general, as the temperature is increased the density of a liquid decreases. This means that the calibration standard to sample density ratio will also be a function of temperature.

The specific temperature of interest is the injection valve temperature. The value of the injection valve temperature establishes the density value of the material in the sample loop. For some applications the injection valve temperature is essentially at room temperature. Using calibration standard and sample densities determined at, or fairly close to, room temperature produces an accurate density compensation value.

For other applications the injection valve is heated. Heating the injection valves ensures the transport of sample from the injection valve into the analyzer system. Using calibration standard and sample densities determined at room temperature can result in a density compensation ratio value that differs from the value existing at the injection valve. In these circumstances it is better to use density values for the calibration standard and the sample reported at the injection valve temperature. The injection valve temperature is specified on the analyzer Calibration Data sheet.

When using the optional densitometer inputs, the densities that correspond to 4 mA and 20 mA must be entered. These values are inputted using the AutoCONFIG software and the SOLA iQ Params_xx preconfigured page. The xx designates the page revision number. Density_Lo_Scale and Density_Hi_Scale values are input for up to four streams in the Stream Setup section of the SOLA iQ Params_xx Configuration pre-configured page. The term EU to the right of these fields indicates that the density value is inputted in Engineering Units. Note that the Engineering Units used here must match the Engineering Units used to input the calibration standard density. Additionally, the Density_Fixed field must indicate No to allow the inputted density meter value to be used for Density Compensation in the SOLA iQ. The drop down menu for this field is used to designate the Density_Fixed as Yes or No. Note that each density meter input has its own Density_Fixed field. The analyzer uses a linear interpolation of the 4-20 mA scale input values for the Lo and Hi density to determine the sample density. 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, the correction factor is 1.000.

The following provides instructions for both methods. Menu items for stream 1 are used.

1. On the SOLA iQ Params Run preconfigured page in the Stream Setup section enter the 4 mA density value and the 20 mA density in Engineering Units (EU) in the fields labeled Density_Lo_Scale and Density_Hi_Scale respectively for the appropriate stream. This step is not done if a fixed density compensation is to be employed.

2. Select No from the drop down menu entitled Density_Fixed. If the analyzer is to use a fixed density compensation, the drop down menu selection is Yes.

3. Click on the Apply button at the top of the page to accept the entered values.

4. On the SOLA iQ Params Configuration preconfigured page in the Configuration Parameters section enter the density of the calibration standard in Engineering Units for Cal A Density or Cal B Density as appropriate. Note that the Engineering Units must be the same for the Sample Density and the Calibration Standard density.

5. Ensure that the appropriate choice of Cal A or Cal B is made in the Stream_Cal field in the Stream Setup section.

6. Click the Apply button at the top of the page to accept the entered values.

7. For a fixed density compensation, enter the value of the sample density in Engineering Units in the Density Stm field in the Stream/Range TS section of the SOLA iQ Params Run preconfigured page.

8. Click the Apply button at the top of the page to accept the entered values.

9. To confirm that the entered values have been accepted click the refresh button at the top of the page and inspect the fields where the changes were made.

10. Follow the same steps to setup the density compensation for streams 2, 3, and 4 but enter stream specific values in the fields identified for streams 2, 3, and 4.

11. The density correction factor is calculated using the entered sample and calibration density values.

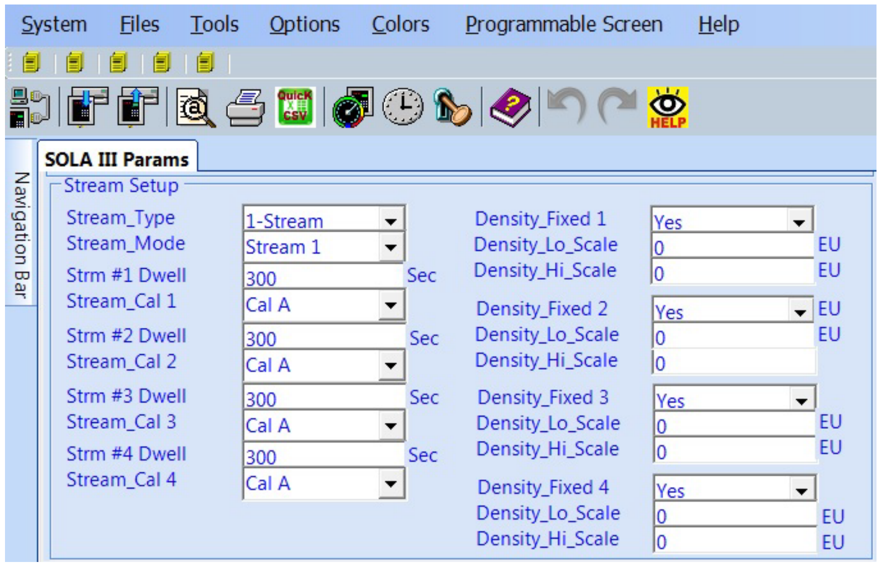


Figure 5–40. SOLA iQ Params Run preconfigured page – Stream Setup Section

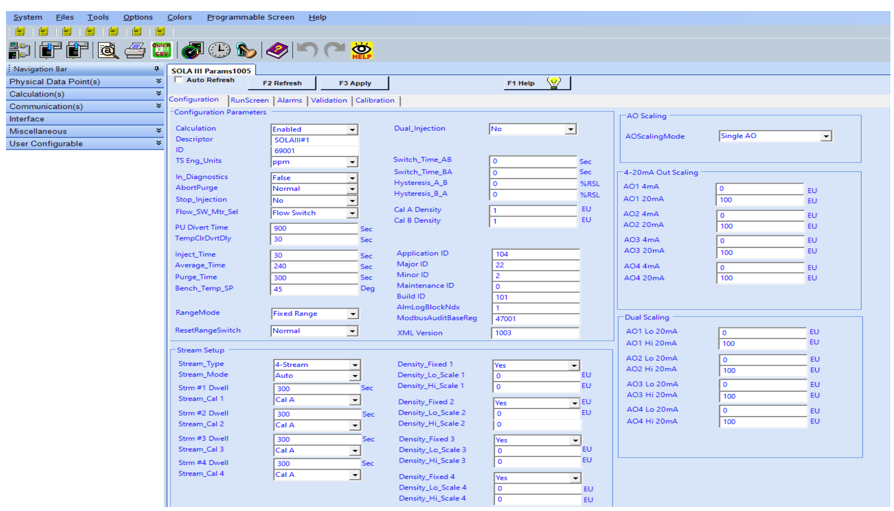


Figure 5–41. SOLA iQ Params Configuration preconfigured page – Configuration Parameters Section

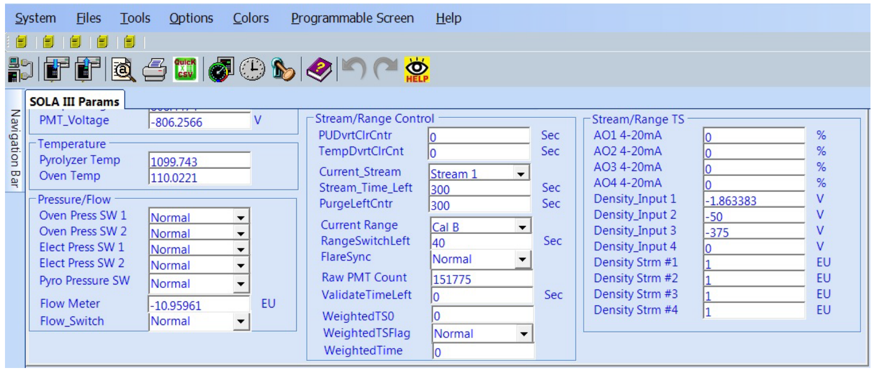


Figure 5–42. SOLA iQ Params Run preconfigured page – Stream/Range TS Section

PMT HV

The PMT HV (High Voltage) is the voltage applied to the PMT so that it is operational. The voltage applied is application dependent and typically falls in the range of -600 V to -1000V. The PMT HV is set during the factory calibration of the SOLA iQ based upon the application data provided by the customer at the time of order placement. This setting is fundamental to the calibration of the SOLA iQ. Its value is typically not changed because if it is changed, then a recalibration of the SOLA iQ is required.

Warning Changing the PMT HV values requires the SOLA iQ to be recalibrated. ▲

Changing Range Parameters

After installation, it may be determined that the initial range parameter selections need to be modified. The procedure below shows how to change range parameters. It is recommended to contact your Thermo Fisher Scientific representative for guidance for this procedure. Contact information is available in Section 8 of this guide.

For single range systems, estimate and set the PMT A voltage to an initial value suitable for the range (for example -950V for < 100ppm through to -550V for %levels).

For dual range systems, set PMT B voltage to a suitable initial value.

Check that the ranges are appropriate for the valve configuration and/or for automatic range changes. For example, if the system uses dual injection valves, the ranges should reflect the difference between the volumes injected by each valve.

For a Flare unit, the high range is 100 times the low range since the volume of the low range injection valve is 100 times the volume of the high range injection valve.

For single injection systems, the automatic range change may require the high range be no more than 20 times the low range.

Also pay attention to the Hysteresis so the SOLA iQ can switch between ranges smoothly.

Using the Touchscreen:

Navigate to Calibration – Update PMT HV – PMT A Voltage (V). Set desired voltage and then select Commit Update PMT HV.

If Dual Range, repeat for PMT B Voltage (V)

Allow the analyzer to stabilize at operating temperature at least overnight. For Trace systems, longer stabilization will be required and may be accelerated by running a blank matrix sample.

Calibration with New Range

For Trace SOLA iQ, perform Low Calibration on a known blank matrix sample and for reference, record also the average PMT mV signal when not injecting sample.

For SOLA iQ with Standard bench, perform Low Calibration either with no injections or on a known blank matrix sample in which case record also the average PMT mV signal when not injecting sample.

Introduce calibration span standard (within 75-100% of required full scale range and in a sample matrix that reflects the application) and calibrate high after PUVF bench reading has stabilized.

If PMT mV Avg value exceeds [7500mV x Span concn / Full scale concn], reduce the magnitude of the PMT voltage until the PMT mV Avg falls below 7500mV

If PMT mV Avg value lies below [5000mV x Span concn / Full scale concn], increase the magnitude of the PMT voltage until it reaches -950V or until the PMT mV Avg value approaches, but does not exceed, [7500mV x Span concn / Full scale concn].

If it has been necessary to adjust the PMT voltage in previous couple of steps, record the new PMT value then repeat the Low Calibration.

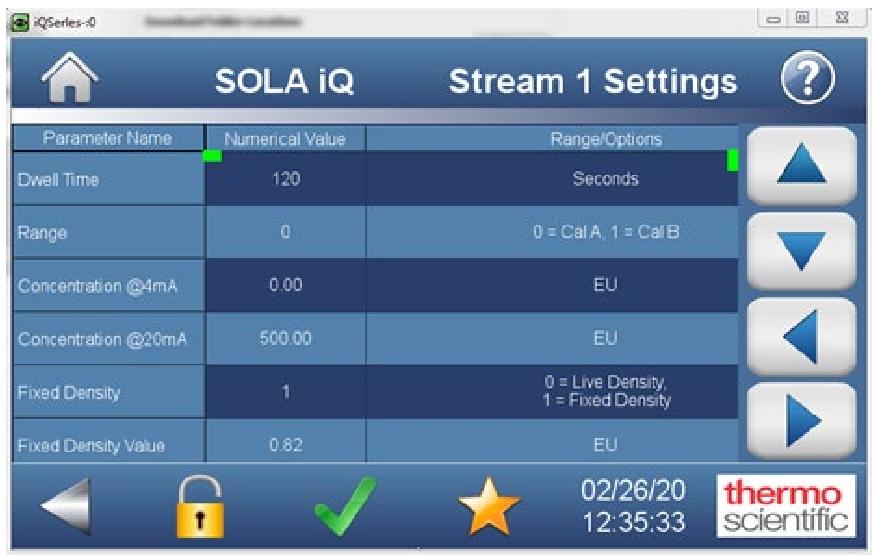
Record new PMT mV Avg values on the unit Test Certificate.

For dual range systems, repeat calibration for other range and record new PMT mV Avg values on the unit Test Certificate.

Update the 4-20 mA Output values for each stream as appropriate.

Using the Touchscreen:

Navigate to Settings – Analyzer Settings – Stream 1 and configure the Concentration @4mA and Concentration @20mA as desired.



Repeat for any other stream desired.

Chapter 6
Viewing Alarms

Alarms Setup

Alarms can be viewed from the Front Panel Display or from the AutoCONFIG software.

From the Front Panel Display:

The Alarms Page can be accessed directly by pressing the Green Check Mark or the flashing red triangle at the bottom of the any page (see Figure 6–1).

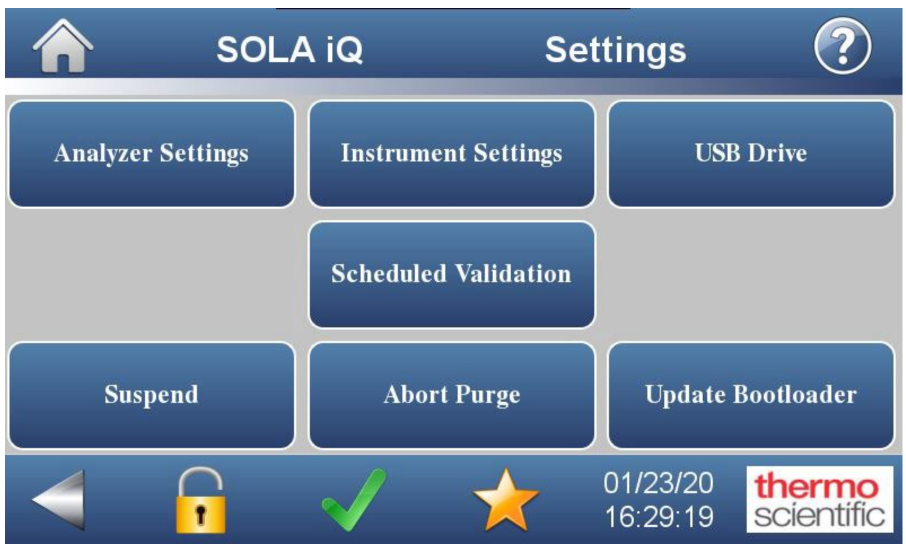


Figure 6–1. SOLA iQ Front Panel Display Page

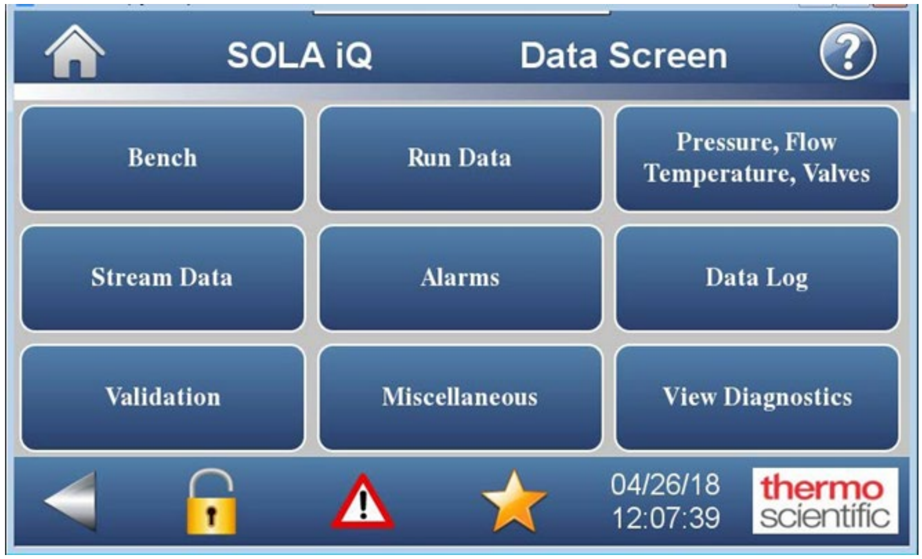


Figure 6–2. Data Screen

The Alarms Page can also be accessed by pressing the Data button on the Front Panel Display which accesses the Data Screen (see Figure 6–2). From the Data Screen, press the Alarms button to access the Alarms page.

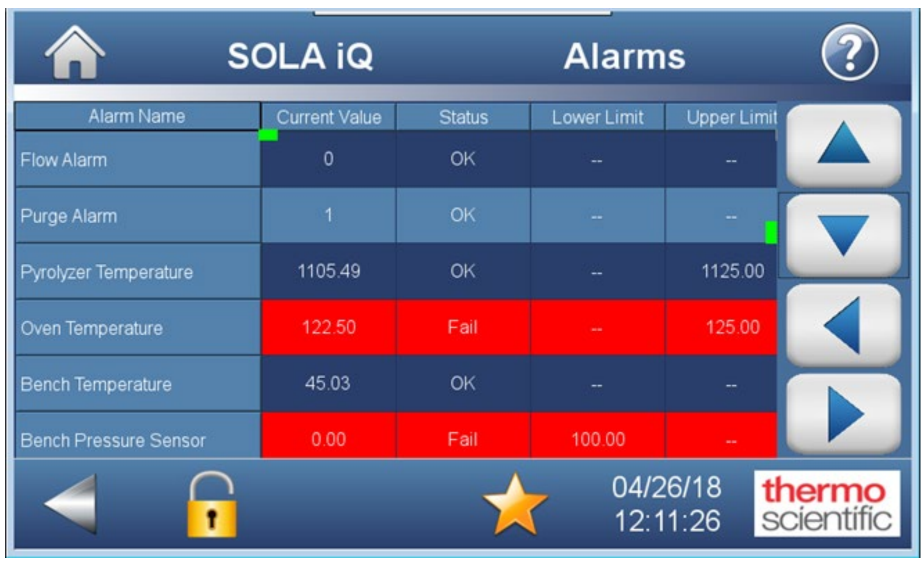


Figure 6–3. Alarms page indicating an alarm condition

When a parameter is in the Alarm State, the data fields for the parameters will be displayed in red (see Figure 6–3). During an Alarm condition, a floating red triangle will appear at the bottom of the Front Panel display.

When there are no Alarm conditions, the data fields will be displayed in blue (see Figure 6–4). When the Alarms are all cleared, a green check mark will be displayed instead of the flashing red triangle at the bottom of the Front Panel display.

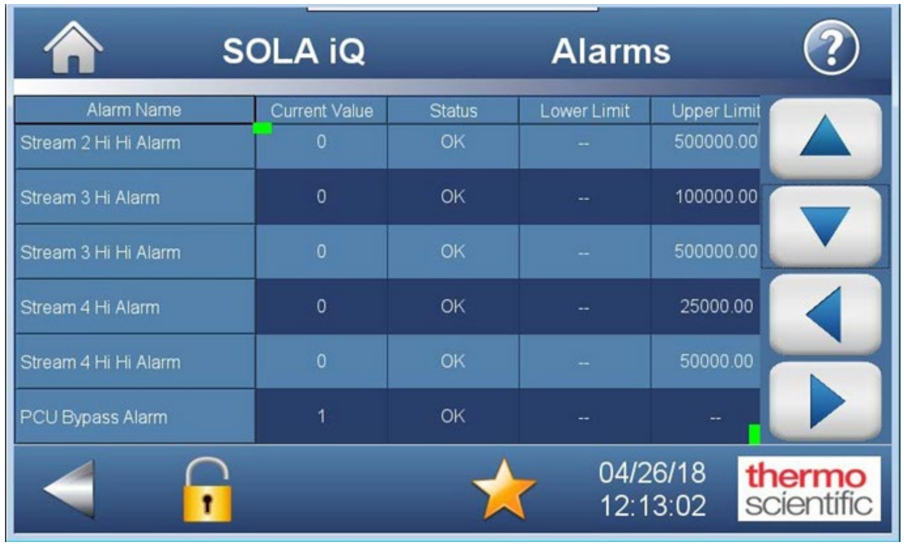


Figure 6–4. Alarms page indicating no alarms

The up and down arrows on the right hand side of the alarms page are used to scroll through the various Alarms. The following Alarms are displayed:

1. Communications Alarm
2. Flow Pressure Comm Alarm
3. 43 DMC Comm Alarm
4. 10 Comm Alarm
5. Malfunction Alarm
6. Offline Alarm
7. Flow Alarm
8. Purge Alarm
9. Pyrolyzer Temperature
10. Oven Temperature
11. Bench Temperature

12. Bench Pressure Sensor (this is the Chamber pressure)

13. Bench DP Pressure Sensor (this is the Chamber flow)

14. Lamp Intensity

15. Lamp Voltage

16. Lamp ROC Alarm (ROC is rate of change)

17. Stream 1 Hi Alarm

18. Stream 1 HiHi Alarm

19. Stream 2 Hi Alarm

20. Stream 2 HiHi Alarm

21. Stream 3 Hi Alarm

22. Stream 3 HiHi Alarm

23. Stream 4 Hi Alarm

24. Stream 4 HiHi Alarm

25. PCU ByPass Alarm (PCU is the Purge Control Unit)

The Malfunction Alarm is a bundled alarm that can be transmitted from the SOLA iQ. It is activated when one of the following parameters goes into an Alarm state:

1. Flow Alarm

2. Purge Alarm

3. Pyrolyzer Temperature

4. Oven Temperature

5. Bench Temperature

6. Bench Pressure Sensor

7. Bench DP Pressure Sensor

8. Lamp Intensity

9. Lamp Voltage

10. Lamp ROC Alarm

The left and right arrows scroll the Alarm Data Fields. The following Data Fields are displayed:

1. Current Value

2. Status

3. Lower Limit

4. Upper Limit

5. Deviation

AutoCONFIG Software Alarms

In the AutoCONFIG Software, Alarms status information is found on the Alarms page of the SOLA_III_Params preconfigured screen (see Figure 6–5).

AutoCONFIG has an Audit/Alarm Data Log. This is accessed from the Miscellaneous tab on the AutoCONFIG Navigation Bar. Open 193-Audit/Alarm Data Log Allocation in the Navigation Bar. Click on Audit Log #1 to access the Audit/Alarms page. Click on Alarms under Total Retrieval Records and then click on Retrieve Data. The Alarm Log appears at the bottom of the page. Scroll through the log to view the details of the log (see Figure 6–6).

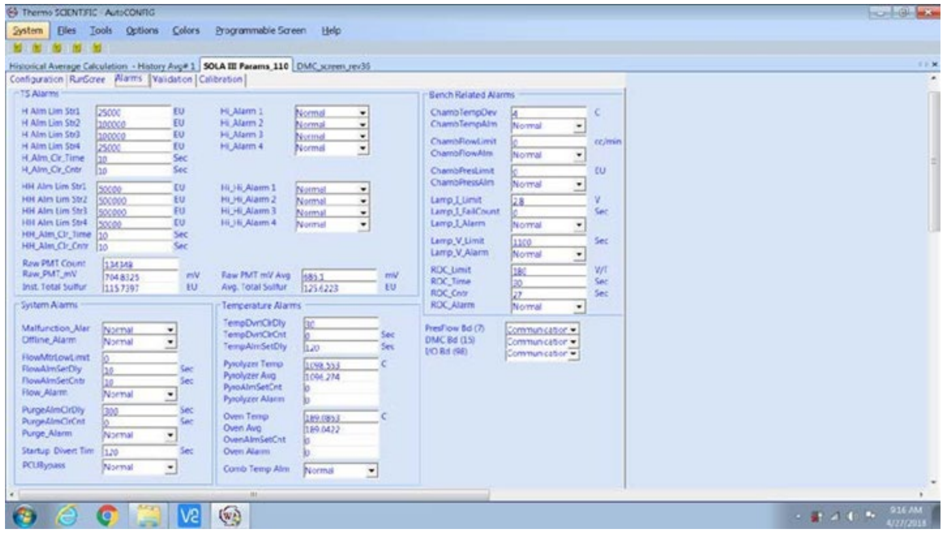


Figure 6–5. Alarm page of the SOLA_III_Params preconfigured screen in Auto CONFIG

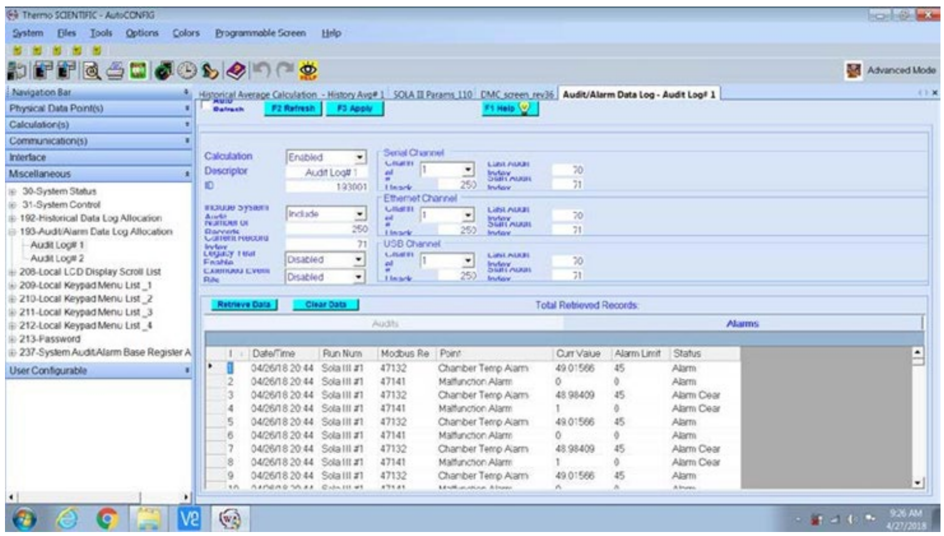


Figure 6–6. AutoCONFIG Alarm Log

Chapter 7
Diagnostics

Diagnostics on the SOLA iQ is available from two sources: 1) the Front Panel Display and 2) the AutoCONFIG software.

The Front Panel Display is used during normal day-to-day operation of the SOLA iQ. The diagnostics available from the Front Panel Display are designed to allow the operator access to status information and controls needed for day-to-day operations. The information and controls available via the AutoCONFIG software are more extensive compared to the Front Panel Display. The AutoCONFIG information and controls allows for an in-depth analysis of the SOLA iQ operation.

The Diagnostics page of the Front Panel Display is accessed by pressing the Data button on the Home page. On the Data Screen page, press the Miscellaneous button to reach the Data Group: Diagnostics screen. (see Figure 7–1).

Figure 7–1. Data Screen

The following diagnostic information is available from the Data Group: Diagnostic screen (see Figure 7–2).

Figure 7–2. Data Group: Diagnostics page

1. Power Up Divert Clear Cnt (Cnt means Counter)
2. Temp Divert Clear Cnt
3. Pyro Alarm Set Cnt
4. Oven Alarm Set Cnt
5. Purge Time Left
6. Stream Time Left
7. Range Switch Cnt
8. PMT Count
9. Bench Heater %
10. Input Board Gain
11. Detector Board Gain
12. Purge Alarm Clear Cnt

All the values, except for the PMT Count, Bench Heater %, Input Board Gain and Detector Board Gain, are reported in units of seconds. The term Cnt means counter.

Additional Diagnostics information can be found by processing the View Diagnostics button on the Data Screen (see Figure 7–1) to access the Diagnostics screen (see Figure 7–3).

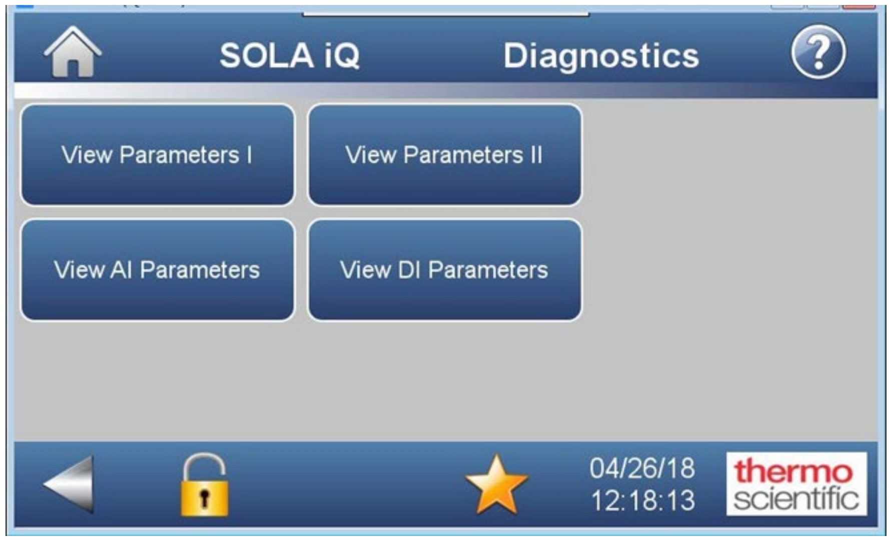


Figure 7–3. Diagnostics

There are four buttons on the Diagnostics screen:

1. View Parameters I
2. View Parameters II
3. View AI Parameters
4. View DI Parameters

The following diagnostic information can be found using these four buttons:

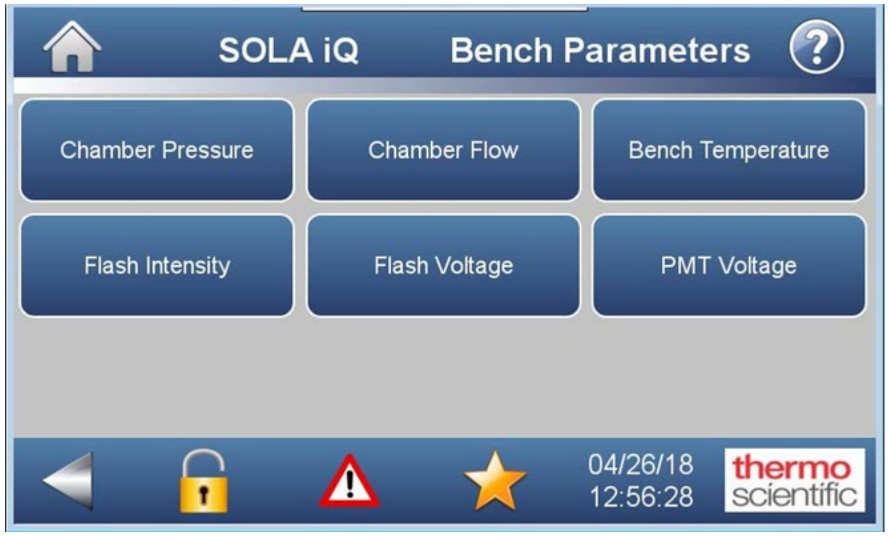


Figure 7–4. View Parameters I > Bench Parameters

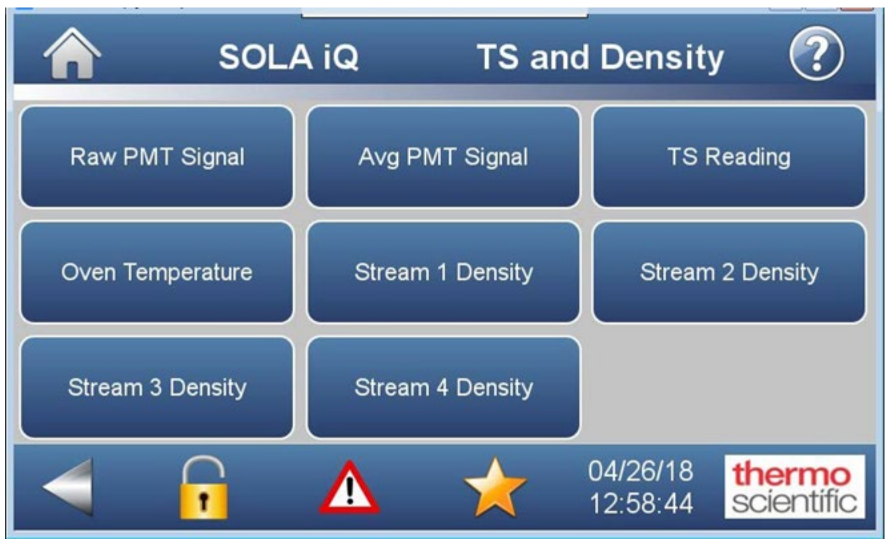


Figure 7–5. View Parameters II > TS and Density

Figure 7–6. View AI Parameters > Analog Input

Figure 7–7. View DI Parameters > Digital Input

The parameter information provided under Bench Parameters and TS and Density pages are:

1. The current value
2. The minimum value
3. The maximum value
4. The average value

A Clear button is also provided. Since the SOLA iQ can monitor up to four streams, parameter information for up to four sample stream densities is available. A density meter needs to be installed in each sample stream and the signal output of the density meter must be wired and installed into the SOLA iQ for the density parameter information to be displayed. Without a density meter, no parameter information is available.

Accessing diagnostics using the AutoCONFIG software is done by viewing the various pre-configured SOLA iQ screens. Information related to the content of the various pre-configured screens can be found at the beginning of Chapter 4, "Operation".

Chapter 8
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. ▲

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

- 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.
- Handle all printed circuit boards by the edges.
- Carefully observe the instructions in each procedure. ▲

Maintenance Schedule

Table 8–1. Maintenance Schedule

Frequency	Tasks
Monthly	Calibrate the analyzer (Chapter 5).
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.
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. ▲

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 Test

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

Note For analyzer systems equipped with a back pressure regulator downstream of the sample injection valve, the inability to establish a backpressure reading on the regulator gauge is an indication that a leak exists in the sample containment system. ▲

1. Set the Clean Air (plus Nitrogen and Sample if installed) regulators for zero pressure.

2. Replace the tubing from the EXHAUST union in the Pneumatics section on the left side of the instrument with a plug. At the EXHAUST union, the Pyrolyzer exit gas-tubing changes from Sulfinerted Stainless Steel to plastic tubing.

3. Adjust the Clean Air regulators (Nitrogen if installed) for 20-psig pressure.

4. Allow the system pressure to stabilize. Because of the flow restrictors downstream of the regulators, stabilization may take about 10 minutes to occur.

5. After the system pressure has stabilized turn the Clean Air (Nitrogen if installed) air regulators fully counterclockwise to close the supply flow.

6. Watch the clean Air (Nitrogen if installed) pressure gauges for 15 minutes.

7. 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.

8. When the system passes the leak test, make sure that the Clean Air (plus Nitrogen and Sample if installed) regulators are turned fully counterclockwise to close supply flows.

9. Remove the plug from the EXHAUST union and reconnect the EXHAUST vent line.

10. Adjust the Clean Air (plus Nitrogen and Sample if installed) regulators to the pressures specified in the application notes shipped with the instrument or as recorded in the instrument logbook.

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

UV Control

Access the UV Control from the Home Page by pressing the Setting Button. Press the Instrument Setting button and then press the Expert button to access the Expert page (see Figure 8–1). Press the Diagnostics button to access the Diagnostics Setting page. The UV Control button is on the Diagnostics Settings page (see Figure 8–2). On the UV Control page (see Figure 8–3), it is possible to turn the Flash Lamp on or off or the test LED on or off.

Figure 8–1. Expert Page

Explanation of Expert buttons:

AutoCFG Sync – Press to ensure changes made by AutoConfig software are synchronized with the touchscreen. You should see the 'gear' icon when the button is pushed. The synchronization is completed within a few seconds and the AutoCFG Sync button can then be pushed again to turn off synchronization and the 'gear' icon should vanish.

Diagnostics – Press to enable testing Analog, Digital or Pneumatic Outputs or to access the UV Control screen.

Erase Cal History – Press to delete the logged calibration data.

Enable Alarm Log – Press to add historical alarms to the logged data.

Enable Fast Sync – Used for screen program debugging. Not recommended for normal operation.

Enable Gui Pulse Check – Prevents intermittent screen freeze. Recommend this remain Enabled.

Gui Pulse Check Interval – Recommend 60 seconds.

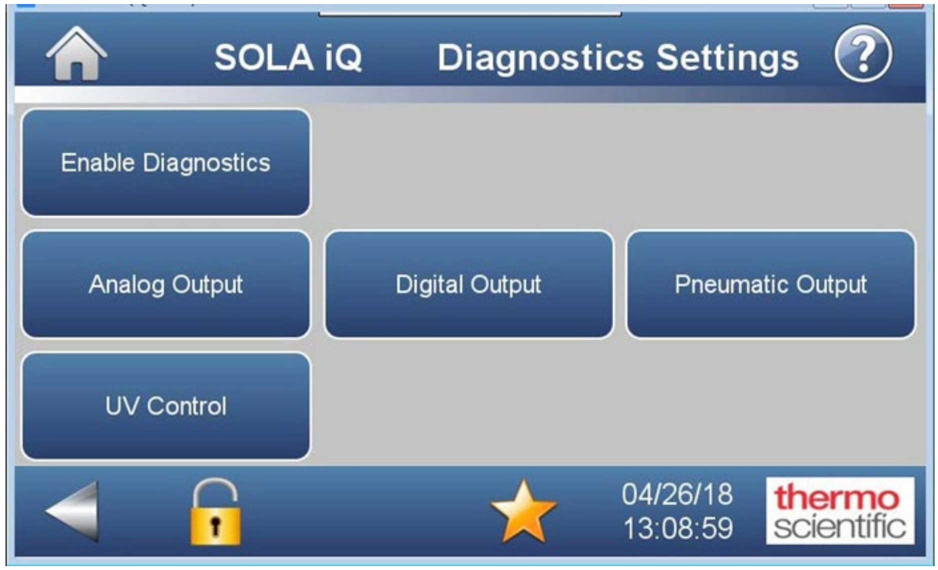


Figure 8–2. Diagnostics Settings page

Flasher ON and OFF: When the Flasher is ON, the field color is yellow. It is also possible to turn on a LED light instead of the Flasher. The LED can be used to diagnose potential Flasher operational issues.

Figure 8–3. UV Control

Figure 8–4. Three-way measure Valve

Flow Rate Checks

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. Stop the injection valve (see Stop Injections Chapter 4). From Display: Home page > Calibration> Stop Injections. From AutoCONFIG: SOLA iQ Params page > Configuration tab > Configuration Parameters section > Stop Injection change to Yes and press the F3 Apply button.

5. Turn the MEAS. CLEAN AIR 1 3-way valves towards the measure port line 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 away from the port for normal operation.

8. Turn the MEAS. CLEAN AIR 2 (or NITROGEN) 3-way valves towards the measure point line for flow measurement.

9. Connect the flow meter to the MEAS. CLEAN AIR 2 (or NITROGEN) 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 away from the port for normal operation.

11. Turn the MEAS. CLEAN AIR 3 (if installed) 3-way valves towards the measure port line for flow measurement.

12. Connect the flow meter to the MEAS. CLEAN AIR 3 (if installed) port and adjust the CLEAN AIR 1 regulator to obtain the required flow.

13. Turn the MEAS. CLEAN AIR 3 (if installed) 3-way valves to point away from the port for normal operation.

14. Restart the analyzer according to Chapter 3.

The Mixing Chamber

1. Shut down the system according to Chapter 3.

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. ▲

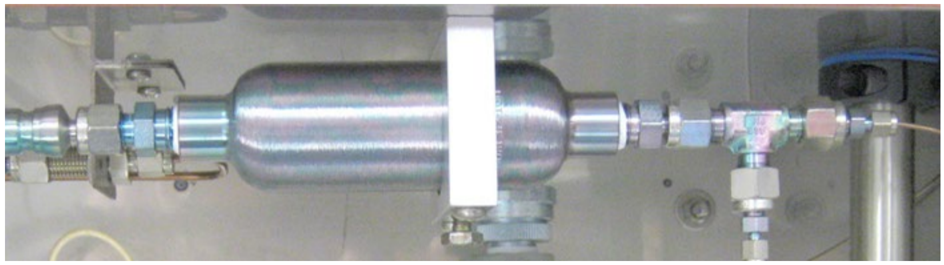


Figure 8–5. Mixing Chamber

Replacing the Pyrolyzer Heater

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

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

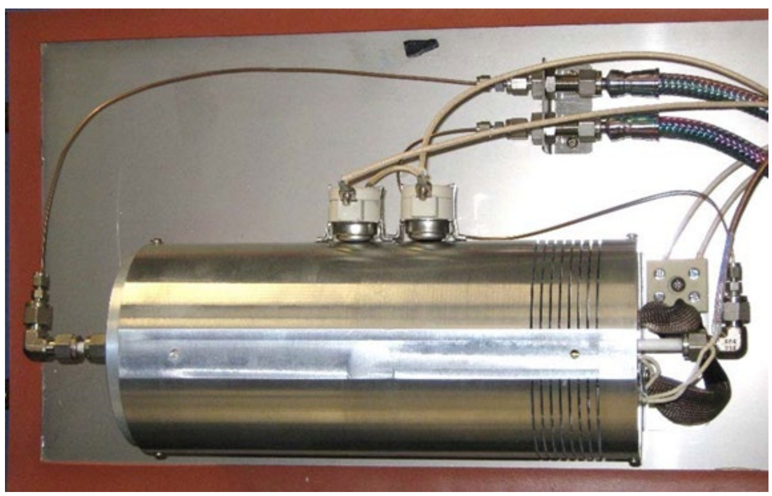


Figure 8–6. Pyrolyzer assembly Mounted on Oven Door

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 8–2. Parts list for heater replacement

P/N	Qty	Description
204-310-261 (ATEX/IECEx V/CV/F), otherwise 204-310-258	1	Heater element
6-5350-013	1	Thermocouple, S-type
56-1074-0	1	Terminal, 2 pole ceramic block, 30 A
HA-101812	2	Ferrule, 1/4 graphite

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

2. Carefully remove the two fittings from the end of the Pyrolyzer reaction tube to the left and right of the Pyrolyzer housing using a backup wrench to keep the stainless steel fittings from turning (see Figure 8–7 and Figure 8–8).

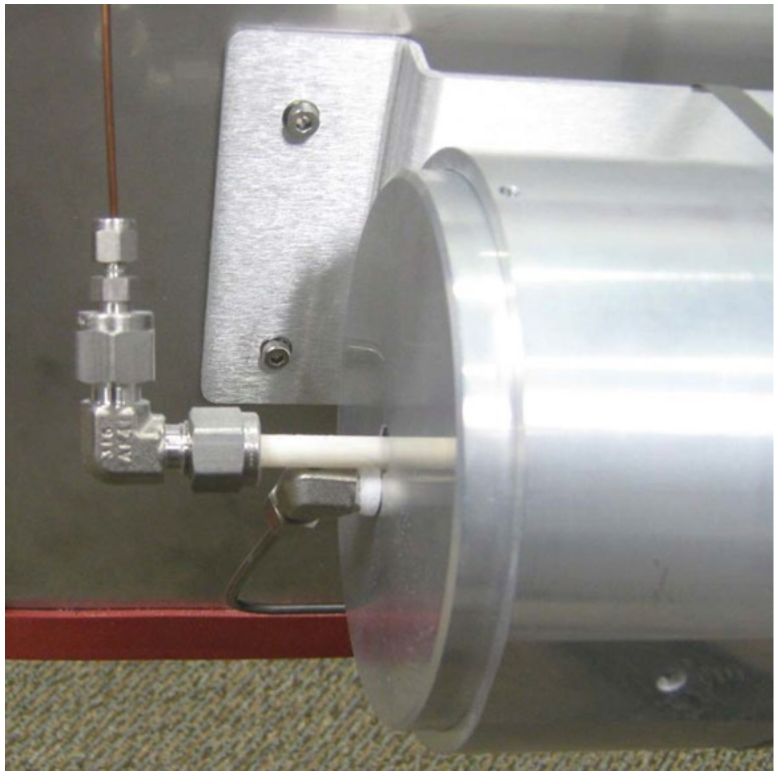


Figure 8–7. Pyrolyzer Fittings - left

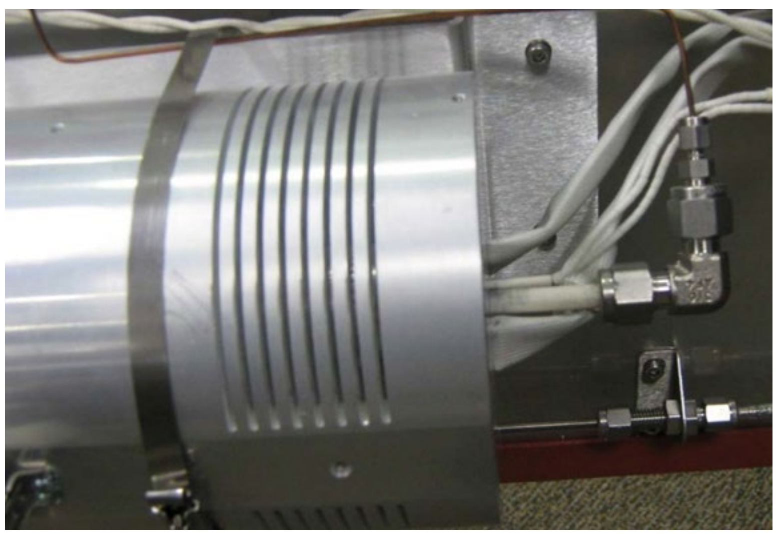


Figure 8–8. Pyrolyzer Fittings – right

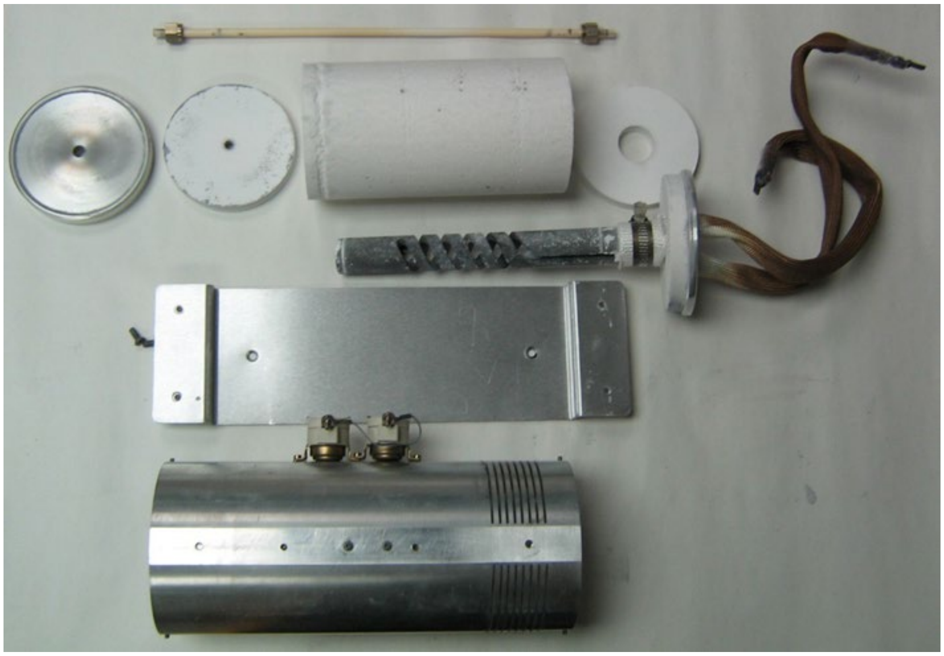


Figure 8–9. Disassembled Pyrolyzer

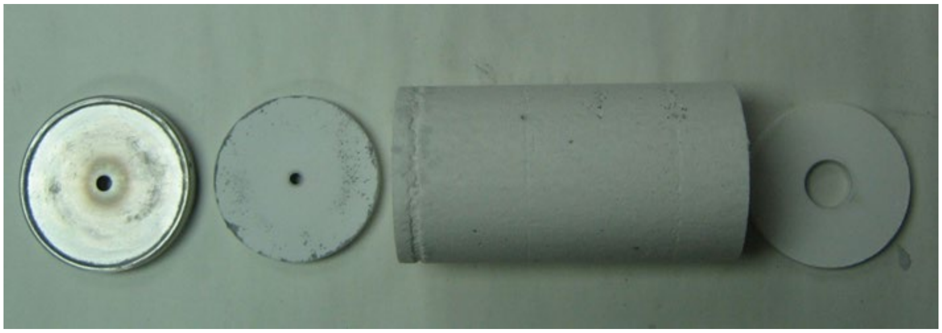


Figure 8–10. Pyrolyzer Insulation

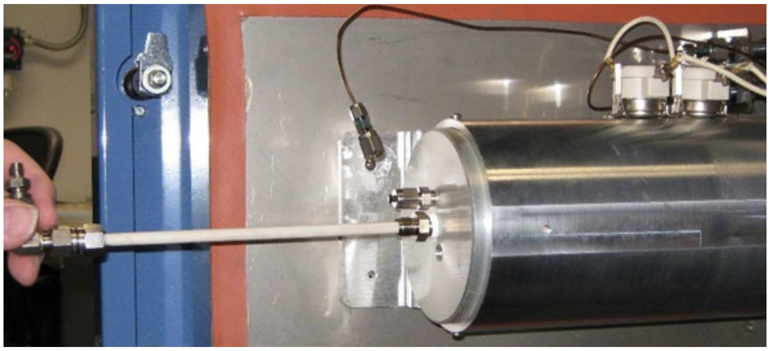


Figure 8–11. Remove Pyrolyzer Reaction Tube

3. Carefully remove the thermocouple from the right hand side of the Pyrolyzer. The hole for the Thermocouple is adjacent to the hole for the Pyrolyzer reaction tube see Figure 8–9).

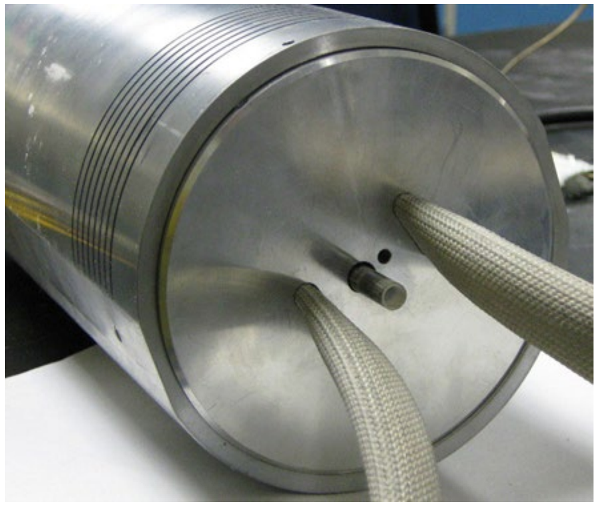


Figure 8–12. Pyrolyzer Thermocouple hole

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

5. Disconnect the two Pyrolyzer heater element wires from the ceramic terminal block.

6. There are four screws that connect the base plate of the Pyrolyzer assembly to the Oven door. Remove the bottom two screws. Do not discard the mounting screws. You will need them later.

7. Support the Pyrolyzer assembly while removing the top two mounting screws that hold it to the Oven door. After both screws have been removed, the Pyrolyzer can be removed from the Oven. Do not discard the mounting screws. You will need them later.

8. Remove the two screws that hold the Pyrolyzer end cover. Remove the cover and set it aside.

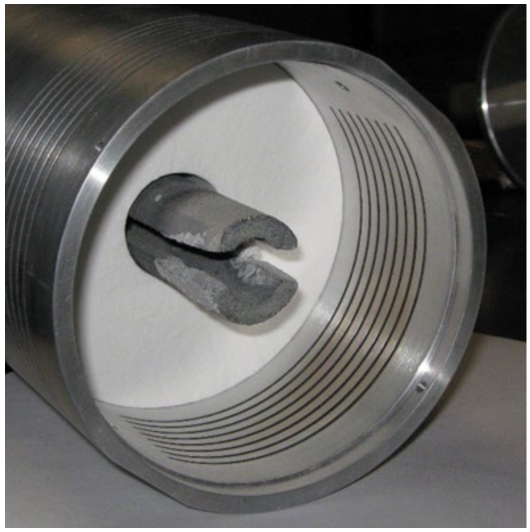


Figure 8–13. End view Silicon Carbide Pyrolyzer Heating Element (without electrical connections)

Figure 8–14. Heater Element with End Cap and Wires

Figure 8–15. Pyrolyzer Heater Element

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

10. Remove the thermocouple from the housing. Set it aside for re-installation later.

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

12. Insert the replacement heater into the housing. Feed the two heater wires through the two slots of end housing.

13. Slide the wire sleeves onto the heater wires. Tighten the fittings

14. Carefully re-install the thermocouple

15. Insert the ends of the heater power wires into the terminal block and tighten them.

16. Use the four screws removed earlier to Pyrolyzer assembly to the Oven door.

17. If necessary, reconnect the wires for the Oven temperature switches.

18. Reconnect the sample tubing.

19. Perform a leak check.

20. After successfully performing a leak check, follow the initial startup procedure in Chapter 3 to restart the analyzer.

The Pyrolyzer Reaction Tube

Replacement

Follow the steps below to replace the Pyrolyzer tube:

1. Let the Pyrolyzer cool before replacing the tube. When the ceramic tube is hot, it is more brittle.

2. To remove the existing Pyrolyzer tube, disconnect the fittings at each end of the tube and pull the tube out. Use protective gloves in the event that the tube is still too hot to handle with bare hands.

3. Carefully push the end of the replacement Pyrolyzer tube through fitting hole.

4. Reconnect the fittings and perform a leak check.

Figure 8–16. Pyrolyzer reaction tube attached

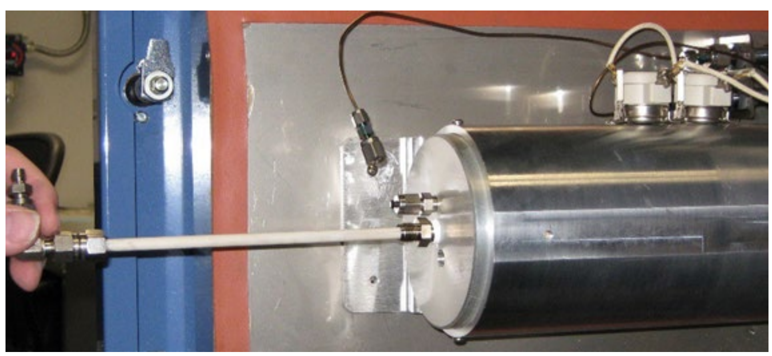


Figure 8–17. Pyrolyzer tube removed/inserted through fitting

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 Decoking the Pyrolyzer reaction tube is not recommended. Instead, replace the tube according to the previous section. ▲

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. ▲

In the event of problems or failure, the troubleshooting guidelines presented in Table 8–3 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 8–3. Troubleshooting

Malfunction	Possible Cause	Action
Analyzer does not start up	No power	Ensure instrument is connected to the proper source. Ensure power switch inside Electronics enclosure is in the ON position.
	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.
	Lamp Do not look directly into lamp without proper eyewear!	Remove lamp and socket from flash holder by loosening the single setscrew. Lamp flash should be clearly visible at 20 yards distance in well-lit room.
	Digital electronics	Replace board one at a time to isolate faulty board.
	Low or no sample flow	1. Check trend of chamber flow from either the Front Panel Display or using AutoCONGIG. 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. 3. Check sample filter and ensure that it is not plugged.
ALARM displayed: Bench Pressure	-Plugged chamber exit line	– Check lines
ALARMdisplayed: Bench DP Pressure (Chamber Flow)	- Plugged line from mixing chamber to valve - Inadequate supply of combustion air	- Check lines.
ALARM displayed: Lamp Voltage	- 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: Bench (Chamber) Temperature	- Detector temperature not stabilized after service or enclosure opened - Ambient temperature or purge air is outside ambient temperature limits	- Close doors and allow system to stabilize. - Measure ambient and purge air temperatures and correct as necessary.

Malfunction	Possible Cause	Action
	- Thermistor not positioned correctly	- Reposition Thermistor.
ALARM displayed: Pyrolyzer Alarm	- Instrument is starting up and has not reached the Pyrolyzer control temperature - Pyrolyzer heater failure - Pyrolyzer temperature failure	- Normal alarm during startup until Pyrolyzer temperature stabilizes. -Oven purge pressure switch is in Active position (in AutoCONFIG). - 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: Oven Alarm	- Instrument is starting up and has not reached the Oven control temperature - Oven heater failure - Oven temperature failure	- Normal alarm during startup until Oven temperature stabilizes. -Oven purge pressure switch is in Active position (in AutoCONFIG). - Check Oven 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 Oven heater contacts and measure heater continuity. Replace heater if it shows open. - Check electronics and replace if necessary.
ALARM displayed: Lamp ROC	- Injection valve worn or scratched, causing port-to-port leakage -Defective flasher lamp, trigger pack, or photodiode used for lamp intensity	- 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 pack, and photodiode. Replace if necessary.
ALARM displayed: Purge Alarm	- 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 PMT related 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.

Malfunction	Possible Cause	Action
		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 pack	Replace.
Low lamp intensity	Flasher lamp	Ensure lamp and trigger pack are securely fastened.
43 DMC Comm Alarm Fail	Missing link DMC board J1 to Back Plane Board J21	Inspect/replace cable p/n TE-118118-18.
	DMC Board failure	Replace board p/n 3-0755-241.
	Back Plane Board failure	Replace board p/n 3-0755-006.
43 DMC Comm Alarm Fail and IO Comm Alarm Fail	Missing link Serial Term Board J2 to Back Plane Board J24	Inspect/replace cable p/n 3-0755-086.
	Serial Term Board failure	Replace board p/n 3-0755-015.
	Back Plane Board failure	Replace board p/n 3-0755-006.
Flow Pressure Comm Alarm Fail and LED's operate normally on F/P Board	Missing link Serial Term Board J4 to F/P Board J2	Inspect/replace cable p/n 3-0755-244.
	Serial Term Board failure	Replace board 3-0755-015.
	F/P Board failure	Replace board p/n TE-117613-04.
Flow Pressure Comm Alarm Fail and all LED's Off on F/P Board	Missing link Back Plane Board J19 to F/P Board J1	Inspect/replace cable p/n 3-0755-245.
	Back Plane Board failure	Replace board p/n 3-0755-006.
	F/P Board failure	Replace board p/n TE-117613-04.
All Comm Alarms Fail or no updated values except for system clock	Missing link APP Board TB16 to Video Adapter Board J4	Inspect/replace cable p/n 3-0755-087.
	APP Board failure	Replace board p/n 3-0500-003.
	Video Adapter Board failure	Replace board p/n 3-0755-048.
No Comm Alarms shown but system will not power heaters (Temperature alarms will probably be active)	Missing link App Board TB15 to Power Board J9 (I2C)	Inspect/replace cable p/n 3-0755-081.
	APP Board failure	Replace board p/n 3-0500-003.
	Power Board failure	Replace board p/n 3-0755-009.
Other critical electronics	I/O board	p/n 3-0755-003
	Touch Screen board	p/n 4-0755-016-03
	System Control Board	p/n TE-113371-00

[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.

27 Forge Parkway Franklin, MA 02038 USA +1 (800) 437-7979	Ion Path, Road Three Winsford, Cheshire CW7 3GA UNITED KINGDOM +44 (0) 1606 548700 +44 (0) 1606 548711 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
A-101, 1CC Trade Tower Senapati Bapat Road Pune 411 016 Maharashtra, INDIA +91 (20) 6626 7000 +91 (20) 6626 7001 fax		
www.thermofisher.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.

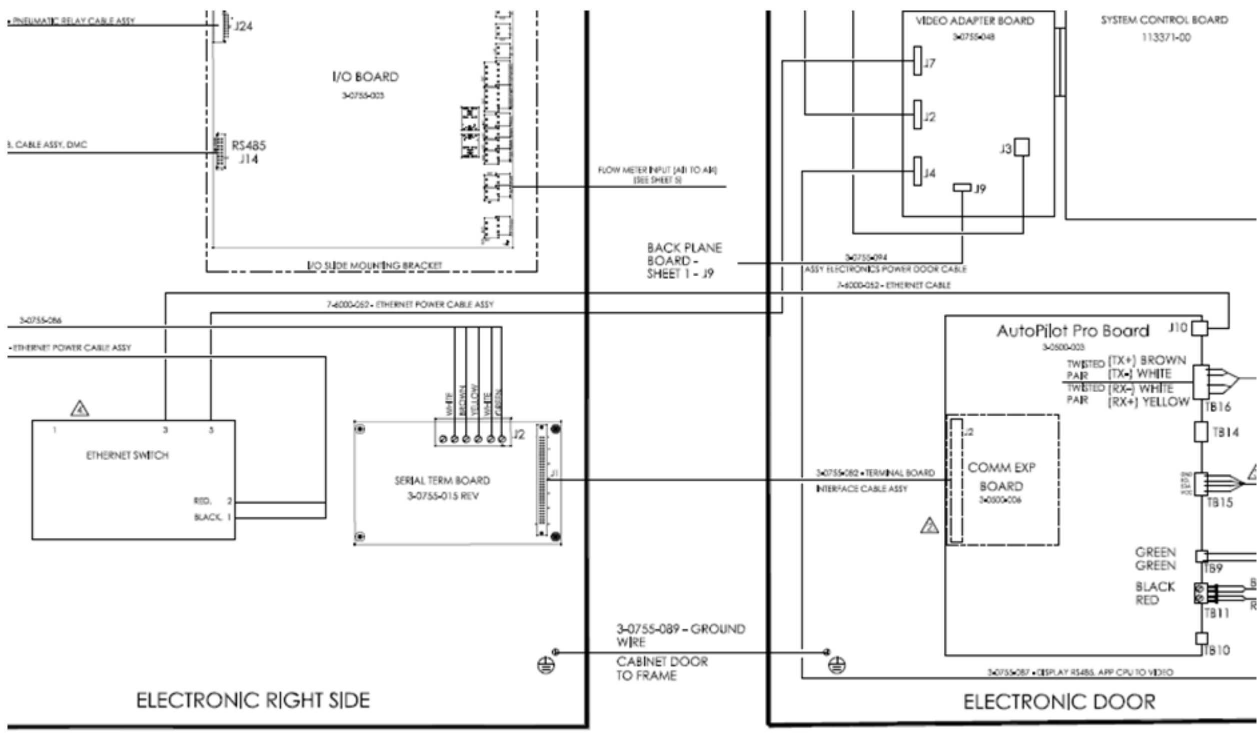
Items not Covered under Warranty

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, ceramic
- Pyrolyzer tube graphite ferrules

Chapter 9
Remote Access

Remote access to the SOLA iQ is accomplished via an Ethernet cable connection to the Ethernet Switch located on the right hand side of the electronics enclosure.



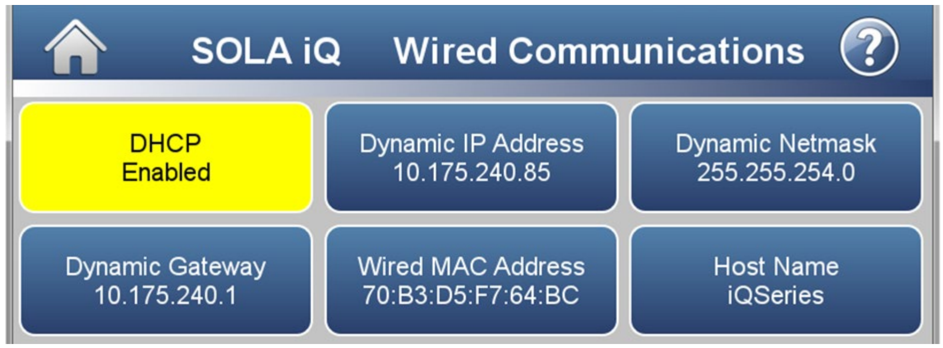
Remote Connect

There are two ways to view the SOLA iQ operation remotely:

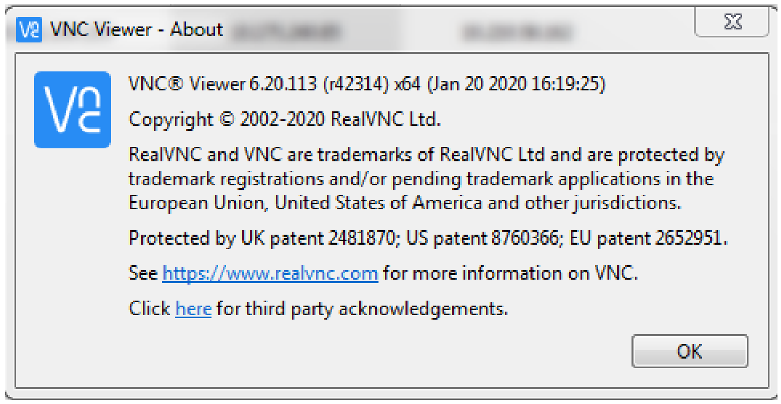
1. Connect to the Front Panel Display via ePort or VNC Viewer software.
2. Connect to the AutoPilot Pro (APP) via AutoCONFIG software.

Both means of remote access require knowledge of the IP address of the analyzer. Both devices may have password security enabled. Password security for the Front Panel Display is discussed in Chapter 5 of this User Guide under Analyzer Setup. Password security for the APP is discussed later in this chapter.

The IP Address of the SOLA iQ Front Panel Display can be either Dynamic or Static. The IP address can be found from the Display Communications page of the System Settings submenu. After accessing the Communications page, access the Wired TCP/DHCP page to see the Dynamic or Static IP Address.

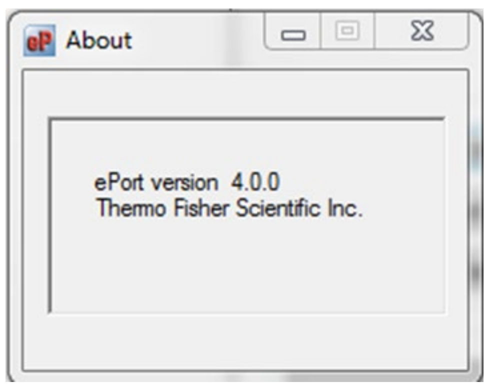


Once you know the IP address, you may connect through a network or Ethernet cable to the Front Panel Display with VNC Viewer or ePort. VNC Viewer is 3rd party software available for free download at https://www.realvnc.com.



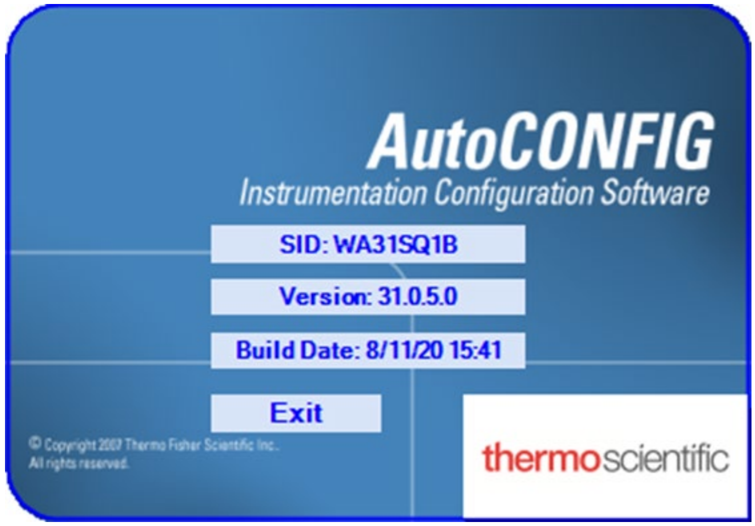
ePort is available for free download from the Thermo Fisher product page for the SOLA iQ at https://www.thermofisher.com/order/catalog/product/SOLAIQ#/SOLAIQ

For more information regarding ePort, please contact Thermo Fisher Scientific and request the iQ Series Communication Manual p/n 117082-00.



Screen images from the SOLA iQ in this User Guide were created both from ePort and VNC Viewer.

The AutoPilot Pro (APP) has a Static IP address that is only viewable through the AutoCONFIG software. The Static IP address is set at the factory and recorded on the Calibration Specification Sheet. The Static IP address for the APP may be changed to match local network requirements. Changing or discovering the Static IP address is only possible with a computer running the AutoCONFIG software and connected to the local serial port of the APP board. Refer to the procedure later in this chapter to change or discover the APP Static IP address. AutoCONFIG is available for free download from the Thermo Fisher product page for the SOLA iQ at https://www.thermofisher.com/order/catalog/product/SOLAIQ#/SOLAIQ



Password security for the AutoPilot Pro can be configured through AutoCONFIG using Table #213. This is a table of passwords that allows you to configure user IDs, passwords, and security access levels. The four access levels are:

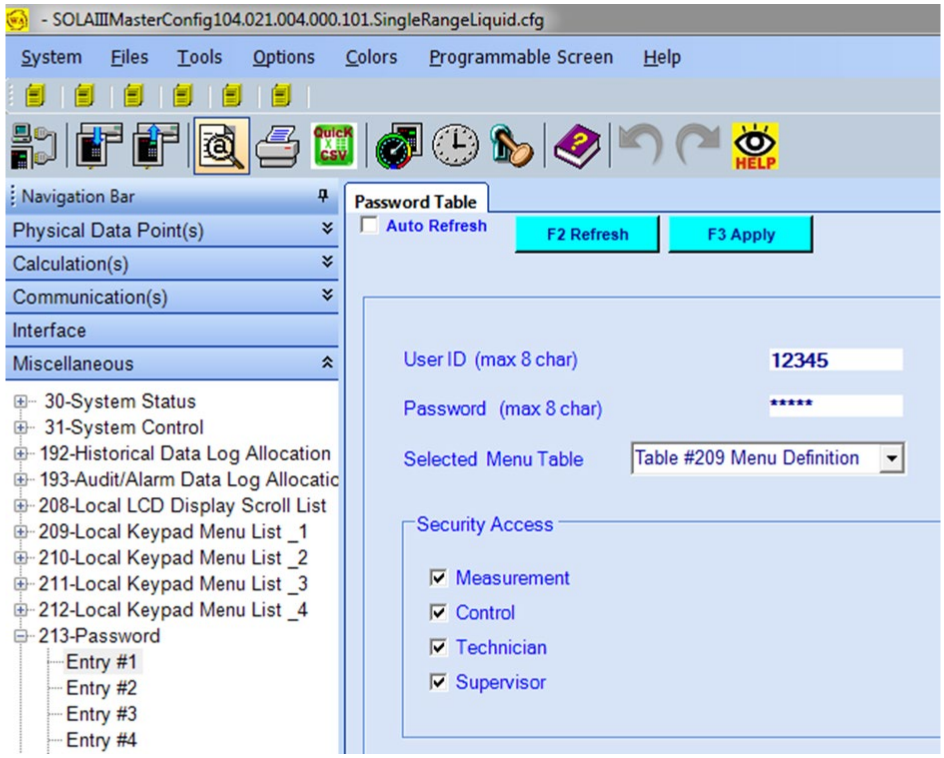
Supervisor: The highest security access level. Allows for access to calibration data and modification of all configuration parameters including passwords.

Technician: Second highest level of security access. Identical to Supervisor, except cannot modify passwords.

Control: Can access tables pertaining to control functions only, PID for example.

Measurement: Can access tables pertaining to measurement functions only, DP flow calculation for example.

Refer to the AutoCONFIG software Help for additional information regarding how to set user IDs, passwords and security access levels.



To set a password in the AutoPilot Pro, enter your desired User ID and Password and select which access levels will be password protected. In the example shown above, all access levels will be password protected.

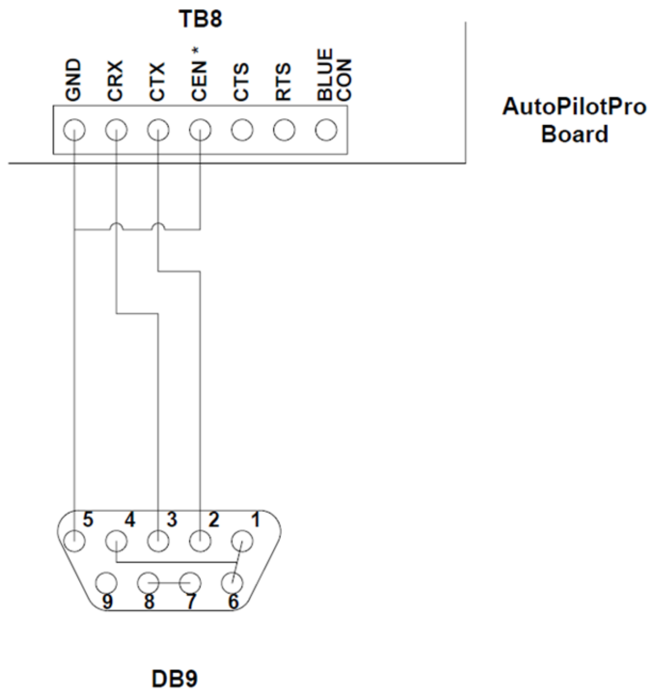
Do not lose your User ID and Password! The only way to recover if you forget the User ID or Password is to perform a Cold Restart and load the last known good configuration. This is a good reason to make frequent backups of the configuration file whenever changes are made to the system. Please contact Thermo Fisher Scientific for assistance if you need to recover from a lost User ID or Password.

Direct Serial Connection to Local Port of the AutoPilot Pro:

To make a direct serial connection to the Local Port of the AutoPilot Pro, please follow these steps:

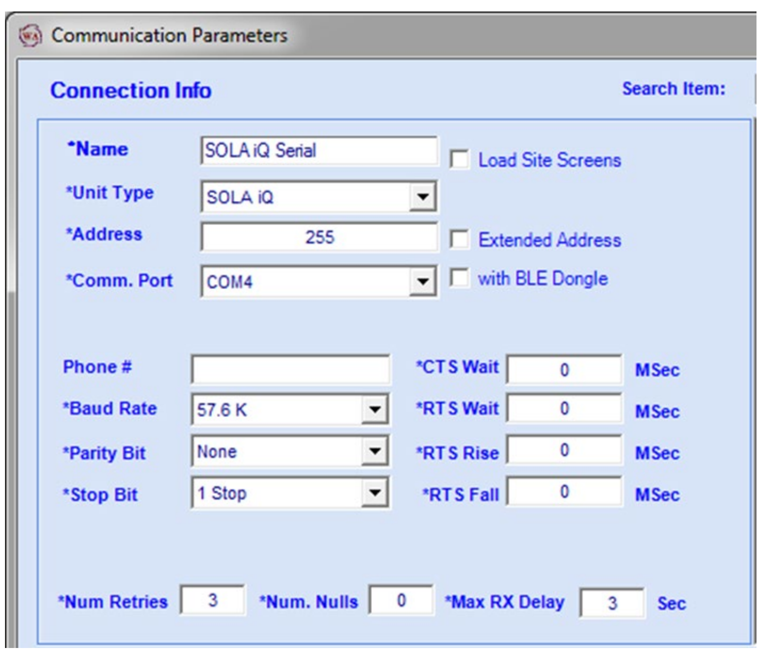
1. When it is safe to do so, open the electronics enclosure door. If the system is fitted with a Purge Control Unit then the bypass key-switch needs to be turned ON to allow mains power to be turned on while the electronics enclosure door is open.

2. Locate the APP Board on the inside of the electronics door. Connect a serial cable between connector ‘TB8’ on the APP board and the PC with AutoConfig installed as shown in the following wiring diagram:



Note It is necessary to communicate with the APP board via its serial port NOT through Ethernet. ▲

3. Refer to the figure below for an example serial configuration for AutoCONFIG (your COMM port number may be different):

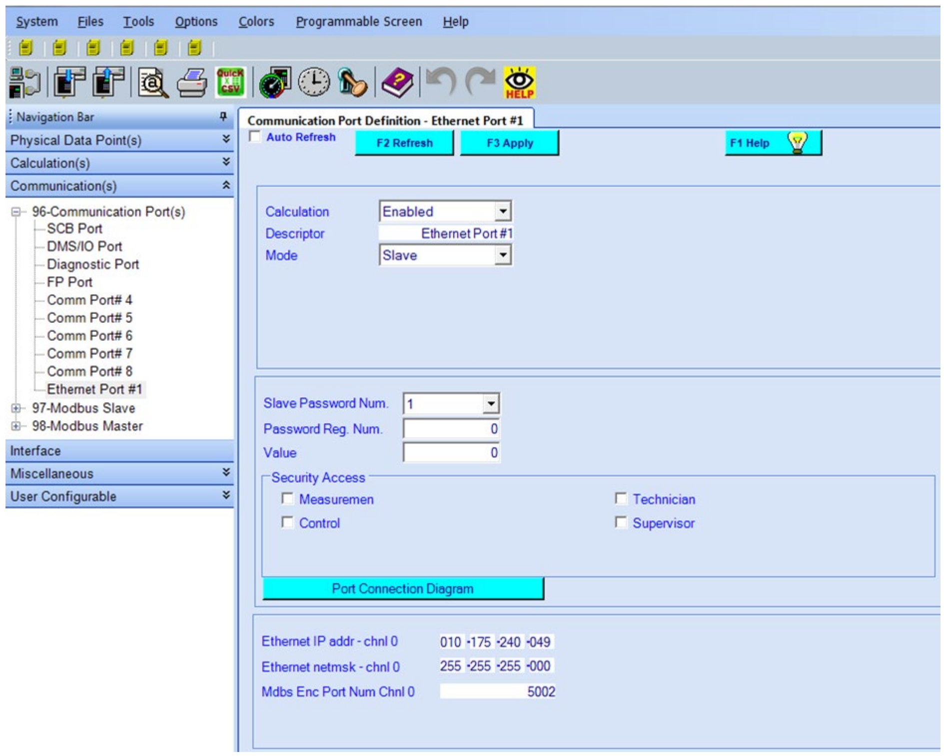


4. Start AutoConfig on the PC/Laptop & connect to the APP board.

When connected it is highly recommended to first take a backup of the existing configuration file and save it in a safe location. The configuration file can be loaded from the APP board (referred to as the RTU within AutoConfig) using the menu option under 'Files' at the top left of the AutoConfig screen.

Discovering or Changing the APP Ethernet IP Address

To see the Ethernet Static IP address, select Communications – 96-Communication Port(s) – Ethernet Port #1.



To change the Ethernet Static IP address, enter a new valid address at Ethernet IP addr - chnl 0. Change the Ethrnt gateway - chnl 0 to match the desired network address. Press F3 Apply and perform a Warm Start (select Tools - Warm Restart) to enable the changes.

Chapter 10
The Purge Control Unit

Description

The Purge Control Unit (PCU) 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 exhaust port enclosure is lost. The Purge Control Unit 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 Purge Control Unit 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, a time delay relay begins its timed cycle (Note that the electronics and Oven purge air pressure needs to be above 5 psig). 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 and Oven enclosures.

An independent a bottled air backup source supplies air for purging the instrument in the event that instrument air pressure is lost. The inlet for this air is labelled a “backup purge”. Refer to the label on the instrument for purge time requirements.

Warning Failure to allow adequate cooling before opening the Oven can lead to injury of personnel or damage to equipment. ▲

Warning Before attempting to install the Purge Control Unit (PCU), review the material in Chapter 1 of this guide, all safety information in this guide and all other applicable documents. ▲

Warning All the flameproof joints of the Purge Control Unit (PCU) are not intended to be repaired. ▲

Warning Installation of the PCU requires an external lockable electric power isolation switch supplied by the customer. ▲

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

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

Figure 10–1. Purge Control Unit

Specifications

Table 10–1. General Specifications

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 10–2. 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)
Electronic enclosure air pressure	Set to approximately 15 psig or as specified in the Application notes shipped with the analyzer.
Oven enclosure air pressure	Set to approximately 15 psig or as specified in the application notes shipped with the analyzer
Oven door	Closed tightly
Electronic housing door	Closed tightly

Table 10–3. Utility requirements

Utility requirements	
Instrument air	60-100 psig, 255-450 SLPM (9-16 SCFM)
Instrument air quality	Water and oil free, -40°C (-40°F) dew point, particles < 5µ, ISA grade, hydrocarbon free
AC power	120/240 VAC 50-60 Hz (wattage depends on the instrument controlled by the PCU)
Power Wire Specification	Use stranded 3-wire copper or tin plated copper rated for at least 600 Vac and 20 amps at the required length. 12 AWG wire is recommended

Installation

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

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

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.

The following table summarizes the AC power and wire information to be used when planning and connecting power to the analyzer.

Power Source Specification
120/240 VAC 50-60 Hz (Wattage depends on instrument controlled by the Purge Control Unit)
Power Wiring Specification
Use stranded, 3-wire copper or tin-plated copper power wire rated for at least 600 Vac and 20 amps at the required length. 12 AWG wire is recommended.

Warning This apparatus must be earth grounded. ▲

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

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

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 10–4. AC Power connections

Power	Terminal
Hot	TB1-1
Neutral	TB1-3
Ground	Ground Lug Adjacent to TB1 (Figure 10-2)

[1]Terminals 1 and 2 are jumpered together.

[2]Terminals 3 and 4 are jumpered together.

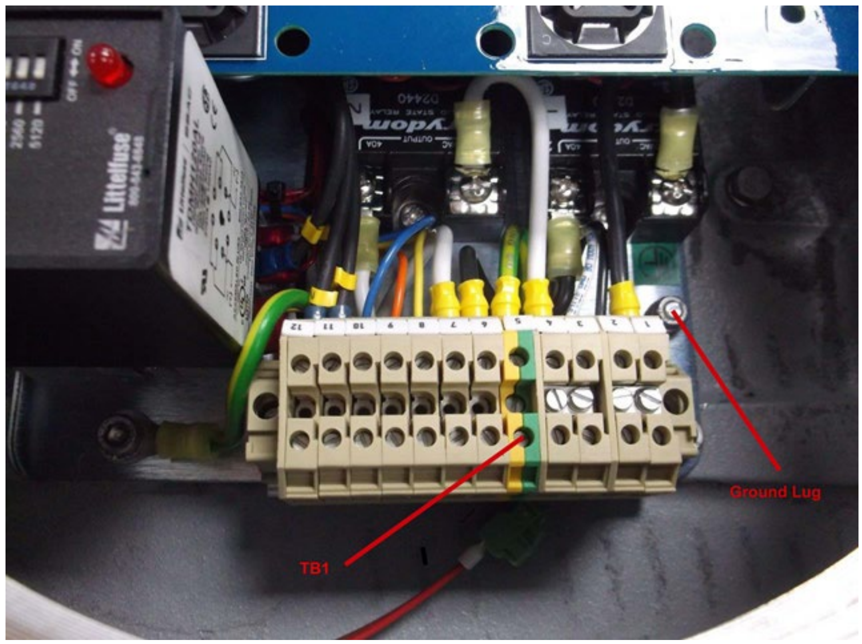


Figure 10–2. Purge Control Unit TB1 and Grounding Lug

Alarm Signal

The Purge Control Unit provides dry alarm contacts. To use the alarm contacts, refer to the following connection table. The alarm contacts are rated for 10 amps resistive at 120/240 VAC and 28 VDC.

Table 10–5. Connection Table

Alarm Terminal	Terminal #
Open on alarm (closed when power is applied to the analyzer system)	TB1 8-9
Closed on alarm (closed when purge is lost or during fast purge of analyzer system)	TB1 8-10

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. ▲

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 the area has been properly tested and is known as being free from explosive gases. ▲

Startup

The following procedure only addresses the application of power to the system. Consult the startup procedures in the instrument Users Guide for additional requirements for system startup.

1. Consult the startup procedures in the instrument Users 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 securely. Adjust the Electronics air pressure regulator to the value required for the analyzer (refer to the application notes or logbook for the analyzer).

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 30 minutes, but required time delay may vary depending upon the system hazardous area classification. 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. ▲

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.

e. Differential pressure switches are not closed at operating gauge pressures (electronics purge, oven air or pyrolyser purge, if fitted).

7. Complete the remaining steps listed in the analyzer startup procedure included in the startup instructions in the instrument Users 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. To remove power from the system manually, perform the following steps.

1. Perform all analyzer shutdown steps listed in the shutdown procedure in the instrument Users 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 Users 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. ▲

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

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. ▲

Timer Adjustment

The required time delay for safe operation is determined by the hazardous area classification of the instrument.

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. ▲

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 Scientific. ▲

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. ▲

The time delay relay is used to sets the length of delay before applying power to the analyzer system.. The duration of delay can be determined by the number the white timer arrow is pointing towards and the time range setting. Standard setup for SOLA iQ is:

Mode = A

Scale = 30

Range = min

Adjustments of the timer delay relay should not typically be required. However, settings on the timer delay relay can be changed using a flat head screwdriver to turn the options for either mode, scale or range if necessary. Please adhere to the time delay settings outlined on the product hazardous area certification.

Please refer to the figures below for information on time delay relay operation. When replacing the time delay relay, the switches on the new relay must be set to provide the time delay as specified by the minimum purge time listed on the tag mounted to the front door of the SOLA iQ.

Figures 10-3, 10-4 & 10-5 show default switch setting of 30 minutes. There are two LED lights on the switch, one red in color labelled 'out' and a second green in color labelled 'power'. During normal operation both LEDS should be lit.

If the instrument is running in normal operation mode (key switch not in bypass position) and there is a loss of purge pressure the instrument will power off and both LEDs will not be lit,

Once adequate purge pressure has been restored to the instrument the green 'pwr' LED will light to indicate the 30 minute countdown has started. Upon completion of the 30 minute countdown the red 'out' LED will light and power will be restored to the SOLA iQ.

If the instrument is operated with the NORMAL / BYPASS switch in the BYPASS position, operation of the LEDs of the timer delay relay performs in the same way as in normal operation.

Figure 10–3. Timer relay in normal operation with default setting of 30 minutes

Figure 10–4. Timer relay during loss of purge pressure prior to supply restoration

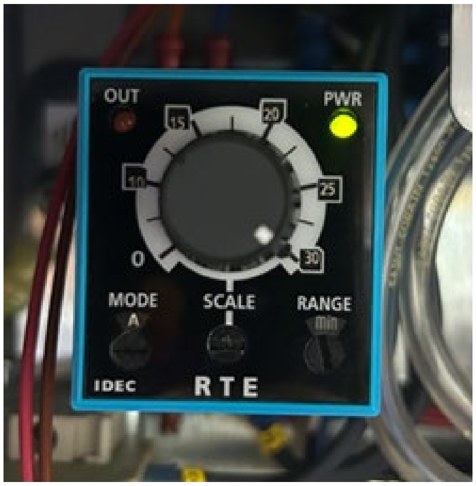


Figure 10–5. Timer relay during 30 minute timer countdown

Chapter 11
Vapor Sample Measurements

Additional guidance on the SOLA iQ for Vapors

This chapter provides additional guidance on the performance specification, ranges and technical characteristics for vapor samples, in particular samples that have a high dew point (Condensable Vapors).

SOLA iQ for Condensable Vapors (CV)

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

The SOLA iQ CV version permits the entry of a heated sample line from the secondary sample conditioning panel to enter the SOLA iQ 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 of 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.

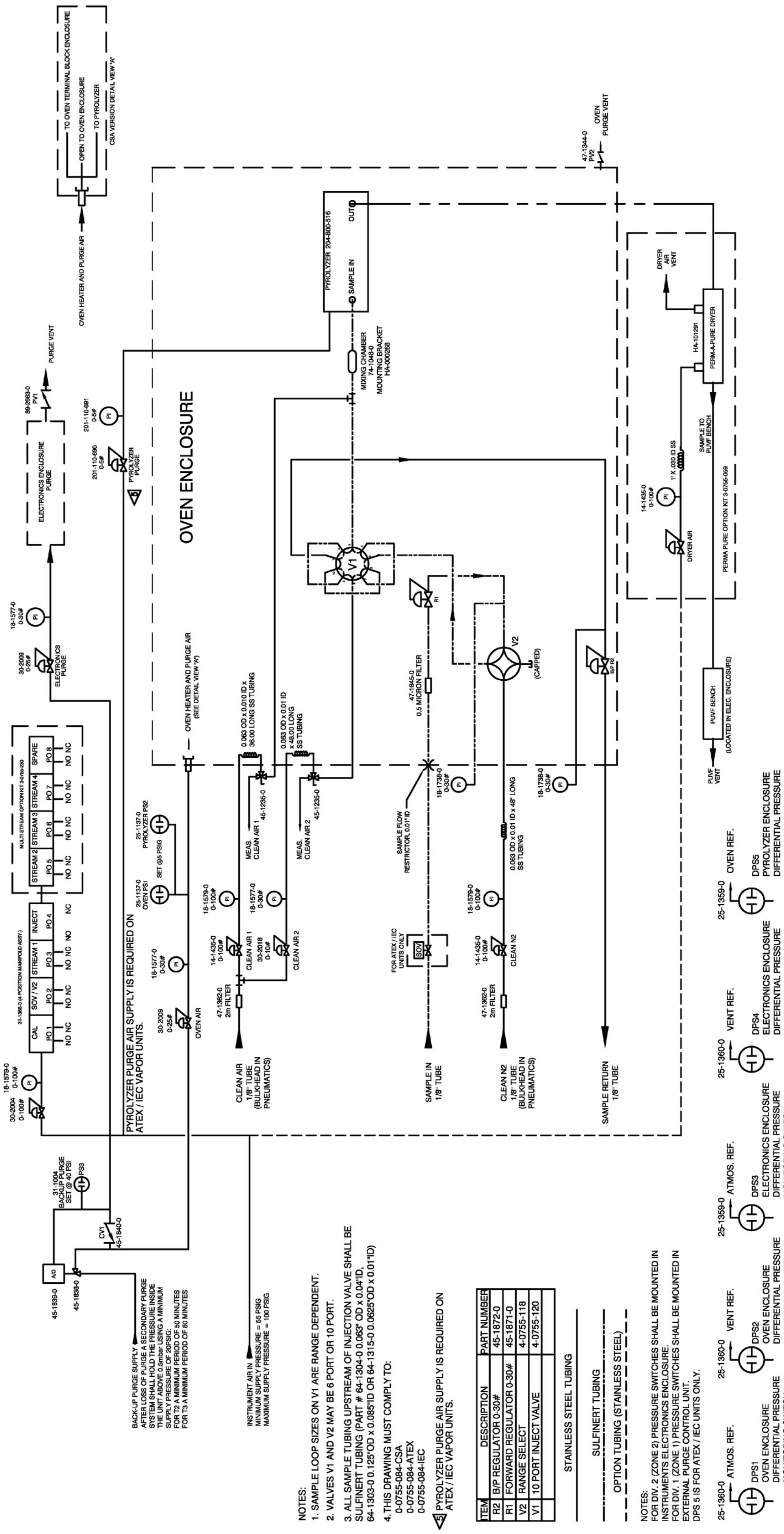


Figure 11–1. SOLA iQ (CV) flow diagram

Chapter 12
Trace Level Measurements

The SOLA iQ Trace analyzer is a modified version of the standard SOLA iQ. All characteristics of the SOLA iQ operation are applicable to the SOLA iQ Trace and is available for both liquid and vapor samples. The primary function of the SOLA iQ Trace is to implement improvements to the limits of detection performance at low total sulphur concentrations.

The SOLA iQ Trace utilizes a modified analytical PUVF bench for determination of total sulphur determination in liquid and vapor 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 SO_2 molecules.

Calibration method

The SOLA iQ 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 iQ Trace, it is recommended that a low concentration standard or a blank be used instead of no injections.

Combustion gas for the SOLA iQ Trace

Field results as well as measurements conducted in the factory indicate that when zero grade air (rather than heliox) is used for the combustion sample in the Pyrolyzer, re-zeroing with no injections can lead to significant overestimation of sulfur content of low-level samples on SOLA iQ Trace. In order to prevent incorrectly reported sulfur levels one of two calibration methods can be selected dependent 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 iQ Trace for an ethylene stream, perform low calibration using pure blank ethylene and high calibration standard made up in ethylene. Alternatively, one can use a low calibration standard made up in ethylene instead of blank.

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.

Warning When purchasing low total sulfur concentration standards, it is important that the standard vendor account for the total sulfur concentration of the matrix material. A matrix material containing 0.3 ppm of total sulfur accounts for 15% of a 2 ppm total sulfur standard. If the total sulfur concentration of the matrix material is not accounted for, the stated total sulfur concentration will under report the actual total sulfur concentration in the standard. ▲

Note For a 2 ppm/wt total sulfur standard in iso-octane, the matrix material is iso-octane. ▲

Table 12–1. Performance specification table for the SOLA iQ Trace

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 iQ Trace	2ppm (2,000 ppb)	5ppm (5,000 ppb)	1.25% of full scale	25	1% of range

Table 12–2. SOLA iQ Trace Related Specifications

Detector	Pulsed UV Fluorescence (PUVF), with pyrolyzer for Total Sulfur Measurement as SO_2
Repeatability	**Sulfur Concentration** / **% RSD at 1 Standard Deviation** > 500 ppb S / +/- 1.5% 500-400 ppb S / +/- 3.0% 400-200 ppb S / +/- 5.0% 200-100 ppb S / +/-10.0% < 100 ppb S / +/-15.0%
Linearity	Equal to or better than repeatability
HeliOx Carrier Gas	Minimum input pressure is 100 psig. HeliOx is a mixture of 79% helium and 21% oxygen. Typical consumption 200 cc/min.

Note All other specifications are the same as the SOLA iQ. See Specifications in Chapter 2. ▲

Available ranges for the SOLA iQ 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 iQ is usually deemed sufficiently good to negate the benefits of the SOLA iQ Trace and provide a more cost effective solution; however, users are invited to consult the factory for the implementation of ranges with the SOLA iQ Trace higher than 5ppm.

Appendix A
Spare Parts and Product Structure

Appendix A provides the SOLA iQ structure with the available spare part kits.

Table A–1. SOLA iQ Liquid Product Structure

Configuration Options	Model Code	Description
Instrument		
	SLiQ L	SOLA iQ Total Sulfur Online Analyzer, Liquid
A. System Core		
	01	120/240 VAC 50-60 Hz, 18 amp
		Note: Basic (purged) SOLA iQ total sulfur system, universal power supply, analytical oven and basic flow and pressure control components
B. Bench Option		
	01	Standard PUVF Bench
	02	Trace Level PUVF Bench using AIR as carrier gas
	03	Trace Level PUVF Bench using Heliox
C. Application		
	01	Valco Rotary Liquid, 6 port (heated)
	02	Valco Rotary Liquid, 6 port (not heated)
	03	Valco Rotary Liquid, 6 port (heated) w/N2 Carrier
	04	Dinfa Liquid Valve (heated)
	05	Dinfa Liquid Valve (heated) w/N2 Carrier
D. Back-Pressure Option		
	01	None (only optional for liquid applications)
	02	Back-Pressure Kit
		Note: Back pressure regulation is required for naphtha and gasoline application. If 97-1595- 0 is purchased then back pressure kit is installed in pneumatics section of SOLA iQ
E. Area Classification		
	01	ATEX Zone 1, Ex px IIC T3, using X-Purge and Back-up Purge
	02	ATEX Zone 2, Ex pz IIC T3, using Z-Purge and Backup Purge
	03	CSA (W/C & US Mark), Class 1, Div. 1, Group B, C, & D, T3, using X-Purge and Back-up Purge
	04	CSA (W/C & US Mark), Class 1, Div. 2, Group B, C, & D, T3, using Z-Purge and Back-up Purge
	05	IEC, Zone 1, Ex px IIC T3, using X-Purge and Back-up Purge
	06	IEC, Zone 2, Ex px IIC T3, using Z-Purge and Back-up Purge
F. Calibration Precision		
	01	+/- 1% full scale using two injections/min
	02	+/- 2% full scales using one injection/min
G. Calibration Range		
	01	Single Range: 0 to ______
	02	Dual Range: 0 to_______and 0 to _______
H. Stream Options		
	01	Single stream
	02	Multiple (up to 4) streams
I. Flow Switch		
	01	None, standard
	02	Flow switch added to system

Table A–2. SOLA iQ Liquid Spare Part Kits

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, START UP, SOLA iQ, VALCO, LIQUID		Including: (For Standard SOLA iQ)	208-760-515
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	2	Rotor, liquid sample valve, 1.0 ul, 6 port	
KIT, ONE YEAR, SOLA iQ , VALCO, LIQUID		Including: (For Standard SOLA iQ)	208-760-520
	1	Heater for pyrolyzer assembly (Starbar)	
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Thermocouple, pyrolyzer S type	
	4	Rotor, liquid sample valve, 1.0 ul, 6 port	
	1	Filter, in-line 2 micron, 1/8" tube connections	
	1	Filter, in-line .5 micron, 1/8" tube connections	
	1	O-ring kit for liquid injection valve actuator	
KIT, TWO YEAR, SOLA iQ, VALCO, LIQUID		Including: (For Standard SOLA iQ)	208-760-525
	1	Heater for pyrolyzer assembly (Starbar)	
	8	Ferrules for pyrolyzer tube fittings, graphite	
	3	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Filter, in-line 2 micron, 1/8" tube connections	
	2	Filter, in-line .5 micron, 1/8" tube connections	
	1	Thermocouple, pyrolyzer S type	
	1	Valve, complete 6-port for liquid	
	1	6-port liquid valve head w/ internal sample loop	
	4	Rotor, liquid sample valve, 1.0 ul, 6 port	
	2	O-ring kit for liquid injection valve actuator	
	1	UV Flash Lamp	
KIT, CRITICAL OP, SOLA iQ, VALCO, LIQUID		Including: (For Standard SOLA iQ only)	208-760-530
	1	Valve, complete 6-port for liquid	
	1	PUVF Bench - Standard / complete	
	1	Pyrolyzer Assembly - complete	
	1	PUVF Trigger Pak - Standard Bench	
	1	I/O PCB	
KIT, START UP SOLA iQ, DINFA, LIQUID		Including: (For Standard SOLA iQ)	208-760-535
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Sliderblock, 1.2 ul	

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, ONE YEAR, SOLA iQ, DINFA, LIQUID		Including: (For Standard SOLA iQ)	208-760-540
	1	Heater for pyrolyzer assembly (Starbar)	
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Thermocouple, pyrolyzer S type	
	1	Sliderblock, 1.2 ul	
	1	Filter, in-line 2 micron, 1/8" tube connections	
	1	Filter, in-line .5 micron, 1/8" tube connections	
KIT TWO YEAR SOLA iQ, DINFA, LIQUID		Including: (For Standard & Trace SOLA iQ)	208-760-545
	2	Heater for pyrolyzer assembly (Starbar)	
	8	Ferrules for pyrolyzer tube fittings, graphite	
	3	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Filter, in-line 2 micron, 1/8" tube connections	
	2	Filter, in-line .5 micron, 1/8" tube connections	
	1	Thermocouple, pyrolyzer S type	
	1	Sliderblock, 1.2 ul	
	1	UV Flash Lamp	
KIT, CRITICAL OP, SOLA iQ, DINFA, LIQUID		Including: (For Standard SOLA iQ only)	208-760-550
	1	Valve, complete 6-port for liquid	
	1	PUVF Bench - Standard / complete	
	1	Pyrolyzer Assembly - complete	
	1	PUVF Trigger Pak - Standard Bench	
	1	Stream Relay PCB	
	1	I/O PCB	

Table A–3. SOLA iQ Vapor Product Structure

Configuration Options	Model Code	Description
Instrument		
	SLiQ V	SOLA iQ Total Sulfur Online Analyzer, Vapor
A. System Core		
	01	120/240 VAC 50-60 Hz, 18 amp
		Note: Basic (purged) SOLA iQ total sulfur system, universal power supply, analytical oven and basic flow and pressure control components
B. Bench Option		
	01	Standard PUVF Bench
	02	Trace Level PUVF Bench using AIR as carrier gas
	03	Trace Level PUVF Bench using Heliox
C. Application		
	01	Valco Rotary Valve, 10 port, w/ back pressure regulator
	02	Valco Rotary Valve, 10 port, w/ back pressure regulator, Perma Pure Dryer
D. Area Classification		
	01	ATEX Zone 1, Ex px IIC T4, using X-Purge and Back-up Purge
	02	ATEX Zone 2, Ex pz IIC T4, using Z-Purge and Back-up Purge
	03	CSA (W/C & US Mark), Class 1 Div. 1, Group B, C, & D, T4, using X-Purge and Back-up Purge
	04	CSA (W/C & US Mark), Class 1 Div. 2, Group B, C, & D, T4, using Z-Purge and Back-up Purge
	05	IEC, Zone 1, Ex px IIC, T4, using X-Purge and Back-up Purge
	06	IEC, Zone 2, Ex px IIC, T4, using Z-Purge and Back-up Purge
E. Calibration Precision		
	01	+/- 1% full scale using two injections/min
	02	+/- 2% full scales using one injection/min
F. Calibration Range		
	01	Single Range: 0 to ______
	02	Dual Range: 0 to _______and 0 to _______
G. Stream Options		
	01	Single stream
	02	Multiple (up to 4) streams
H. Flow Switch		
	01	None, standard
	02	Flow switch added to system

Table A–4. SOLA iQ Vapor Spare Part Kits

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, START-UP, SOLA iQ VALCO, VAPOR		Including: (For Standard & Trace SOLA)	208-760-500
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	2	Rotor, 10 port, gas	
KIT, ONE-YEAR, SOLA iQ VALCO, VAPOR		Including: (For Standard & Trace SOLA)	208-760-505
	1	Heater for pyrolyzer assembly (Starbar)	
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Thermocouple, pyrolyzer S type	
	4	Rotor, 10 port, gas	
	1	Filter, in-line 2 micron, 1/8" tube connections	
	1	Filter, in-line .5 micron, 1/8" tube connections	
	1	O-ring kit for injection valve actuator	
KIT, TWO-YEAR, SOLA iQ VALCO, VAPOR		Including: (For Standard & Trace SOLA)	208-760-510
	1	Heater for pyrolyzer assembly (Starbar)	
	8	Ferrules for pyrolyzer tube fittings, graphite	
	3	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Filter, in-line 2 micron, 1/8" tube connections	
	2	Filter, in-line .5 micron, 1/8" tube connections	
	1	Thermocouple, pyrolyzer S type	
	1	Valve, complete 10-port for vapor samples	
	1	10-port valve head, gas	
	4	Rotor, 10 port, gas	
	2	O-ring kit for valve actuator	
	1	UV Flash Lamp	
KIT, CRITICAL OPERATION, SOLA iQ VALCO, VAPOR		Including: (For Standard & Trace SOLA)	208-760-512
	1	Valve, complete 10-port for vapor samples	
	1	PUVF Bench - Standard / complete	
	1	Pyrolyzer Assembly - complete	
	1	PUVF Trigger Pak - Standard Bench	
	1	I/O PCB	

Table A–5. Condensible Vapors (CV) Product Structure

Configuration Options	Model Code	Description
Instrument		
	SLiQ CV	SOLA iQ Total Sulfur Online Analyzer, Condensable Vapor
A. System Core		
	01	120/240 VAC 50-60 Hz, 18 amp
		Note: Basic (purged) SOLA iQ total sulfur system, universal power supply, analytical oven and basic flow and pressure control components
B. Bench Option		
	01	Standard PUVF Bench
	02	Trace Level PUVF Bench using AIR as carrier gas
	03	Trace Level PUVF Bench using Heliox
C. Application		
	01	Valco Rotary Valve, 10 port, w/ back pressure regulator
	02	Valco Rotary Valve, 10 port, w/ back pressure regulator, Perma Pure Dryer
D. Area Classification		
	01	ATEX Zone 1, Ex px IIC T4, using X-Purge and Back-up Purge
	02	ATEX Zone 2, Ex pz IIC T4, using Z-Purge and Back-up Purge
	03	CSA (W/C & US Mark), Class 1 Div. 1, Group B, C, & D, T4, using X-Purge and Back-up Purge
	04	CSA (W/C & US Mark), Class 1 Div. 2, Group B, C, & D, T4, using Z-Purge and Back-up Purge
	05	IEC, Zone 1, Ex px IIC, T4, using X-Purge and Back-up Purge
	06	IEC, Zone 2, Ex px IIC, T4, using Z-Purge and Back-up Purge
E. Calibration Precision		
	01	+/- 1% full scale using two injections/min
	02	+/- 2% full scales using one injection/min
F. Calibration Range		
	01	Single Range: 0 to ______
	02	Dual Range: 0 to _______and 0 to _______
G. Stream Options		
	01	Single stream
	02	Multiple (up to 4) streams
H. Flow Switch		
	01	None, standard
	02	Flow switch added to system

Table A–6. SOLA iQ Condensible Vapors Spare Part Kits

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, START-UP, SOLA iQ VALCO, CV		Including: (For Standard & Trace SOLA)	208-760-555
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	2	Rotor, 10 port, gas	
KIT, ONE-YEAR, SOLA iQ VALCO, CV		Including: (For Standard & Trace SOLA)	208-760-560
	1	Heater for pyrolyzer assembly (Starbar)	
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Thermocouple, pyrolyzer S type	
	4	Rotor, 10 port, gas	
	1	Filter, in-line 2 micron, 1/8" tube connections	
	1	Filter, in-line .5 micron, 1/8" tube connections	
	1	O-ring kit for injection valve actuator	
KIT, TWO-YEAR, SOLA iQ VALCO, CV		Including: (For Standard & Trace SOLA)	208-760-565
	1	Heater for pyrolyzer assembly (Starbar)	
	8	Ferrules for pyrolyzer tube fittings, graphite	
	3	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Filter, in-line 2 micron, 1/8" tube connections	
	2	Filter, in-line .5 micron, 1/8" tube connections	
	1	Thermocouple, pyrolyzer S type	
	1	Valve, complete 10-port for vapor samples	
	1	10-port valve head, gas	
	4	Rotor, 10 port, gas	
	2	O-ring kit for liquid valve actuator	
	1	UV Flash Lamp	

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, START U-UP, SOLA iQ VALCO, CV		Including: (For Standard & Trace SOLA CV	208-760-555
	4	Ferrules for pyrolyzer tube fittings, graphite	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	2	Rotor, 10 port, gas, less external sample loops	

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, ONE-YEAR, SOLA iQ , CV		Including: (For Standard & Trace SOLA CV)	208-760-571
	1	Thermocouple, pyrolyzer S type	
	1	Heater for pyrolyzer assembly (Starbar)	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	4	Rotor, 10 port, gas	
	1	Rotor, 4 port, gas	
	1	O-ring kit, actuator	
	4	Ferrules for pyrolyzer tube fittings, graphite	
	1	Filter, Inline, 2 micron, 1/8" tube connection	
	1	Filter, Inline, 0.5 micron, 1/8" tube connection	

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, TWO-YEAR, SOLA iQ, CV		Including: (For Standard & Trace SOLA CV)	208-760-572
	1	Thermocouple. S-Type, Pyrolyzer	
	2	Heater for pyrolyzer assembly (Starbar)	
	3	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	1	Valve, 10 Port, 1/16", 150PSI, 175C, complete assembly	
	8	Rotor, 10 Port, Gas	
	4	Rotor, 4 Port, Valco Valve	
	1	Valve head, 10 Port, Gas, less sample loops	
	2	O-ring kit, valve actuator	
	8	Ferrules for pyrolyzer tube fittings, graphite	
	1	Filter, Inline, 2 micron, 1/8" tube connection	
	2	Filter, Inline, 0.5 micron, 1/8" tube connection	
	1	Lamp, Xenon Flash Lamp for SO_2 Bench	

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, CRITICAL OPERATION, SOLA iQ, CV		Including: (For Standard SOLA CV only)	208-760-573
	1	Valve, 10 Port, 1/16", 150PSI, 175C, complete assembly	
	1	PUVF Bench - Standard / complete	
	1	Pyrolyzer Assembly - complete	
	1	PUVF Trigger Pak - Standard Bench	
	1	I/O PCB	
	1	Lamp, Xenon Flash Lamp for SO_2 Bench	
	1	Pressure Regulator, Forward Pressure, Sulfinert coated. 0-25psi	
	1	Pressure Regulator, Back Pressure, 0-25psi	

Table A–7. SOLA iQ Flare Product Structure

Configuration Options	Model Code	Description
Instrument Base		
	SLiQ F	SOLA iQ Total Sulfur Flare Analyzer, Dual Injection
A. Core System		
	01	120/240 VAC 50-60 Hz, 18 amp
		Note: Basic (purged) SOLA iQ total sulfur system, universal power supply, analytical oven and basic flow and pressure control components
B. Bench Option		
	01	Standard PUVF Bench
C. Application		
	01	Valco Rotary Valve, 10 port and 6 port, w/ back pressure regulator
D. Area Classification		
	01	ATEX Zone 1, Ex px IIC T4, using X-Purge and Back-up Purge
	02	ATEX Zone 2, Ex pz IIC T4, using Z-Purge and Back-up Purge
	03	CSA (W/C & US Mark), Class 1 Div. 1, Group B, C, & D, T4, using X-Purge and Back-up Purge
	04	CSA (W/C & US Mark), Class 1 Div. 2, Group B, C, & D, T4, using Z-Purge and Back-up Purge
	05	IEC, Zone 1, Ex px IIC, T4, using X-Purge and Back-up Purge
	06	IEC, Zone 2, Ex px IIC, T4, using Z-Purge and Back-up Purge
E. Calibration Range		
	01	Dual Range: 0 to _______and 0 to _______

Table A–8. SOLA iQ Flare Spare Part Kits

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, START UP, SOLA iQ, FLARE		Including:	208-760-574
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	2	Rotor, 10 Port, Gas	
	4	Ferrules for pyrolyzer tube fittings, graphite	
	1	Rotor, 4 Port, Valco Valve	
	2	Rotor, 6 Port, 1ul	
KIT, ONE YEAR, SOLA iQ, FLARE		Including:	208-760-575
	1	Thermocouple. S-Type, Pyrolyzer	
	1	Heater for pyrolyzer assembly (Starbar)	
	1	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	4	Rotor, 10 Port, Gas	
	2	O-ring kit, valve actuator	
	4	Ferrules for pyrolyzer tube fittings, graphite	
	1	Rotor, 4 Port, Valco Valve	
	1	Filter, Inline, 2 micron, 1/8" tube connection	
	1	Filter, Inline, 0.5 micron, 1/8" tube connection	
	4	Rotor, 6 Port, 1ul	

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, TWO YEAR, SOLA iQ, FLARE		Including:	208-760-576
	1	Thermocouple. S-Type, Pyrolyzer	
	1	Heater for pyrolyzer assembly (Starbar)	
	2	TUBE,CERAMIC,.250 OD X .156 ID X 14~L	
	8	Rotor, 10 Port, Gas	
	1	Valve, 10 Port, 1/16", 150PSI, 175C, complete assembly	
	1	Valve head, 10 Port, Gas	
	2	O-ring kit, valve actuator	
	8	Ferrules for pyrolyzer tube fittings, graphite	
	2	Filter, Inline, 2 micron, 1/8" tube connection	
	2	Filter, Inline, 0.5 micron, 1/8" tube connection	
	1	Lamp, Xenon Flash Lamp for SO_2 Bench	
	2	Rotor, 4 Port, Valco Valve	
	8	Rotor, 6 Port, 1ul	
	1	Valve head, 6 Port, Valco	

KIT, CRITICAL OPERATION, SOLA iQ, FLARE		Including:	208-760-577
	1	Valve, 10 Port, 1/16", 150PSI, 175C, complete assembly	
	1	PUVF Bench - Standard / complete	
	1	Pyrolyzer Assembly - complete	
	1	PUVF Trigger Pak - Standard Bench	
	1	I/O PCB	
	1	Lamp, Xenon Flash Lamp for SO_2 Bench	
	1	Pressure Regulator, Forward Pressure, Sulfinert coated. 0-25psi	
	1	Pressure Regulator, Back Pressure, 0-25psi	

Table A–9. SOLA iQ Trace Spare Part Kits

SOLA iQ Spare Part Kit Name	Quantity	SOLA iQ Description	SOLA iQ Kit PN
KIT, CRITICAL OP,SOLA iQ TL,VALCO, LIQUID		Including: (For TRACE SOLA LIQUID)	208-760-533
	1	VALVE INJECT 1/16 6 PT 1ul 150psi 175C	
	1	ASSY, DMC, 43iQ TL, SOLA (118201-01)	
	1	SOLA III – PYROLISER ASSEMBLY	
	1	43 DMC board (116485-00)	
	1	SQUARE TRIGGER PACK, SOLA iQ TL	
	1	PCA, SOLA III I/O Board Tested, RoHS	
KIT, CRITICAL OP,SOLA iQ TL,VALCO, VAPOR		Including: (For TRACE SOLA VAPOR)	208-760-133
	1	Valve, 10 port rotary, RoHS	
	1	ASSY, DMC, 43iQ TL, SOLA (118201-01)	
	1	SOLA II – PYROLISER ASSEMBLY	
	1	43 DMC board (116485-00)	
	1	SQUARE TRIGGER PACK, SOLA iQ TL	
	1	PCA, SOLA III I/O Board Tested, RoHS	
KIT, CRITICAL OP,SOLA iQ TRACE CV		Including: (For TRACE SOLA CV)	208-760-580
	1	Valve, 10-port rotary, RoHS	
	1	ASSY, DMC, 43iQ TL, SOLA (118201-01)	
	1	SOLA III – PYROLISER ASSEMBLY	
	1	43 DMC board (116485-00)	
	1	SQUARE TRIGGER PACK, SOLA iQ TL	
	1	PCA, SOLA III I/O Board Tested, RoHS	
	1	LAMP, XENON FLASH LAMP FOR SO2 BENCH	
	1	Regulator, 0-25#, Sulfinert, ROHS	
	1	Regulator, Back Pressure,0-15#, ROHS	

Appendix B
Display Menu Map

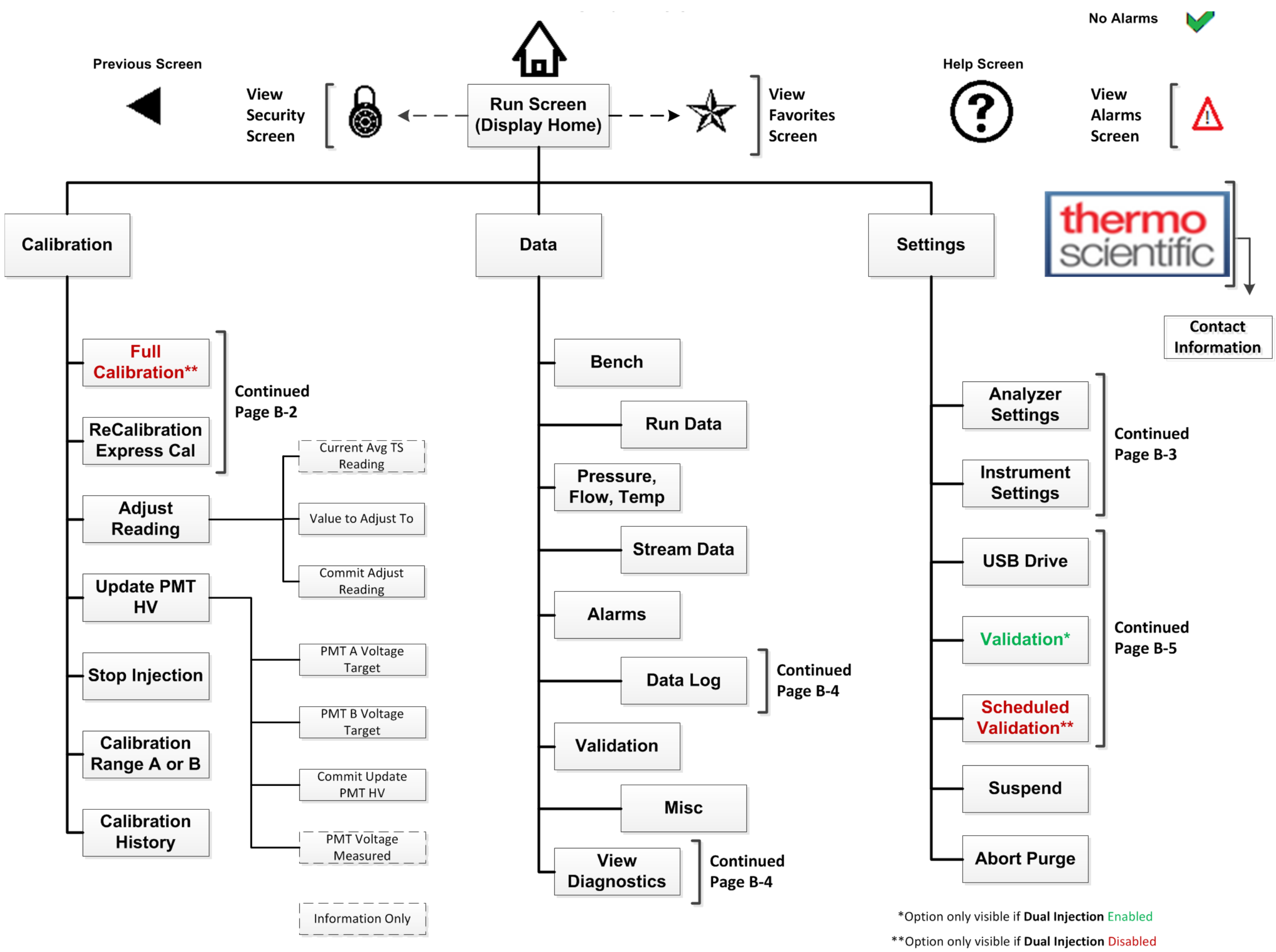


Figure B–1. Display Menu Tree

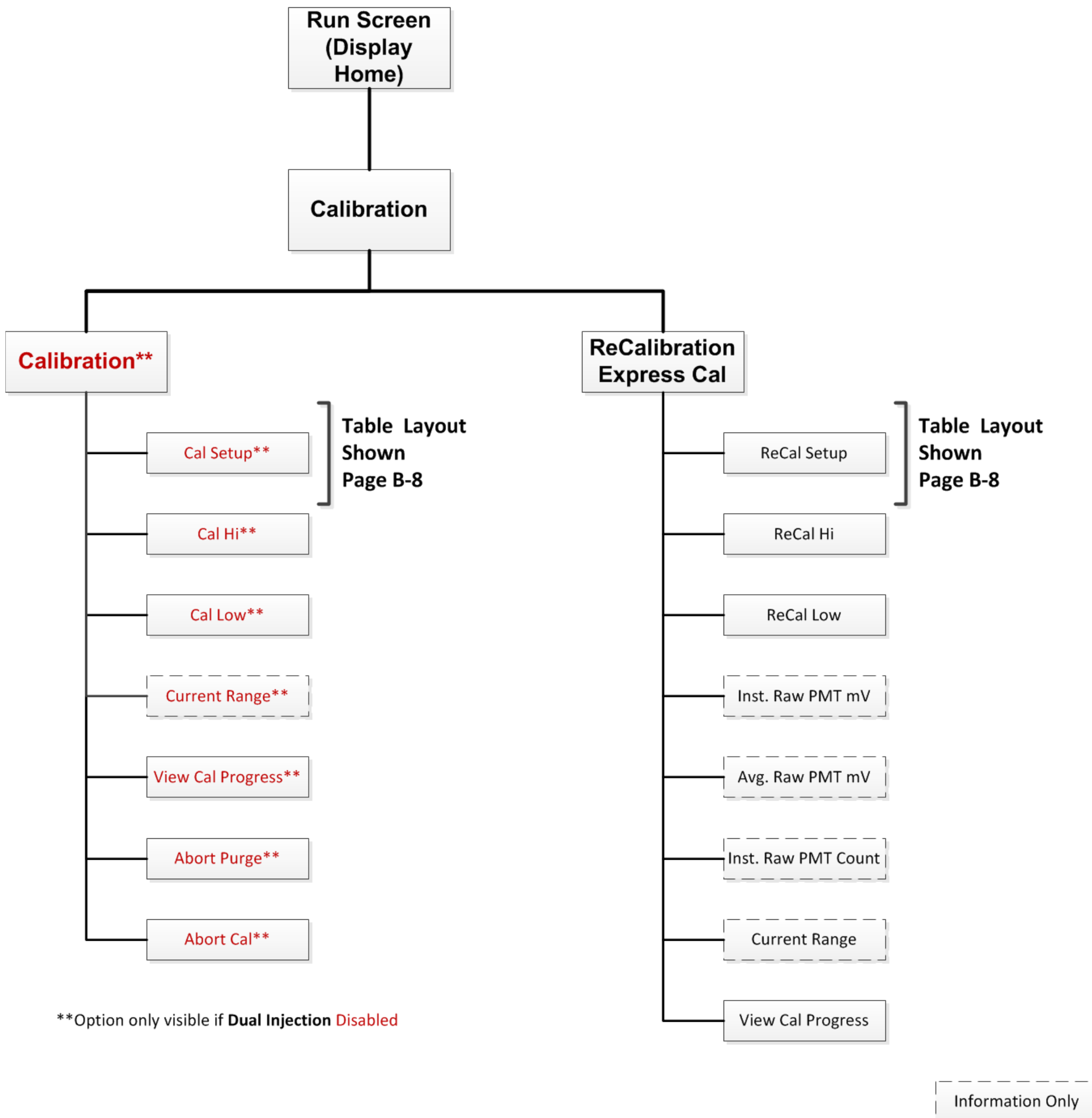


Figure B–2. Menu Tree – Calibration

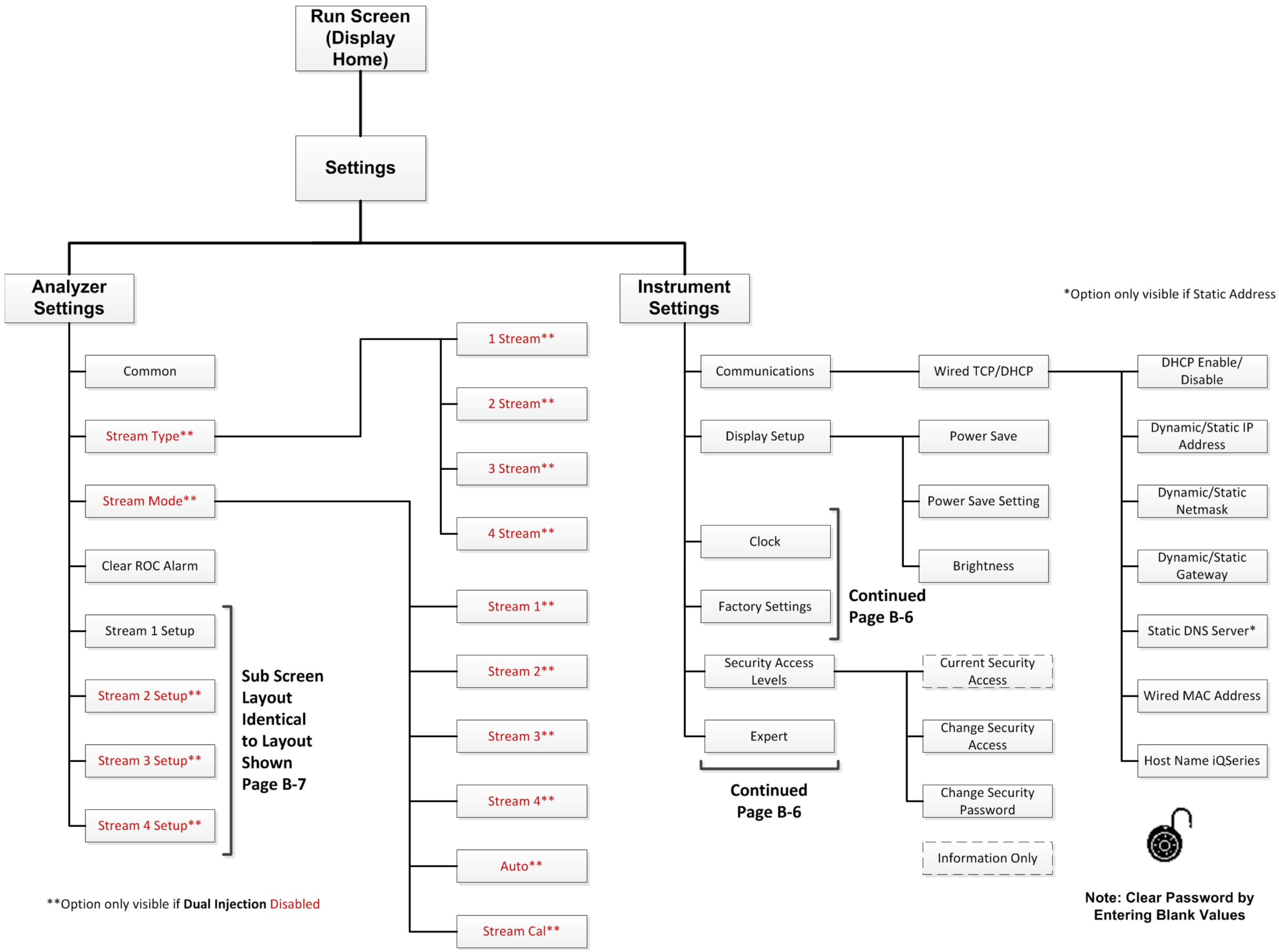


Figure B–3. Menu Tree – Settings

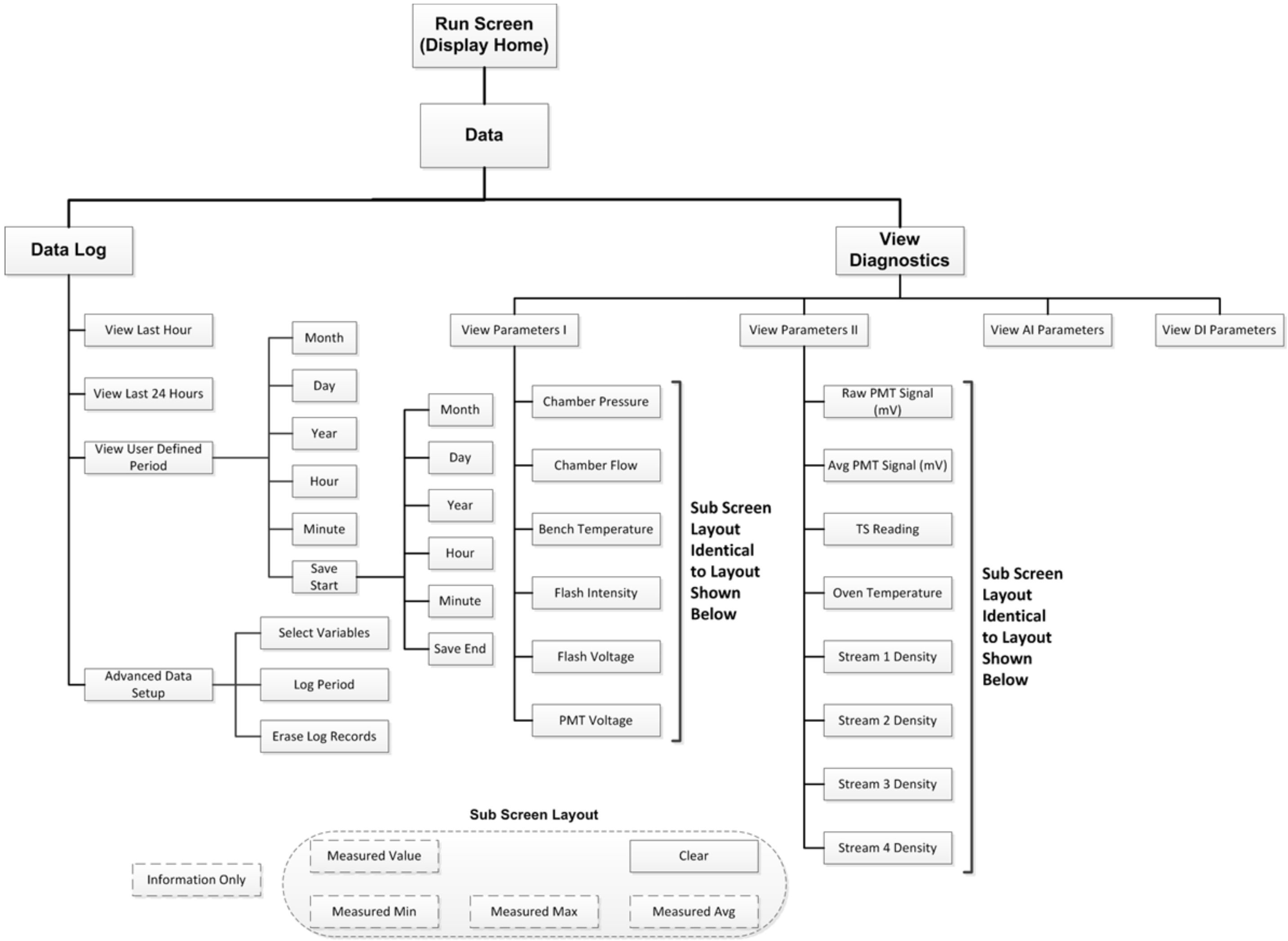


Figure B–4. Menu Tree – Data

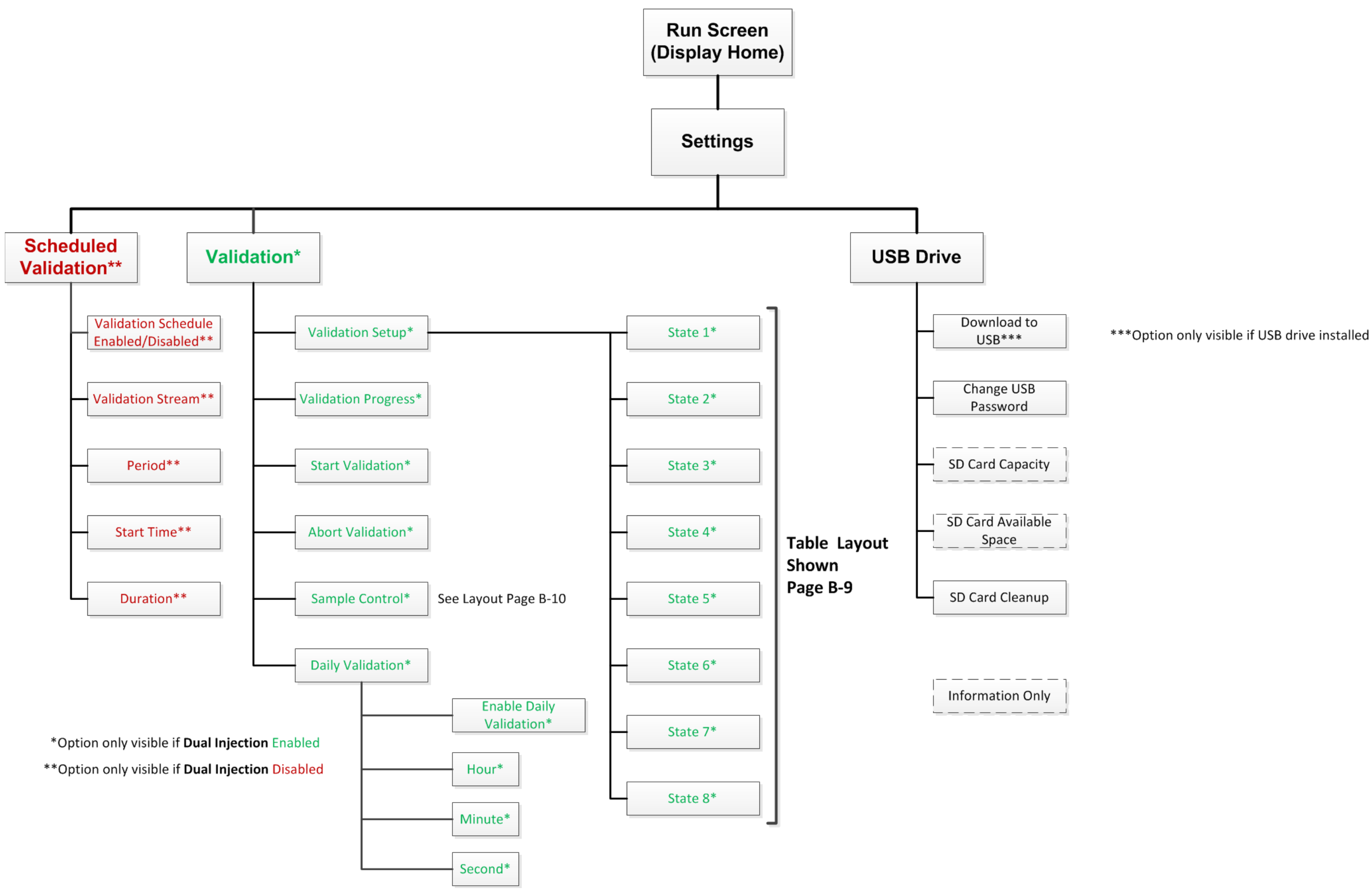


Figure B–5. Menu Tree –Optional Settings

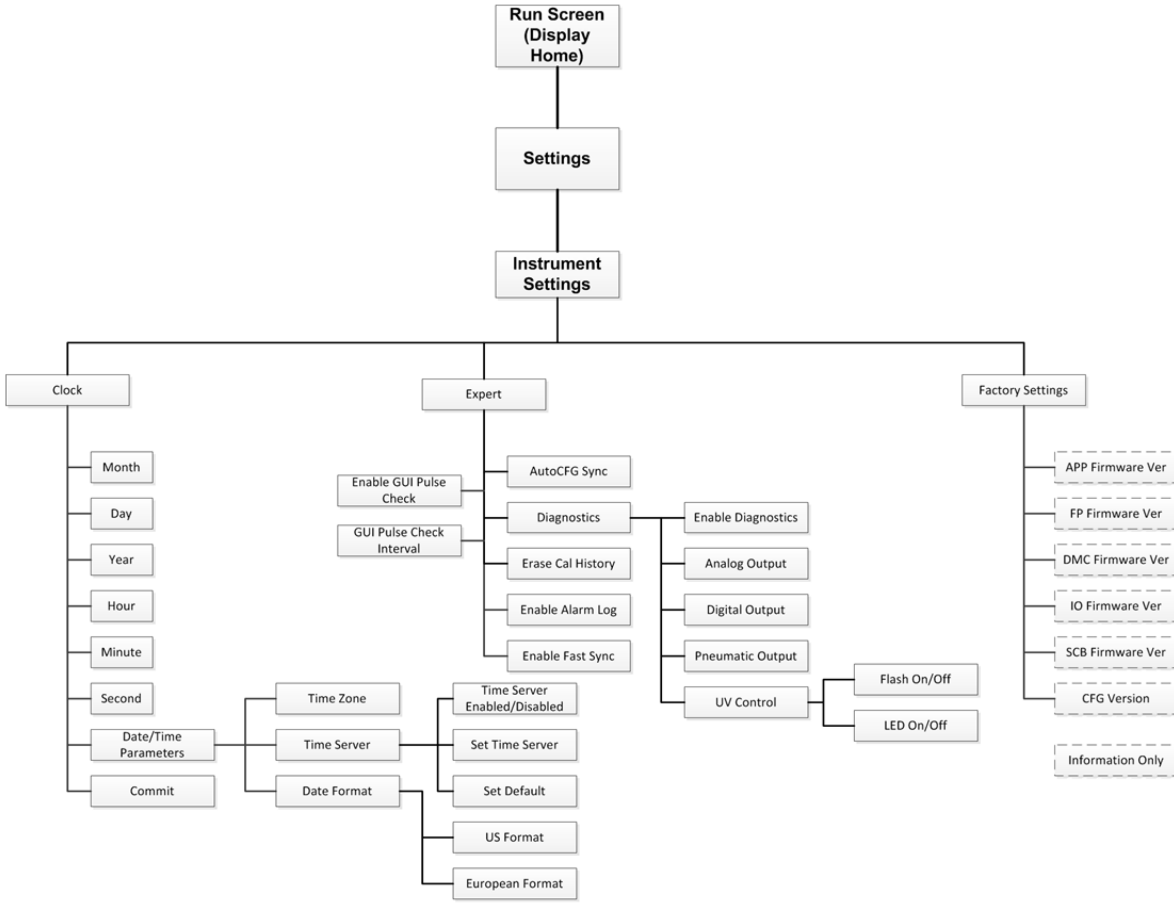


Figure B–6. Menu Tree – Instrument Settings

Stream (#) Setup

Parameter Name	Numerical Value	Range/Options
Dwell Time	300	Seconds
Range	0	0 = Cal A, 1 = Cal B
Concentration @4mA	0.00	EU
Concentration @20mA	60.00	EU
Fixed Density	1	0 = Live Density, 1 = Fixed Density
Fixed Density Value	1.00	EU
Density Low Scale	0.00	EU
Density High Scale	0.00	EU

Figure B–7. Stream (#) Setup Screen

Cal & ReCal Setup

Setup Parameters	User Input	Description
Cal A High Value	2.00	Cal A High Point Value
Cal A Low Value	0.00	Cal A Low Point Value
Cal A Unit	0	0 = ppm, 1 = ppb, 2 = %, 3 = mg/l
Cal B High Value	0.00	Cal B High Point Value
Cal B Low Value	0.00	Cal B Low Point Value
Cal B Unit	0	0 = ppm, 1 = ppb, 2 = %, 3 = mg/l
Cal Range	0	0 = Cal A, 1 = Cal B
Cal Reads	240	Number of reads to average for Full Cals

Figure B–8. Cal & ReCal Setup Screen

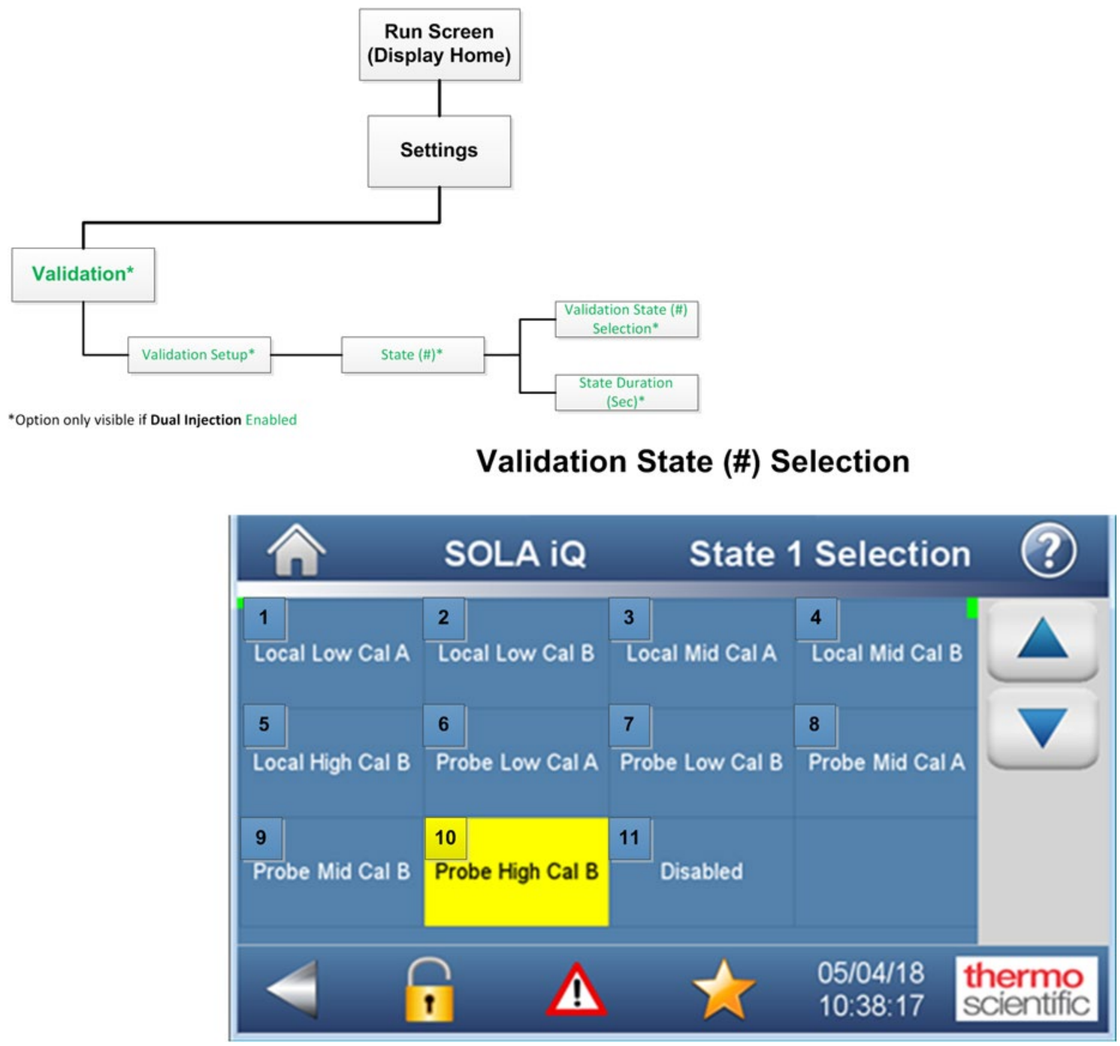


Figure B–9. Menu Tree – Validation State (#) Selection Screen

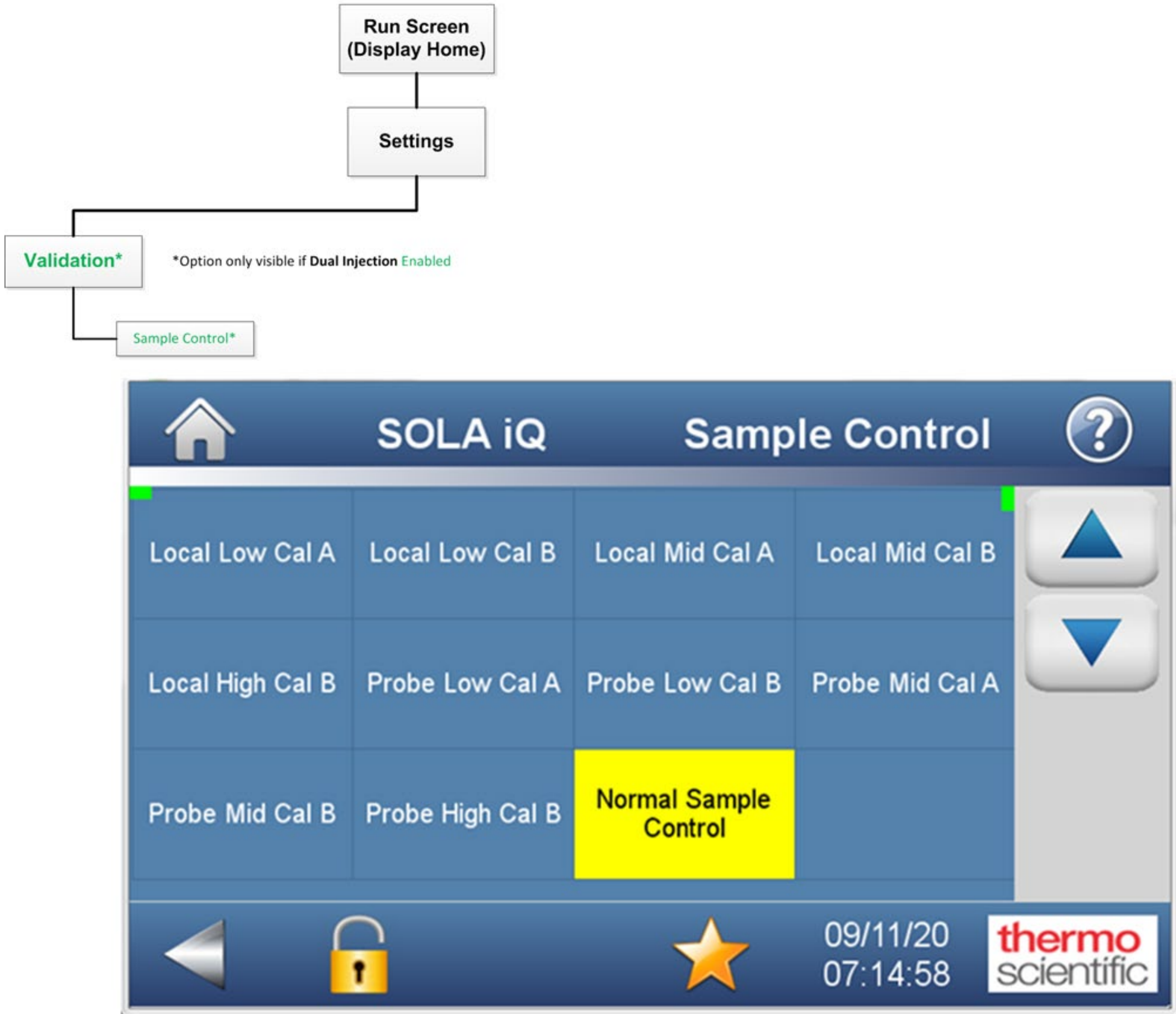


Figure B–10. Menu Tree – Validation Sample Control Screen

Appendix C
Toxic & Hazardous Substances Tables

The English and Chinese versions of the Toxic and Hazardous Substances tables are shown below.

Table C–1. China RoHL Table

Product	Possible EIP Category	EPUP Number
SOLA iQ	Electronic Measuring Instrument Products	30 years

Table C–2. Toxic and Hazardous Substances or Elements

部件名称 Part Name	**有毒和危险品** Toxic and Hazardous Substances or Elements					
SOLA iQ	铅 (Pb)	水银 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴化苯 (PBB)	多溴化二苯醚 (PBDE)
印刷电路板 (PCBs)	X	O	O	O	O	O
机电配件(Electro -Mechanical Parts)	X	O	O	O	O	O
电缆和电线 (Cables & Wires)	O	O	O	O	O	O
金属部件 (Metal Parts)	X	O	O	O	O	O
塑料零件 (Plastic Parts)	O	O	O	O	O	O
显示 (Display)	X	O	O	O	O	O
电池 (Batteries)	O	O	O	O	O	O
无焰燃烧器 (Flameless Burner)	O	O	O	O	O	O
光学单元 (Optical Unit)	O	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制

O = 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572规定的限量要求以下(indicates that the content of the toxic and hazardous substance in all the Homogeneous Materials of the part is below the concentration limit requirement as described in GB/T 26572).

X = 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572规定的限量要求 (indicates that the content of the toxic and hazardous substance in at least one Homogeneous Material of the part exceeds the concentration limit requirement as described in GB/T 26572).

Appendix D
Rotary Valve Service

SOLA iQ analyzers may use 10 and 6 port rotary injection valves plus a 4-port range select valve. This appendix references a typical 6-port rotary injection valve. These are 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. ▲

Initial Precautions

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 For Valco W and UW Type valves. ▲

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. ▲

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 chemically and mechanically cleaned. ▲

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

Ensure 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. ▲

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.

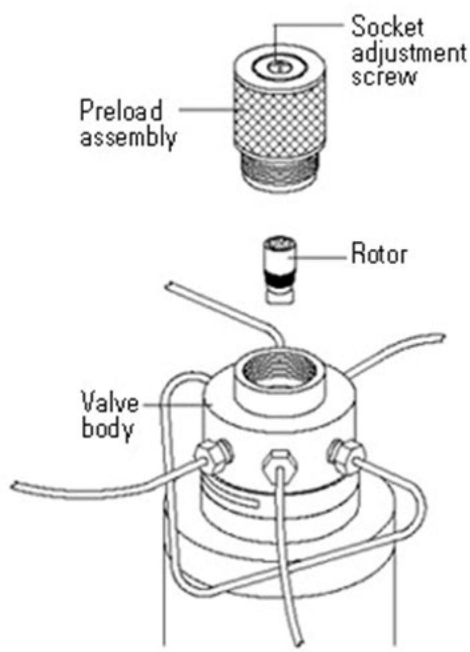


Figure D–1. Rotary valve disassembly

As Figure D–1 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 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.

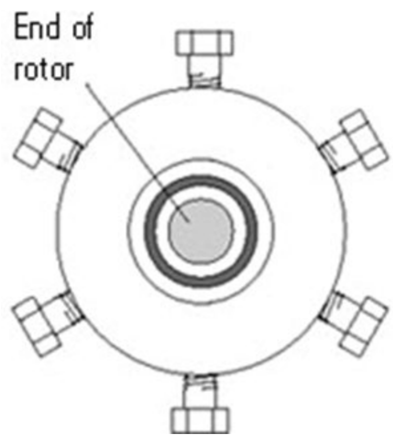


Figure D–2. Preload removed (preload end view)

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. ▲

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 D–3 shows how to orient the ID letter for different VICI valves (C6W is shown in Figure D–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 D–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 further tighten 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. ▲

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

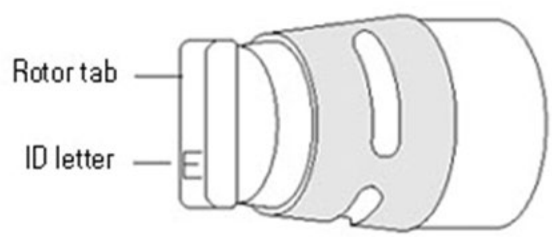


Figure D–3. Location of ID letter on valve rotor

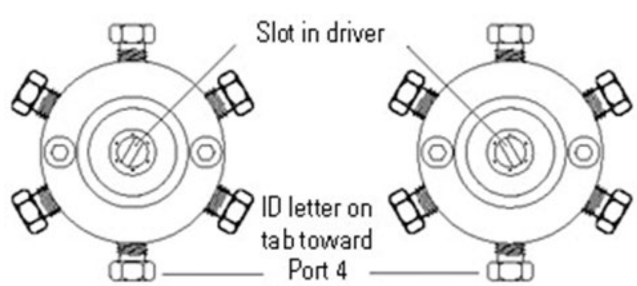


Figure D–4. C6 W valve with preload and rotor removed (preload end view)

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 items 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)

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.

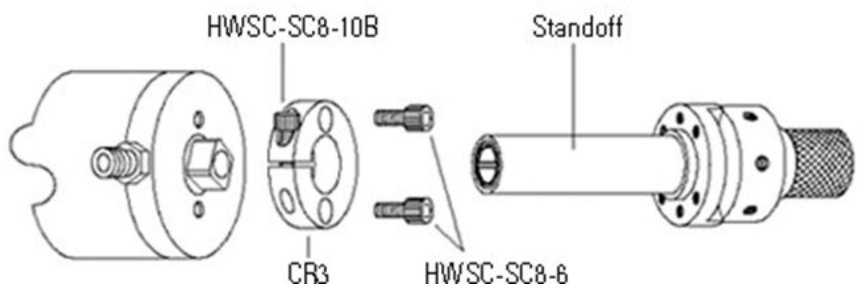


Figure D–5. Disassembly

2. Remove the valve and valve-mounting hardware from the actuator (as shown in Figure D–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.

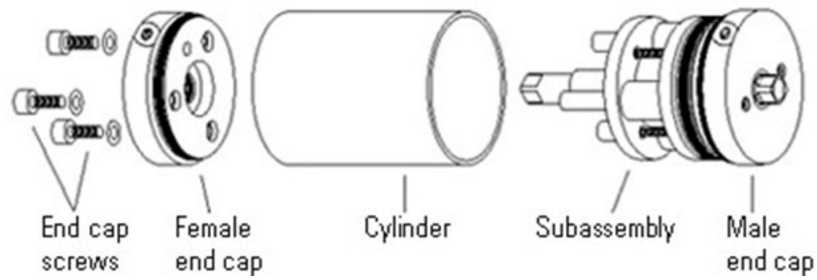


Figure D–6. Disassembly Steps 3 through 6

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.

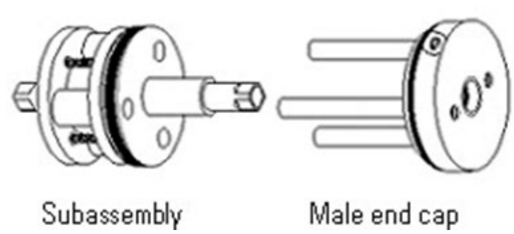


Figure D–7. Disassembly Steps 7 through 8

7. Pull the subassembly off the male end cap as indicated in Figure D–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.

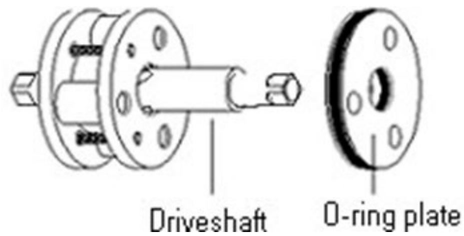


Figure D–8. Disassemble O-Ring Plate from Driveshaft

9. Take care to hold the rest of the subassembly together, and slide the O-Ring plate off the drive shaft (Figure D–8). Refer to reassembly instructions in Assembly after the subassembly comes 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).

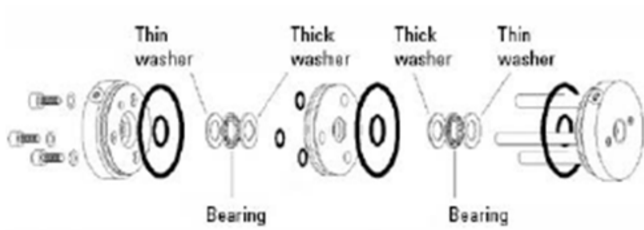


Figure D–9. Locations of O-Rings

Assembly

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.

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.

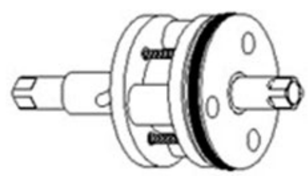


Figure D–10. O-Ring plate attached to drive shaft

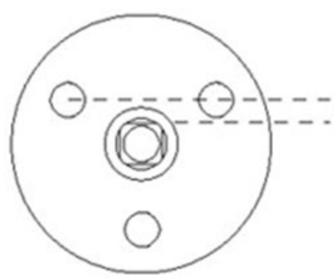


Figure D–11. Correct alignment of O-Ring plate

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 D–10.

3. Place the washers and bearing in the male end cap (thin washers in first, as shown Figure D–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 D–11).

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

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

6. 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.

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

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

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

10. 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

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. 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.

5. 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.

Rebuild the Assembly

Follow these steps to rebuild the subassembly:

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.

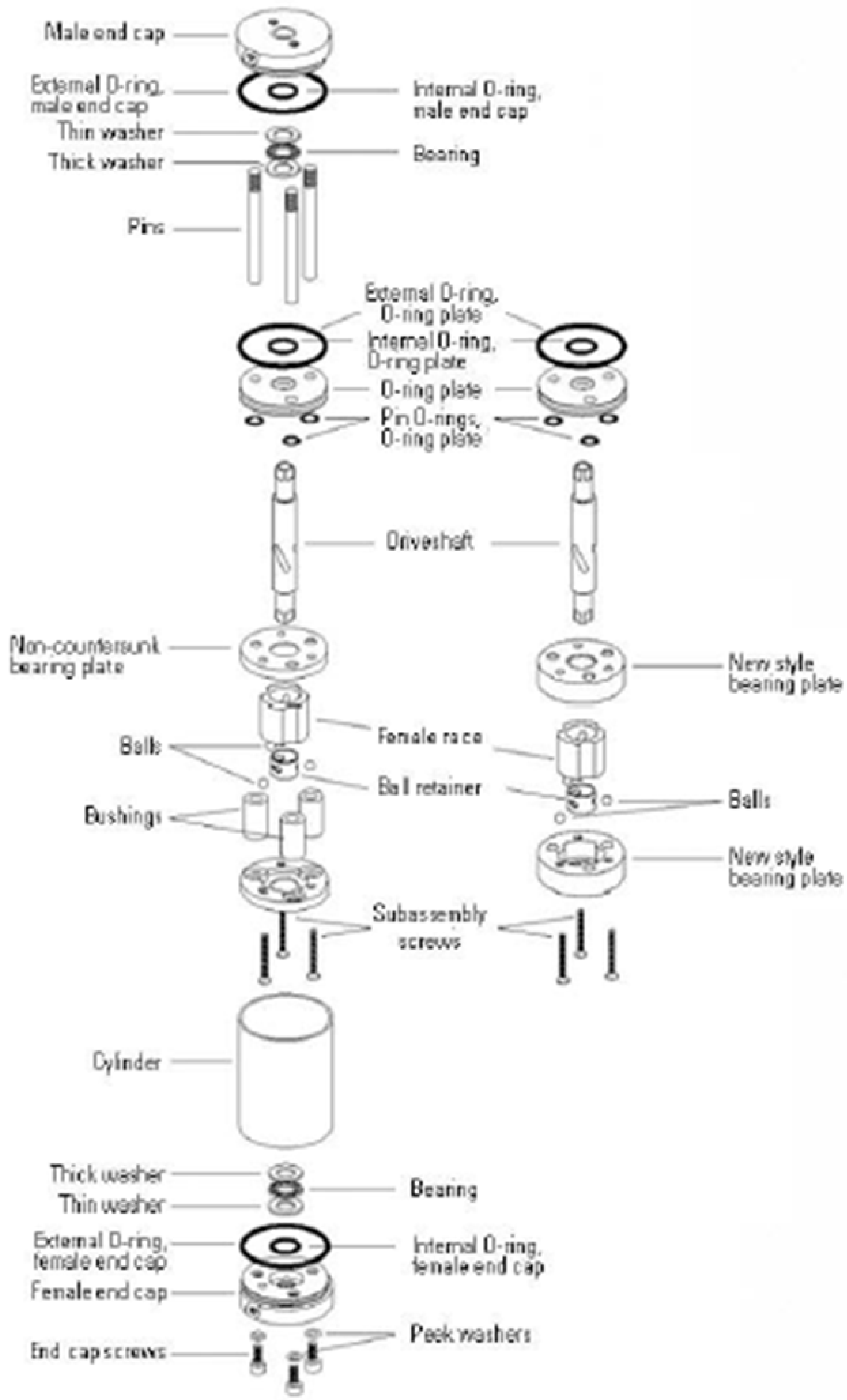


Figure D–12. Exploded view of two-position actuator

Appendix E
Dinfa Valve Service

The Dinfa valve is a slider type injection valve with a sample channel volume of nominally 1.2 microliters. The valve is used only for liquid applications on the Sola iQ when required by customers.

Overview

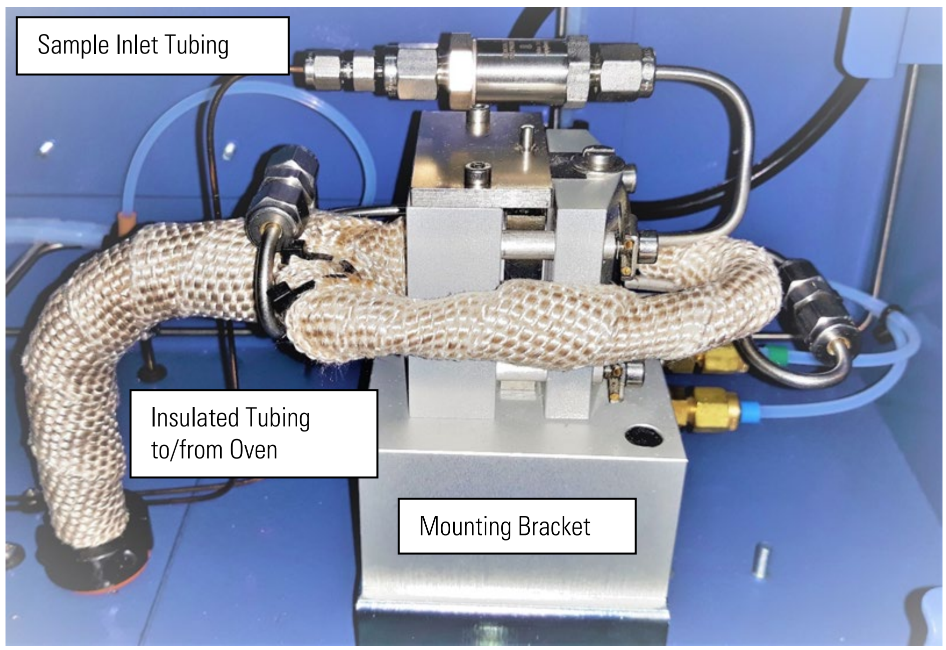


Figure E–1. Dinfa Valve mounted in Pneumatics Section

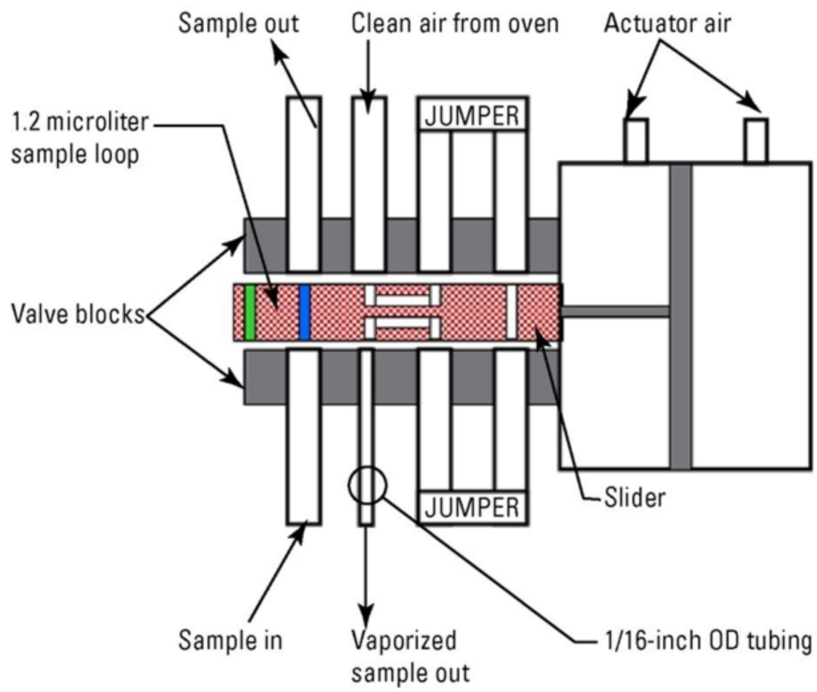


Figure E–2. Dinfa 8-port liquid injection valve, sample load position

Note To set up two injections/minute, set the injection time to 15 seconds. ▲

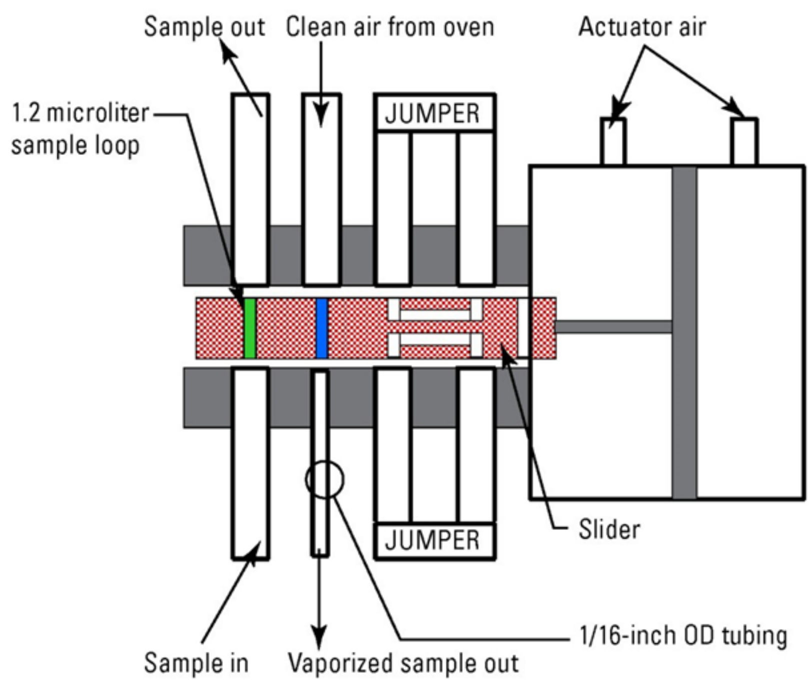


Figure E–3. Dinfa 8-port liquid injection valve, inject position

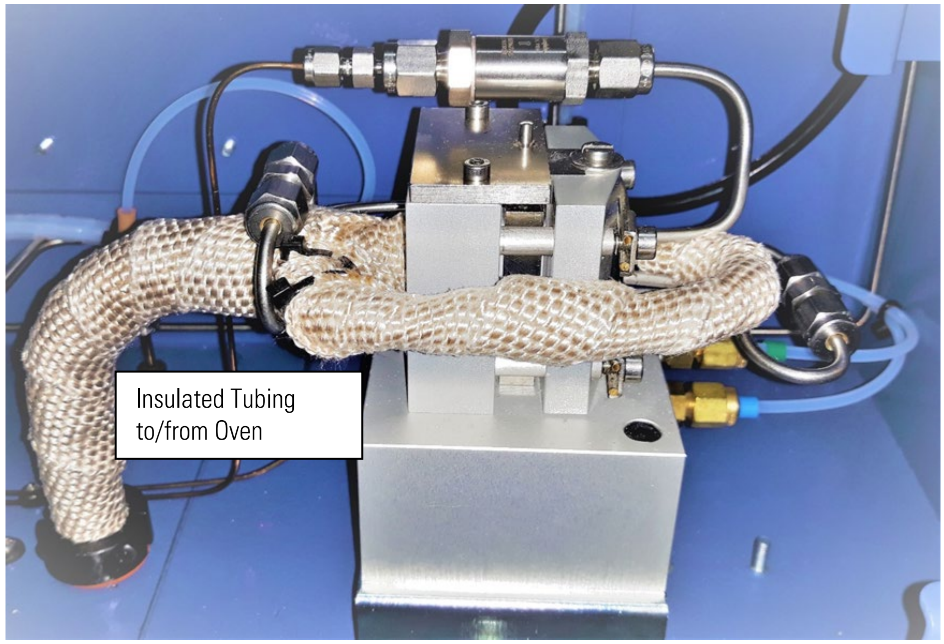


Figure E–4. Insulated Dinfa Valve

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 heat resistant tie wraps.

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.

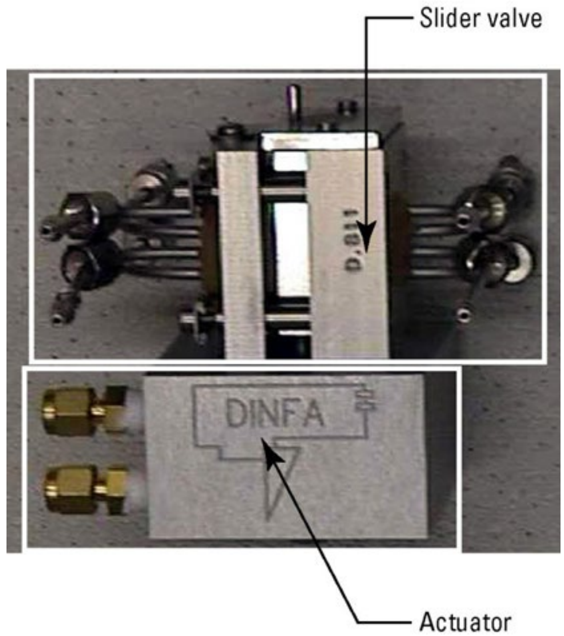


Figure E–5. Dinfa 8-port liquid injection valve

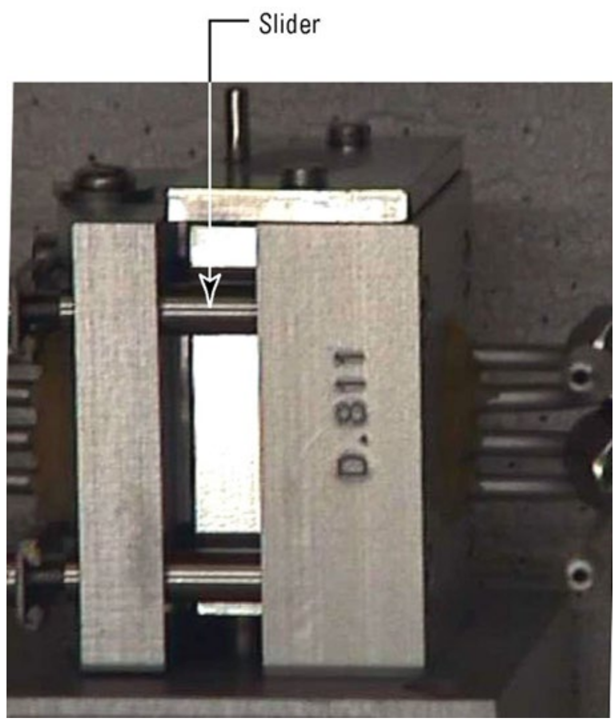


Figure E–6. Close-up of slider

Troubleshooting

If you suspect a valve leak, tighten the valve block tension adjustment bolts (Figure E–7).

- If there is insufficient signal, ensure the injection time 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.

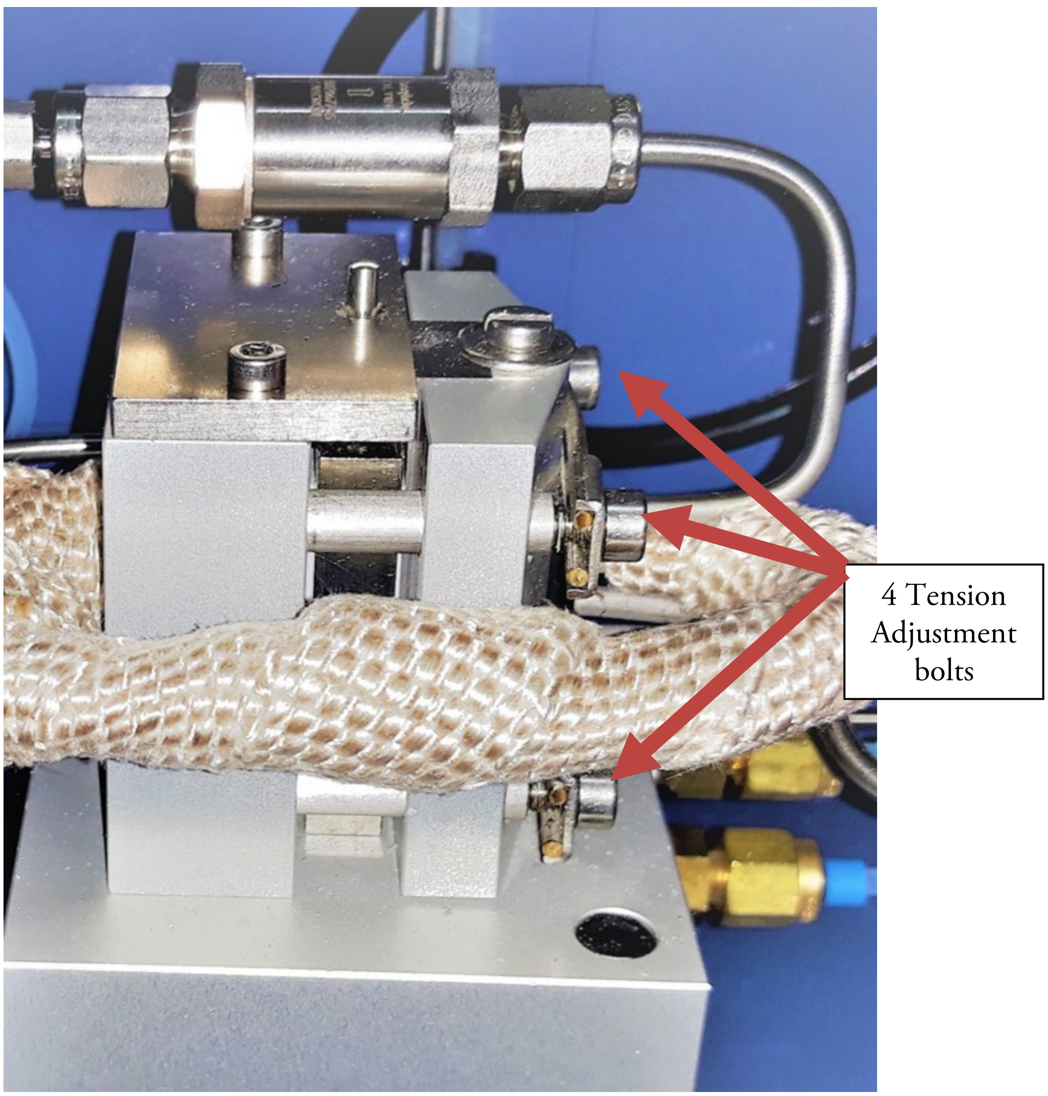


Figure E–7. Valve block tension adjustment bolts

If you suspect that the valve leak has not been fixed after tightening the valve block tension adjustment bolts, contact your Thermo Fisher Scientific representative. A more extensive valve leak and flow test procedure, 99-1345-0, is performed on the Dinfa valve before it is installed in the analyzer. Some or all of this more extensive procedure may be needed to resolve a suspected valve leak issue.

Appendix F
Connecting to a Sarasota FD910H Density

Purpose

The SOLA iQ can be connected up to four Thermo Scientific Sarasota FD910 density meters for use with live density compensation. This appendix provides information on how to make the connections.

Connections

In Figure F–1 below, terminals 2 and 4 of the Sarasota FD910H density meter are connected to the return of the SOLA iQ supply loop. Figure B-1 shows the installation of two FD910H liquid density meters. Up to four density meters can be wired to the SOLA iQ following the pattern shown in Figure F–1. One density meter is used for each stream. Connecting a density meter measuring the sample density to the SOLA iQ allows for performing live density compensation. The incoming 4-20mA density signal needs to be set-up in the SOLA iQ so that the reported total sulfur value includes the density compensation. Information related to the density compensation set-up can be found in Chapter 5 of the SOLA iQ Users Guide.

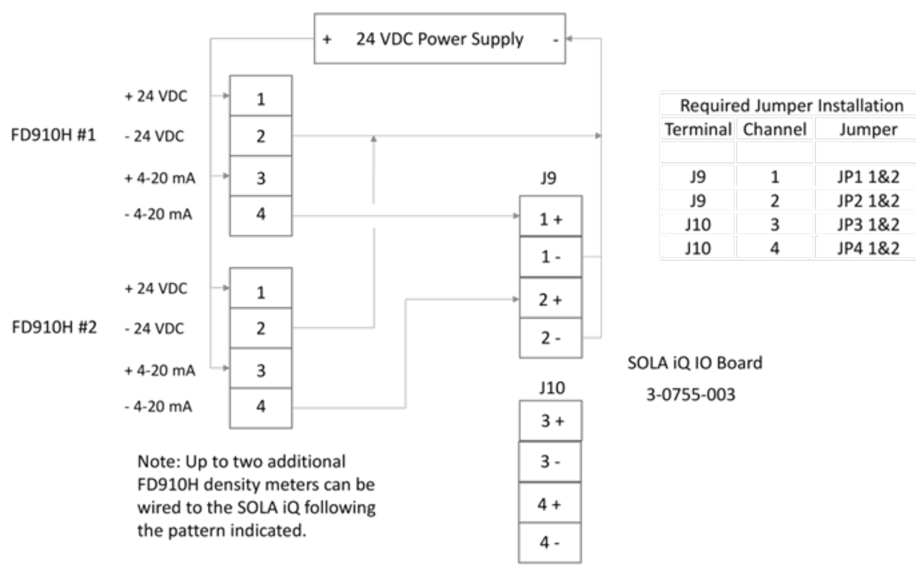


Figure F–1. Sarasota FD910H density meter to SOLA iQ connections

24 Vdc Power Supply

The I/O Board has an isolated 24 Vdc output rated for five watts (0.21 amps) available via J12. The J12 connection provides for 24 Vdc and 0 (zero) Vdc, a floating ground. Only one Sarasota meter can be operated using the 24 Vdc available on J12. For multiple meters, independent 24 Vdc power supplies are recommended.

Figure F–2 shows the density meter head mount assembly terminal connections. These terminals are the ones shown on the left in Figure F–1. Each density meter has its own set of terminals.

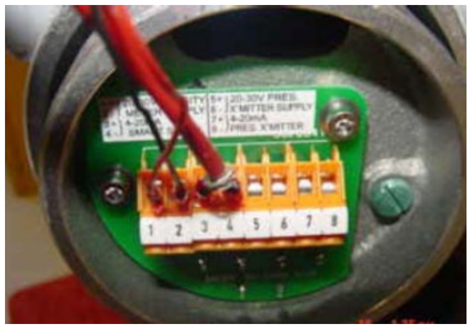


Figure F–2. Sarasota FD910 headmount assembly terminal connections

Figure F–3 is a picture of the SOLA IQ optional analog input board 3-0755-003.

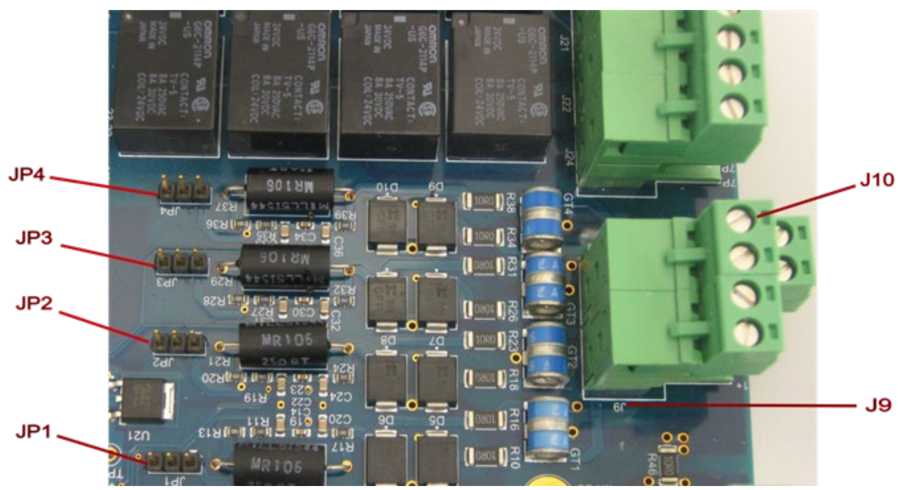


Figure F–3. Lower right corner of SOLA iQ IO Board 3-0755-003

In Figure F–3, there are four jumpers to the left of J9/J10. These jumpers are designated JP1, JP2, JP3 and JP4. If the jumper is installed per the Require Jumper Installation Table in Figure F–1, then the 4-20mA circuit is active. Jumper pins 1 and 2 are for the active position. Jumper pins 2 and 3 are for the inactive position. Figure F–4 schematically shows the relative locations of JP1, JP2, JP3 and JP4 when looking at the installed SOLA iQ board.

Warning . When AI input voltage is greater than 12 VDC, damage may result to the AI1, AI2, AI3 and AI4 circuit.
- To apply 4-20mA current input to AI1 to AI4, a jumper must be installed on Pin 1 and Pin 2 of JP1 to JP4 respectively, before connecting to the signal. Otherwise, the 24V loop power voltage will damage the circuit. ▲

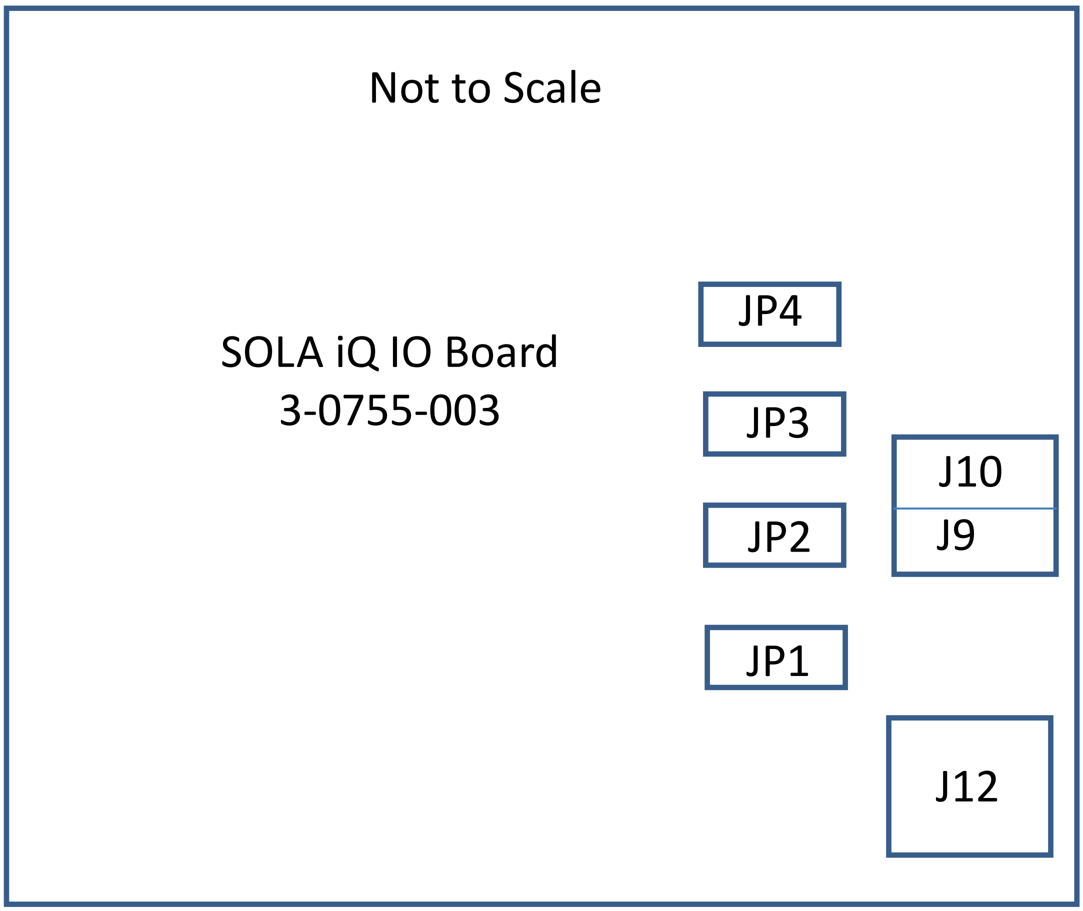


Figure F–4. Terminal block connectors on SOLA iQ IO board 3-0755-003

Appendix G
FlowP Calibration Using AutoCONFIG

Introduction

SOLA iQ Flow Pressure board contains differential pressure sensors that require calibration before using in the system. The calibration procedure is described in a separate document details the procedure to calibrate outside of SOLA iQ system.

After the board is installed in the system, the board can be re-calibrated in situ if required. This document describes the procedure to calibrate/re-calibrate the board in situ using AutoCFG.

System Requirement

For in situ calibration, the following is assumed in the system:

SOLA iQ Flow Pressure board (Bd 117612-00, Rev 08) programmed with firmware version 1.5.6.7 and above. Refer to FP programming procedure for properly programming and testing of the board prior proceed to calibration.

- Capillary assembly and tubes
- Air flow source
- Host PC running Microsoft Windows
- AutoCFG executable installed in PC, and communicates with SOLA iQ.
- Associated AutoCFG config files, and user programmable screens installed.

Calibration Procedure, Part A

The following session assumes user is familiar with AutoCFG operation, the system connects with AutoCFG, and all components/boards are operational. In addition, a digital flow meter or other appropriate calibrated flow reference is connected in the system.

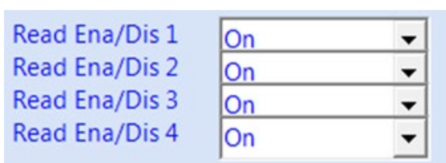
- Power up the system as normal.
- Open up AutoCFG as in normal run time.

- Open up user programmable screen FlowP_screen_17.xml or above.
- Check the value for CalLimitCheck (the one under header "Flow Read Info 3"). If the value is decimal 250 (0xFA), it needs to be programmed by following the procedures outlined. If the value is decimal 173 (0xAD), skip this subsection, and go directly to Calibration Procedure, Part B.

1. From the Navigation Bar in AutoCFG, click Communications, and open up "98-Modbus Master". Scroll down to Entry #88. Double click Entry #88 to open it up. For "Master Comm", select Enabled. Select Apply. Select Disable then Apply. This enables the write to the below register.

2. On FlowP_screen_17 screen, under header "FlowP Write Write 87", write in 173 next to CalLimitCheck. Click Apply. Select "Enabled" or "Communications" next to CalLimitCheck under header "FlowP Write Write 87". Click Apply.

3. Check if the CalLimitCheck under header "FlowP Read Info 3" is changed to 173. If it is changed to 173, this step is successful. Select "Disabled" for "Communication" to disable the write to CalLimitCheck. Move to the next part of the procedure. If not, repeat from step 1 again. Also ensure reads are enabled (see below):



4. If programmed successfully, the FlowP_screen_17 should look as below:

FlowP Read Info 3	
Board Type	261
FW Major	1
FW Minor	5
FW Maintenance	6
FW Build	7
BL Major	65535
BL Minor	65535
BL Maintenance	65535
BL Build	65535
CalLimitCheck	173

Calibration Procedure, Part B

- Establish a steady flow. Low flow should be around 100- 150cc/min.
- In FlowP_screen_17, change the “Low Point 2” value under header “FlowP Write Cal” to match the reading from external flow meter. Click Apply. Select Enabled next to the “Communications”. Click Apply.

Low Point 2	155	Communications	Disabled

- Check the value in “Low Point 2” under header “FlowP Read Cal 6-18”. If the value matches that in “Low Point 2” value under header “FlowP Write Cal”, the write is successful. Select Disabled next to the “Communications” next to “Low Point 2”. Click Apply.

Low Point 2	155

- Observe “Sensor 2” reading under “FlowP Read Data 1-2”. Wait for 3 minutes or until the reading is stable.
- Change the “Cal Action” under FlowP Wrte Write 25-26 to 5. Click Apply.

FlowP Write Write 25-26			
Cal Action	5	Communications	Off

- Select On next to the “Communications”. Click Apply.
- Observe “Low Point 2 Cnt” under header “FlowP Read Cal 6-18”. If the value is updated, the write is successful. Select Off next to the “Communications” next to “Cal Action”. Click Apply.
- This concludes the low point calibration.
- Change the flow rate until the external reference reads to 200-250cc/min.
- Repeat the above steps for the high point calibration. Points used are “High Point 2”, and “High Point 2 Cnt”. “Cal Action” for high point 2 calibration is 4. i.e., write value 4 to “Cal Action”.

- To verify the calibration, change the flow, and wait for the flow reading to stabilize on the external flow meter.
- Observe "Sensor2" under header "FlowP Read Data 1-2", and ensure it matches closely with the reading on the external flow meter. Change the flow to a few different values to verify the flow measurement is accurate across the operating range. Regarding desired flow operating range and accuracy, please check with SOLA System team.
- This concludes the flow pressure sensor calibration.

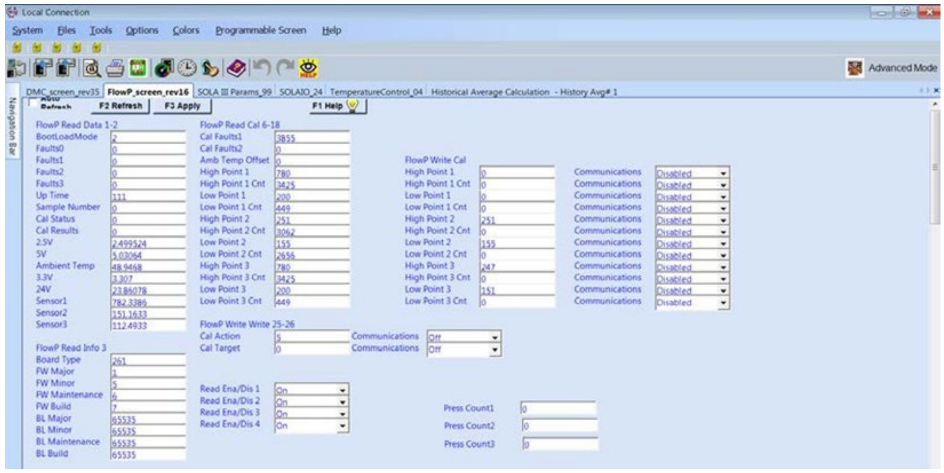


Figure G–1. FlowP Preconfigured page

Appendix H
Replacing the Real Time Clock Backup Battery on the AutoPilot PRO Board and System Control Board

A lithium backup battery, BR2330, is located at BT1 on the front of the main board. Another lithium backup battery is located at XBT1 on the front of the SCB board. These are field replaceable batteries. However, the batteries can only be replaced in non-hazardous areas or non-hazardous conditions.

SCB firmware version 31955 and higher includes a visual alarm to indicate a low backup battery on the APP board.

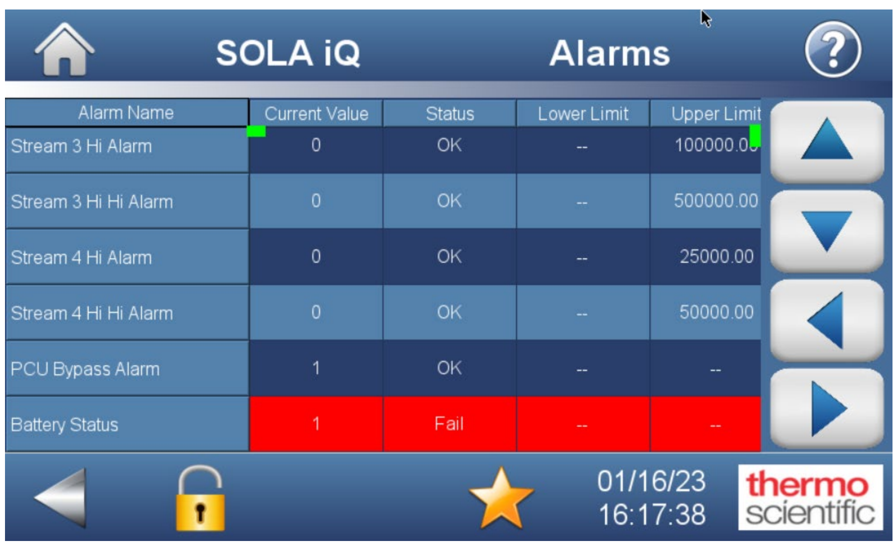


Figure H–1. Alarms page indicating low backup battery status

The APP board automatically performs battery voltage monitoring upon power-up and at factory-programmed time intervals of approximately 24 hours. The Battery Low flag will be asserted if the battery voltage is found to be less than approximately 2.5V. The Battery Low flag will remain asserted until completion of battery replacement and subsequent battery low monitoring tests, either during the next power-up sequence or the next scheduled 24-hour interval.

Figure H–2. Replace Lithium backup battery warning

Warning The Lithium battery may explode if mistreated. Do not attempt to recharge, disassemble, or burn it. ▲

Warning Ensure that the Electronics enclosure purge air is off, the power is off and the area is non-hazardous before performing this procedure. ▲

1. Open the Electronics enclosure door and locate the AutoPilot PRO board or SCB.

2. Gently lift up the battery retainer and lift the battery out.

3. Install the new battery, ensuring it is secured by the retainer.

4. Shut the Electronics enclosure door.

5. Turn on the electronics purge air and apply power to the SOLA iQ.

6. Dispose the battery in accordance with local, state, and federal environmental regulations.

PCA	Part Number	Description	MFG	MFG P/N
AutoPilot Pro Board	5-3980-015	Lithium backup battery	Panasonic	BR2330
System Control Board	101440-00	Lithium backup battery	Panasonic	CR1632

Appendix I
SOLA iQ PCU Wiring Diagram

For PCU wiring details, please refer to the latest version of drawing 0-755-083.

Appendix J
Modbus for SOLA iQ

Modbus Register Additions for the SOLA iQ

Registers can be added to the Modbus map for the SOLA iQ. Changing Modbus Registers requires the use of AutoConfig software in communication with the APP Board.

This procedure shows an example of adding the SOLA Suspend function to the Modbus Slave block.

Connect to the system with AutoConfig.

Verify which serial port is being used for Modbus. Factory default is the ‘Diagnostics Port’ as seen in the next figure. Check that the Comm Block is set to ‘Modbus Slave’ and verify ‘Block Index’ is set to the desired value. The next figure shows that the “Block Index” is set to Entry #49. Entry #49 means that register map #49 is to be edited in the example described below. Once the desired “Block Index” is selected, this window can be closed.

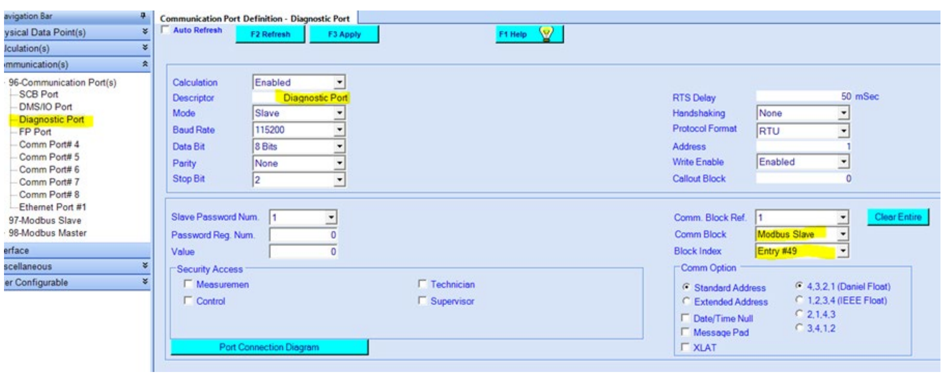


Figure J–1. Diagnostic Port of the Communication Port Definition APP Screen

The next step is to open the 97 Modbus Slave Block and scroll down the list to open Entry #49 as shown in the next figure:

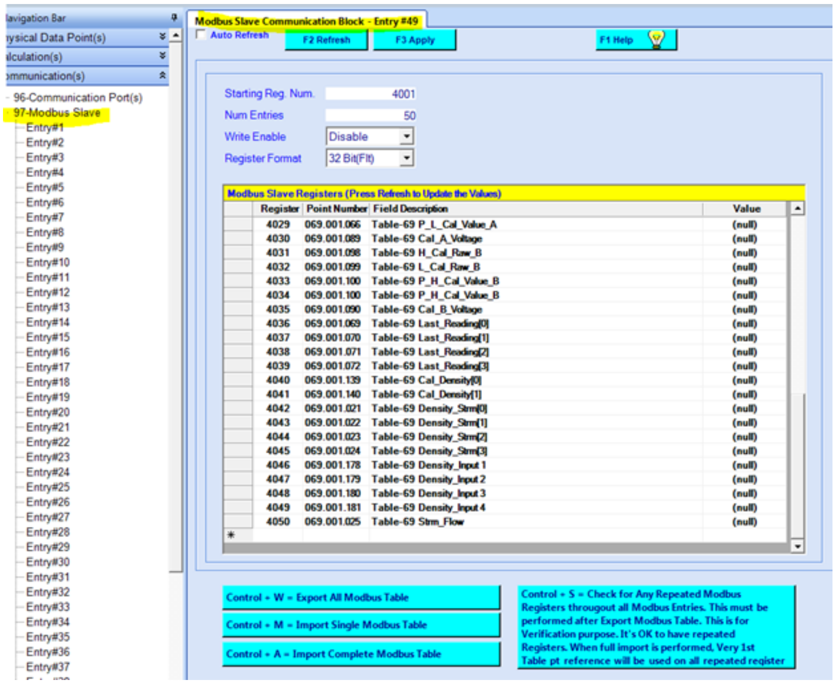


Figure J–2. Modbus Slave Communication Block APP Screen

If there are no spare registers (as in the example above) then the total number of registers can be increased in ‘Num Entries’ (at the top of the above figure).

The figure below shows that register 4051 has been added but not defined yet by increasing the ‘Num Entries’ value from 50 in to 51.

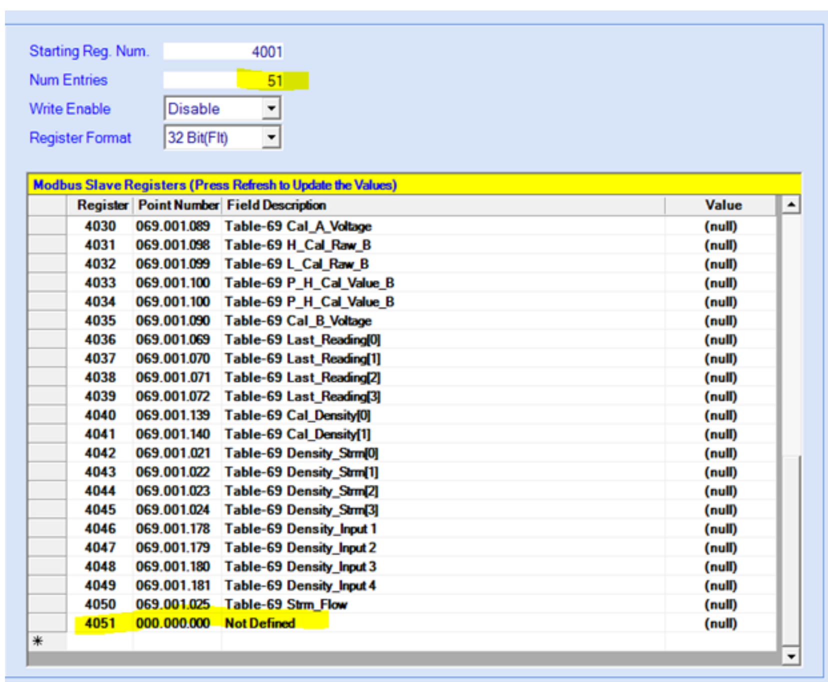


Figure J–3. Modified Modbus Slave Communication Block APP Screen

To the left of the Modbus Slave Communication Block APP Screen, scroll down to 'User Configurable' tab and open it and select 'SOLA III Params' (see below).

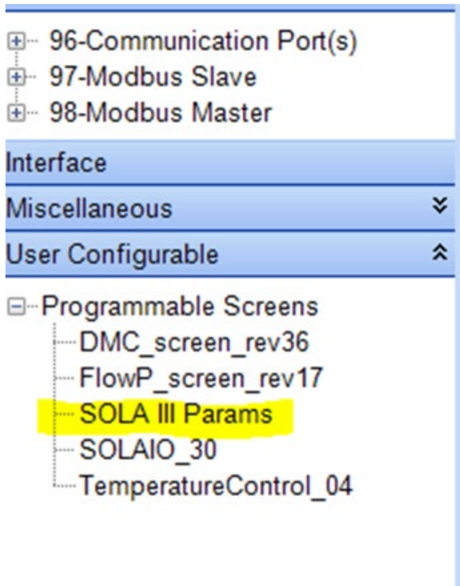


Figure J–4. User Configurable SOLA III Params

When the SOLA III Params screen opens select 'Run Screen' near the top (see figure below).

Figure J–5. Run Screen in SOLA III Params

Under 'Controls With Remote DI' on the right side of the screen identify the entry labelled 'Analyzer_Mode' (see figure below).

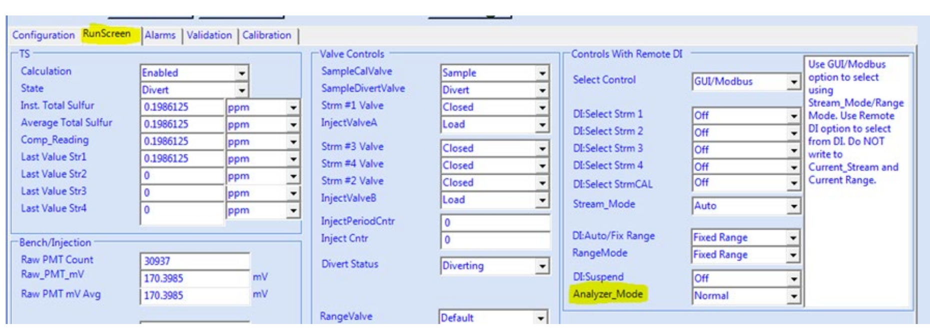


Figure J–6. Analyzer_Mode box on Run Screen in SOLA III Params

Warning **DO NOT change the value in the Analyzer_Mode drop down box.** ▲

Hover the mouse cursor over the **TEXT** 'Analyzer_Mode'. Right click on the TEXT and select 'Copy Point'.

Go back to the Modbus Slave Communications Block- Entry #49'. Highlight register line 4051 then right click and select paste. Register 4051 will now be configured to accept remote command via Modbus to either go to Standby or Normal mode.

The F3 Apply button must be selected at the top of the Modbus Slave Communication Block screen to save the change to the APP board (see below).

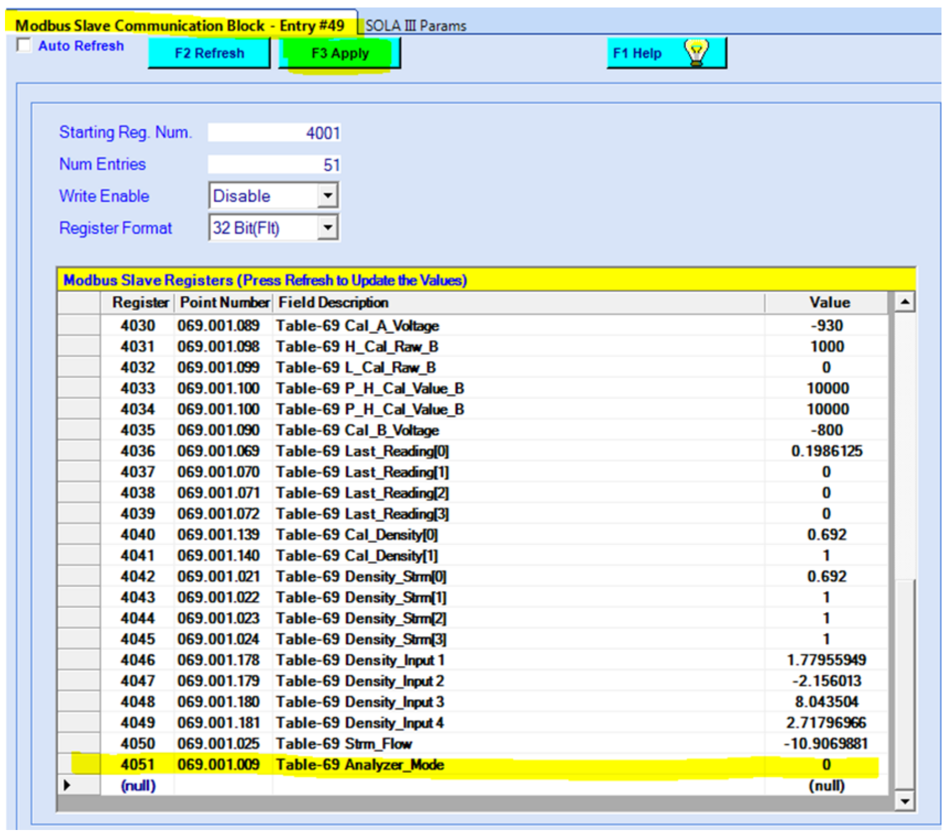


Figure J–7. F3 Apply button on the Modbus Slave Communication Block

SOLA iQ User Accessible Modbus Register Map

The SOLA iQ provides user access to a wide range of internal system registers. These registers can be used to read the measurement data, status and parameters and to write to the control registers and output data. The user accessible registers are listed below.

The registers are split into Read section and Write sections. Follow the procedure outlined in SOLA iQ User Modbus Register Addition Procedure to setup and customize the Modbus address and the number of registers in each packet. Read registers and Write registers should be defined in different packets, e.g., each packet can be defined as Read or Write, but not a mixture of both.

The points defined in the entries below (Table 97, Entries 43 – 45, and Entries 47-48) can be used as a reference for setting up user defined packets. Example user defined packets are shown as Entry #10 and Entry #49. User defined packets may duplicate points in other entries.

Point ID is in the form .Table.Item.Field.

Read Registers

Table J–1. Table_97, Entry-43 (Modbus Slave Comm Block Entry #43)

Register No.	Register Name	Point ID	Point Type
1	Chamber_Pressure	.1.7.4.	Floating Point Value
2	Chamber_Flow	.1.8.4.	Floating Point Value
3	Reserved	.1.9.4.	Floating Point Value
4	Bench Temperature	.1.34.4.	Floating Point Value
5	Flash_Intensity_Monitor	.1.35.4.	Floating Point Value
6	Flash_HV	.1.36.4.	Floating Point Value
7	PMT_HV	.1.37.4.	Floating Point Value
8	PMT_Frequency_Count	.1.38.4.	Floating Point Value
9	Raw_PMT_mV	.69.1.210.	Floating Point Pt. Reference
10	Bench_Heater_PWM	.1.40.4.	Floating Point Value
11	Input_Board_Gain	.1.41.4.	Floating Point Value
12	Detector_Gain_Id	.1.42.4.	Floating Point Value
13	Flash_Reference_%	.1.44.4.	Floating Point Value
14	CalState	.69.1.74.	Byte Point Reference
15	Cal_Cntr	.69.1.81.	16-Bit Word Pt. Reference
16	H_Cal_Raw_A	.69.1.63.	Floating Point Pt. Reference
17	L_Cal_Raw_A	.69.1.64.	Floating Point Pt. Reference

Register No.	Register Name	Point ID	Point Type
18	H_Cal_Raw_B	.69.1.98.	Floating Point Pt. Reference
19	L_Cal_Raw_B	.69.1.99.	Floating Point Pt. Reference
20	State	.69.1.78.	Byte Point Reference
21	Eng_Units	.69.1.145.	Byte Point Reference
22	Cnts_Avg	.69.1.28.	Floating Point Pt. Reference
23	Raw_Reading	.69.1.41.	Floating Point Pt. Reference
24	Averaged_Reading	.69.1.75.	Floating Point Pt. Reference
25	Comp_Reading	.69.1.68.	Floating Point Pt. Reference
26	Last_Reading[0]	.69.1.69.	Floating Point Pt. Reference
27	Last_Reading[1]	.69.1.70.	Floating Point Pt. Reference
28	Last_Reading[2]	.69.1.71.	Floating Point Pt. Reference
29	Last_Reading[3]	.69.1.72.	Floating Point Pt. Reference
30	Stream_Output_1	.69.1.165.	Floating Point Pt. Reference
31	Stream_Output_2	.69.1.166.	Floating Point Pt. Reference
32	Stream_Output_3	.69.1.167.	Floating Point Pt. Reference
33	Stream_Output_4	.69.1.168.	Floating Point Pt. Reference
34	Str1Unit	.69.1.205.	Byte Point Reference
35	Str2Unit	.69.1.206.	Byte Point Reference
36	Str3Unit	.69.1.207.	Byte Point Reference
37	Str4Unit	.69.1.208.	Byte Point Reference
38	Density_Input_1	.69.1.178.	Floating Point Pt. Reference
39	Density_Input_2	.69.1.179.	Floating Point Pt. Reference
40	Density_Input_3	.69.1.180.	Floating Point Pt. Reference
41	Density_Input_4	.69.1.181.	Floating Point Pt. Reference
42	Density_Strm[0]	.69.1.21.	Floating Point Pt. Reference
43	Density_Strm[1]	.69.1.22.	Floating Point Pt. Reference
44	Density_Strm[2]	.69.1.23.	Floating Point Pt. Reference
45	Density_Strm[3]	.69.1.24.	Floating Point Pt. Reference
46	Pressure_SW_1	.69.1.151.	Discrete Point Pt. Reference
47	Pressure_SW_2	.69.1.152.	Discrete Point Pt. Reference
48	Pressure_SW_3	.69.1.153.	Discrete Point Pt. Reference
49	Pressure_SW_4	.69.1.154.	Discrete Point Pt. Reference
50	Strm_Flow	.69.1.25.	Floating Point Pt. Reference
51	SampleCalValve	.69.1.44.	Discrete Point Pt. Reference

Register No.	Register Name	Point ID	Point Type
52	SampleDivertValve	.69.1.45.	Discrete Point Pt. Reference
53	StmValve[0]	.69.1.47.	Discrete Point Pt. Reference
54	InjectValveA	.69.1.46.	Discrete Point Pt. Reference
55	StmValve[1]	.69.1.48.	Discrete Point Pt. Reference
56	StmValve[2]	.69.1.49.	Discrete Point Pt. Reference
57	StmValve[3]	.69.1.50.	Discrete Point Pt. Reference
58	InjectValveB	.69.1.43.	Discrete Point Pt. Reference
59	RangeValve	.69.1.88.	Discrete Point Pt. Reference

Table J–2. Table_97, Entry-44 (Modbus Slave Comm Block Entry #44)

Register No.	Register Name	Point ID	Point Type
100	LoGasValve	.69.1.102.	Discrete Point Pt. Reference
101	MidGasValve	.69.1.103.	Discrete Point Pt. Reference
102	HiGasValve	.69.1.104.	Discrete Point Pt. Reference
103	LocalProbeValve	.69.1.105.	Discrete Point Pt. Reference
104	Pyro_temperature	.1.200.4.	Floating Point Value
105	Oven_Temperature	.1.201.4.	Floating Point Value
106	Divert	.69.1.79.	Discrete Point Pt. Reference
107	Hi_Alarm_1	.69.1.197.	Discrete Point Pt. Reference
108	Hi_Hi_Alarm_1	.69.1.193.	Discrete Point Pt. Reference
109	Hi_Alarm_2	.69.1.198.	Discrete Point Pt. Reference
110	Hi_Hi_Alarm_2	.69.1.194.	Discrete Point Pt. Reference
111	Hi_Alarm_3	.69.1.199.	Discrete Point Pt. Reference
112	Hi_Hi_Alarm_3	.69.1.195.	Discrete Point Pt. Reference
113	Hi_Alarm_4	.69.1.200.	Discrete Point Pt. Reference
114	Hi_Hi_Alarm_4	.69.1.196.	Discrete Point Pt. Reference
115	Chamber_Temp_Alarm	.69.1.132.	Discrete Point Pt. Reference
116	Chamber_Flow_Alarm	.69.1.138.	Discrete Point Pt. Reference
117	Chamber_Press_Alarm	.69.1.135.	Discrete Point Pt. Reference
118	Lamp_I_Alarm	.69.1.51.	Discrete Point Pt. Reference
119	Lamp_V_Alarm	.69.1.128.	Discrete Point Pt. Reference
120	ROC_Alarm	.69.1.84.	Discrete Point Pt. Reference
121	Purge_Alarm	.69.1.54.	Discrete Point Pt. Reference

Register No.	Register Name	Point ID	Point Type
122	Pyrolyzer_Alarm	.1.225.4.	Floating Point Value
123	Oven_Alarm	.1.226.4.	Floating Point Value
124	Flow_Pressure_Comm_Status	.2.83.5.	Discrete State
125	DMC_Board_Comm_Status	.2.84.5.	Discrete State
126	IO_Board_Comm_Status	.2.85.5.	Discrete State
127	Malfunction_Alarm	.69.1.141.	Discrete Point Pt. Reference
128	No_Injection_Alarm	.69.1.53.	Discrete Point Pt. Reference
129	Powerup_Divert_Clear_Counter	.1.250.4.	Floating Point Value
130	PID_Alarm_Cntr	.69.1.59.	16-Bit Word Pt. Reference
131	Purge_Alarm_Cntr	.69.1.156.	16-Bit Word Pt. Reference
132	Flow_Alarm_Cntr	.69.1.142.	16-Bit Word Pt. Reference
133	Pyro_Alarm_Set_Counter	.1.252.4.	Floating Point Value
134	Oven_Alarm_Set_Counter	.1.253.4.	Floating Point Value
135	H_Alarm_Cntr	.69.1.58.	16-Bit Word Pt. Reference
136	HH_Alarm_Cntr	.69.1.57.	16-Bit Word Pt. Reference
137	Inject_Rate_Cntr	.69.1.76.	16-Bit Word Pt. Reference
138	Inject_Time_Cntr	.69.1.77.	16-Bit Word Pt. Reference
139	Purge_Left_Cntr	.69.1.60.	16-Bit Word Pt. Reference
140	Stream_Time_Left	.69.1.209.	Floating Point Pt. Reference
140	Switch_Left_BA	.69.1.95.	16-Bit Word Pt. Reference
142	Pyro_Low_Range	.1.217.4.	Floating Point Value
143	Oven_Low_Range	.1.221.4.	Floating Point Value
144	In_Cal	.69.1.6.	Discrete Point Pt. Reference
145	AbortPurge	.69.1.5.	Discrete Point Pt. Reference
146	Current_Stream	.69.1.73.	Byte Point Reference
147	Range_Current	.69.1.87.	Discrete Point Pt. Reference
148	ValidateStep	.69.1.107.	Byte Point Reference
149	ValidateTimeLeft	.69.1.124.	16-Bit Word Pt. Reference
150	Flow_Input	.69.1.56.	Discrete Point Pt. Reference
151	Flow_Alarm	.69.1.144.	Discrete Point Pt. Reference
152	ValidateStart	.69.1.106.	Discrete Point Pt. Reference
153	PCUBypass	.69.1.201.	Discrete Point Pt. Reference
154	Bench_Config	.4.94.3.	16-Bit Word Value
155	AI1	.1.101.4.	Floating Point Value

Register No.	Register Name	Point ID	Point Type
156	AI2	.1.102.4.	Floating Point Value
157	AI3	.1.103.4.	Floating Point Value
158	AI4	.1.104.4.	Floating Point Value
159	DI1	.2.1.5.	Discrete State
160	DI2	.2.2.5.	Discrete State
161	DI3	.2.3.5.	Discrete State
162	DI4	.2.4.5.	Discrete State
163	DI5	.2.5.5.	Discrete State
164	DI6	.2.6.5.	Discrete State
165	DI7	.2.7.5.	Discrete State
166	DI8	.2.8.5.	Discrete State
167	DI9	.2.9.5.	Discrete State
168	DI10	.2.10.5.	Discrete State
169	DI11	.2.11.5.	Discrete State
170	DI12	.2.12.5.	Discrete State
171	DI13	.2.13.5.	Discrete State
172	DI14	.2.14.5.	Discrete State
173	DI15	.2.15.5.	Discrete State
174	DI16	.2.16.5.	Discrete State
175	Pyro_High_Range	.1.216.4.	Floating Point Value
176	Oven_High_Range	.1.220.4.	Floating Point Value
177	Pyro_Pressure_SW	.69.1.202.	Discrete Point Pt. Reference

Table J–3. Table_97, Entry-45 (Modbus Slave Comm Block Entry #45)

Register No.	Register Name	Point ID	Point Type
512	Board_Type	.4.138.3.	16-Bit Word Value
513	Flow_Pressure_FW	.4.10.3.	16-Bit Word Value
514	Flow_Pressure_FW	.4.11.3.	16-Bit Word Value
515	Flow_Pressure_FW	.4.12.3.	16-Bit Word Value
516	Flow_Pressure_FW	.4.13.3.	16-Bit Word Value
517	Reserved	.4.14.3.	16-Bit Word Value
518	Reserved	.4.15.3.	16-Bit Word Value
519	Reserved	.4.16.3.	16-Bit Word Value

Register No.	Register Name	Point ID	Point Type
520	Reserved	.4.17.3.	16-Bit Word Value
521	DMC_FW	.4.72.3.	16-Bit Word Value
522	DMC_FW	.4.73.3.	16-Bit Word Value
523	DMC_FW	.4.74.3.	16-Bit Word Value
524	DMC_FW	.4.75.3.	16-Bit Word Value
525	Reserved	.4.76.3.	16-Bit Word Value
526	Reserved	.4.77.3.	16-Bit Word Value
527	Reserved	.4.78.3.	16-Bit Word Value
528	Reserved	.4.79.3.	16-Bit Word Value
529	RTU_Software_Version	.30.1.5.	Floating Point Value
530	IO_FW	.4.158.3.	16-Bit Word Value
531	IO_FW	.4.159.3.	16-Bit Word Value
532	CFG_Version	.4.150.3.	16-Bit Word Value
533	CFG_Version	.4.151.3.	16-Bit Word Value
534	CFG_Version	.4.152.3.	16-Bit Word Value
535	CFG_Version	.4.153.3.	16-Bit Word Value
536	CFG_Version	.4.154.3.	16-Bit Word Value
512	Board_Type	.4.138.3.	16-Bit Word Value
513	Flow_Pressure_FW	.4.10.3.	16-Bit Word Value
514	Flow_Pressure_FW	.4.11.3.	16-Bit Word Value
515	Flow_Pressure_FW	.4.12.3.	16-Bit Word Value
516	Flow_Pressure_FW	.4.13.3.	16-Bit Word Value
517	Reserved	.4.14.3.	16-Bit Word Value
518	Reserved	.4.15.3.	16-Bit Word Value
519	Reserved	.4.16.3.	16-Bit Word Value
520	Reserved	.4.17.3.	16-Bit Word Value
521	DMC_FW	.4.72.3.	16-Bit Word Value
522	DMC_FW	.4.73.3.	16-Bit Word Value
523	DMC_FW	.4.74.3.	16-Bit Word Value

Write Registers

Table J–4. Table_97, Entry-47 (Modbus Slave Comm Block Entry #47)

Register No.	Register Name	Point ID	Point Type
2048	Reserved	.2.256.5.	Discrete Point Pt. Reference
2049	Dual_Injection	.69.1.192.	Discrete Point Pt. Reference
2050	Type	.69.1.4.	Byte Point Reference
2051	Stream_Mode	.69.1.8.	Byte Point Reference
2052	RangeMode	.69.1.86.	Discrete Point Pt. Reference
2053	FlareSync	.69.1.125.	Discrete Point Pt. Reference
2054	Analyzer_Mode	.69.1.9.	Discrete Point Pt. Reference
2055	AbortPurge	.69.1.5.	Discrete Point Pt. Reference
2056	Stop_Injection	.69.1.190.	Discrete Point Pt. Reference
2057	AdaptiveMovingAvg	.69.1.52.	Discrete Point Pt. Reference
2058	Hysteresis_A_B	.69.1.92.	Floating Point Pt. Reference
2059	Hysteresis_B_A	.69.1.93.	Floating Point Pt. Reference
2060	CalAUnit	.69.1.213.	Byte Point Reference
2061	CalBUnit	.69.1.214.	Byte Point Reference
2062	Cal_Density[0]	.69.1.139.	Floating Point Pt. Reference
2063	Cal_Density[1]	.69.1.140.	Floating Point Pt. Reference
2064	Cal_Range	.69.1.191.	Discrete Point Pt. Reference
2065	CalSelected	.69.1.7.	Byte Point Reference
2066	Cal_A_Voltage	.69.1.89.	Floating Point Pt. Reference
2067	H_Cal_Value_A	.69.1.61.	Floating Point Pt. Reference
2068	L_Cal_Value_A	.69.1.62.	Floating Point Pt. Reference
2069	Cal_B_Voltage	.69.1.90.	Floating Point Pt. Reference
2070	H_Cal_Value_B	.69.1.96.	Floating Point Pt. Reference
2071	L_Cal_Value_B	.69.1.97.	Floating Point Pt. Reference
2072	Adj_Reading	.69.1.27.	Floating Point Pt. Reference
2073	Cal_Reads	.69.1.20.	16-Bit Word Pt. Reference
2074	In_Cal	.69.1.6.	Discrete Point Pt. Reference
2075	Strm_Dwell[0]	.69.1.29.	Floating Point Pt. Reference
2076	Strm_Dwell[1]	.69.1.30.	Floating Point Pt. Reference
2077	Strm_Dwell[2]	.69.1.31.	Floating Point Pt. Reference
2078	Strm_Dwell[3]	.69.1.32.	Floating Point Pt. Reference

Register No.	Register Name	Point ID	Point Type
2079	Stream_Cal_1	.69.1.146.	Discrete Point Pt. Reference
2080	Stream_Cal_2	.69.1.147.	Discrete Point Pt. Reference
2081	Stream_Cal_3	.69.1.148.	Discrete Point Pt. Reference
2082	Stream_Cal_4	.69.1.149.	Discrete Point Pt. Reference
2083	Stream_Lo_Scale_1	.69.1.157.	Floating Point Pt. Reference
2084	Stream_Hi_Scale_1	.69.1.161.	Floating Point Pt. Reference
2085	Stream_Lo_Scale_2	.69.1.158.	Floating Point Pt. Reference
2086	Stream_Hi_Scale_2	.69.1.162.	Floating Point Pt. Reference
2087	Stream_Lo_Scale_3	.69.1.159.	Floating Point Pt. Reference
2088	Stream_Hi_Scale_3	.69.1.163.	Floating Point Pt. Reference
2089	Stream_Lo_Scale_4	.69.1.160.	Floating Point Pt. Reference
2090	Stream_Hi_Scale_4	.69.1.164.	Floating Point Pt. Reference
2091	Density_Lo_Scale_1	.69.1.170.	Floating Point Pt. Reference
2092	Density_Hi_Scale_1	.69.1.174.	Floating Point Pt. Reference
2093	Density_Lo_Scale_2	.69.1.171.	Floating Point Pt. Reference
2094	Density_Hi_Scale_2	.69.1.175.	Floating Point Pt. Reference
2095	Density_Lo_Scale_3	.69.1.172.	Floating Point Pt. Reference
2096	Density_Hi_Scale_3	.69.1.176.	Floating Point Pt. Reference
2097	Density_Lo_Scale_4	.69.1.173.	Floating Point Pt. Reference
2098	Density_Hi_Scale_4	.69.1.177.	Floating Point Pt. Reference
2099	Density_Fixed_1	.69.1.186.	Discrete Point Pt. Reference
2100	Density_Fixed_2	.69.1.187.	Discrete Point Pt. Reference
2101	Density_Fixed_3	.69.1.188.	Discrete Point Pt. Reference
2102	Density_Fixed_4	.69.1.189.	Discrete Point Pt. Reference
2103	Density_Strm[0]	.69.1.21.	Floating Point Pt. Reference
2104	Density_Strm[1]	.69.1.22.	Floating Point Pt. Reference
2105	Density_Strm[2]	.69.1.23.	Floating Point Pt. Reference
2106	Density_Strm[3]	.69.1.24.	Floating Point Pt. Reference
2107	PU_Divert_Time	.1.223.4.	Floating Point Value

Table J–5. Table_97, Entry-48 (Modbus Slave Comm Block Entry #48)

Register No.	Register Name	Point ID	Point Type
2108	PID_Time	.69.1.16.	16-Bit Word Pt. Reference
2109	Purge_Time	.69.1.13.	16-Bit Word Pt. Reference
2110	Inject_Time	.69.1.18.	16-Bit Word Pt. Reference
2111	Average_Time	.69.1.12.	16-Bit Word Pt. Reference
2112	Switch_Time_BA	.69.1.94.	16-Bit Word Pt. Reference
2113	Temperature_Alarm_Set_Delay	.1.224.4.	Floating Point Value
2114	Purge_Alarm_Time	.69.1.155.	16-Bit Word Pt. Reference
2115	Flow_Alarm_Time	.69.1.143.	16-Bit Word Pt. Reference
2116	H_Time	.69.1.14.	16-Bit Word Pt. Reference
2117	HH_Time	.69.1.15.	16-Bit Word Pt. Reference
2118	Chamber_Temp_Dev	.69.1.131.	Floating Point Pt. Reference
2119	Chamber_Flow_Alm_Limit	.69.1.137.	Floating Point Pt. Reference
2120	Chamber_Press_Alm_Limit	.69.1.134.	Floating Point Pt. Reference
2121	Lamp_I_Alarm_Limit	.69.1.11.	Floating Point Pt. Reference
2122	Lamp_V_Alm_Limit	.69.1.127.	Floating Point Pt. Reference
2123	ROC_Alm_Limit	.69.1.83.	Floating Point Pt. Reference
2124	ROC_Time	.69.1.85.	16-Bit Word Pt. Reference
2125	ROC_Alarm	.69.1.84.	Discrete Point Pt. Reference
2126	Pyro_Range	.1.215.4.	Floating Point Value
2127	Pyro_High_Range	.1.216.4.	Floating Point Value
2128	Oven_Range	.1.219.4.	Floating Point Value
2129	Oven_High_Range	.1.220.4.	Floating Point Value
2130	H_Alarm_Strm[0]	.69.1.33.	Floating Point Pt. Reference
2131	HH_Alarm_Strm[0]	.69.1.37.	Floating Point Pt. Reference
2132	H_Alarm_Strm[1]	.69.1.34.	Floating Point Pt. Reference
2133	HH_Alarm_Strm[1]	.69.1.38.	Floating Point Pt. Reference
2134	H_Alarm_Strm[2]	.69.1.35.	Floating Point Pt. Reference
2135	HH_Alarm_Strm[2]	.69.1.39.	Floating Point Pt. Reference
2136	H_Alarm_Strm[3]	.69.1.36.	Floating Point Pt. Reference
2137	HH_Alarm_Strm[3]	.69.1.40.	Floating Point Pt. Reference
2138	ValidateStart	.69.1.106.	Discrete Point Pt. Reference
2139	ValidateState[0]	.69.1.108.	Byte Point Reference
2140	ValidateState[1]	.69.1.109.	Byte Point Reference

Register No.	Register Name	Point ID	Point Type
2141	ValidateState[2]	.69.1.110.	Byte Point Reference
2142	ValidateState[3]	.69.1.111.	Byte Point Reference
2143	ValidateState[4]	.69.1.112.	Byte Point Reference
2144	ValidateState[5]	.69.1.113.	Byte Point Reference
2145	ValidateState[6]	.69.1.114.	Byte Point Reference
2146	ValidateState[7]	.69.1.115.	Byte Point Reference
2147	ValidateTime[0]	.69.1.116.	16-Bit Word Pt. Reference
2148	ValidateTime[1]	.69.1.117.	16-Bit Word Pt. Reference
2149	ValidateTime[2]	.69.1.118.	16-Bit Word Pt. Reference
2150	ValidateTime[3]	.69.1.119.	16-Bit Word Pt. Reference
2151	ValidateTime[4]	.69.1.120.	16-Bit Word Pt. Reference
2152	ValidateTime[5]	.69.1.121.	16-Bit Word Pt. Reference
2153	ValidateTime[6]	.69.1.122.	16-Bit Word Pt. Reference
2154	ValidateTime[7]	.69.1.123.	16-Bit Word Pt. Reference
2155	Sample_Control	.69.1.150.	Byte Point Reference
2156	Flow_SW_Mtr	.69.1.182.	Discrete Point Reference
2157	Reserved	.4.126.3.	16-Bit Word Value
2158	System_Date	.31.1.1.	Floating Point Value
2159	System_Time	.31.1.2.	Floating Point Value
2160	In_Diagnostics	.69.1.10.	Discrete Point Reference
2161	AO1	.1.157.4.	Floating Point Value
2162	AO2	.1.158.4.	Floating Point Value
2163	AO3	.1.159.4.	Floating Point Value
2164	AO4	.1.160.4.	Floating Point Value
2165	DO1	.2.67.5.	Discrete State
2166	DO2	.2.68.5.	Discrete State
2167	DO3	.2.69.5.	Discrete State
2168	DO4	.2.70.5.	Discrete State
2169	DO5	.2.71.5.	Discrete State
2170	DO6	.2.72.5.	Discrete State
2171	DO7	.2.73.5.	Discrete State
2172	DO8	.2.74.5.	Discrete State
2173	DO9	.2.75.5.	Discrete State
2174	DO10	.2.76.5.	Discrete State

Register No.	Register Name	Point ID	Point Type
2175	DO11	.2.77.5.	Discrete State
2176	DO12	.2.78.5.	Discrete State
2177	DO13	.2.79.5.	Discrete State
2178	DO14	.2.80.5.	Discrete State
2179	DO15	.2.81.5.	Discrete State
2180	DO16	.2.82.5.	Discrete State
2181	PO1	.2.51.5.	Discrete State
2182	PO2	.2.52.5.	Discrete State
2183	PO3	.2.53.5.	Discrete State
2184	PO4	.2.54.5.	Discrete State
2185	PO5	.2.55.5.	Discrete State
2186	PO6	.2.56.5.	Discrete State
2187	PO7	.2.57.5.	Discrete State
2188	PO8	.2.58.5.	Discrete State
2189	PO9	.2.59.5.	Discrete State
2190	PO10	.2.60.5.	Discrete State
2191	PO11	.2.61.5.	Discrete State
2192	PO12	.2.62.5.	Discrete State
2193	PO13	.2.63.5.	Discrete State
2194	PO14	.2.64.5.	Discrete State
2195	PO15	.2.65.5.	Discrete State
2196	PO16	.2.66.5.	Discrete State

Example User Defined Packets

Table J–6. Table_97, Entry-49 (Modbus Slave Comm Block Entry #49)

Register No.	Register Name	Point ID	Point Type
4001	Comp_Reading	.69.1.68.	Floating Point Pt. Reference
4002	State	.69.1.78.	Byte Point Reference
4003	Malfunction_Alarm	.69.1.141.	Discrete Point Pt. Reference
4004	No_Injection_Alarm	.69.1.53.	Discrete Point Pt. Reference
4005	Flow_Alarm	.69.1.144.	Discrete Point Pt. Reference
4006	Purge_Alarm	.69.1.54.	Discrete Point Pt. Reference
4007	DO8	.2.74.5.	Discrete State

Register No.	Register Name	Point ID	Point Type
4008	PID_Alarm	.69.1.55.	Discrete Point Pt. Reference
4009	Chamber_Temp_Alarm	.69.1.132.	Discrete Point Pt. Reference
4010	Chamber_Flow_Alarm	.69.1.138.	Discrete Point Pt. Reference
4011	Chamber_Press_Alarm	.69.1.135.	Discrete Point Pt. Reference
4012	Lamp_I_Alarm	.69.1.51.	Discrete Point Pt. Reference
4013	Lamp_V_Alarm	.69.1.128.	Discrete Point Pt. Reference
4014	ROC_Alarm	.69.1.84.	Discrete Point Pt. Reference
4015	Chamber_Temp	.69.1.129.	Floating Point Value
4016	Chamber_Press	.69.1.133.	Floating Point Value
4017	Chamber_Flow	.69.1.136.	Floating Point Value
4018	Lamp_Intensity	.69.1.42.	Floating Point Value
4019	Lamp_V	.69.1.126.	Floating Point Value
4020	PMT_HV	.1.37.4.	Floating Point Value
4021	Pyro_temperature	.1.200.4.	Floating Point Value
4022	Oven_Temperature	.1.201.4.	Floating Point Value
4023	Cnts_Avg	.69.1.28.	Floating Point Pt. Reference
4024	Current_Stream	.69.1.73.	Byte Point Reference
4025	Range_Current	.69.1.87.	Discrete Point Pt. Reference
4026	H_Cal_Raw_A	.69.1.63.	Floating Point Pt. Reference
4027	L_Cal_Raw_A	.69.1.64.	Floating Point Pt. Reference
4028	P_H_Cal_Value_A	.69.1.65.	Floating Point Pt. Reference
4029	P_L_Cal_Value_A	.69.1.66.	Floating Point Pt. Reference
4030	Cal_A_Voltage	.69.1.89.	Floating Point Pt. Reference
4031	H_Cal_Raw_B	.69.1.98.	Floating Point Pt. Reference
4032	L_Cal_Raw_B	.69.1.99.	Floating Point Pt. Reference
4033	P_H_Cal_Value_B	.69.1.100.	Floating Point Pt. Reference
4034	P_L_Cal_Value_B	.69.1.101.	Floating Point Pt. Reference
4035	Cal_B_Voltage	.69.1.90.	Floating Point Pt. Reference
4036	Last_Reading[0]	.69.1.69.	Floating Point Pt. Reference
4037	Last_Reading[1]	.69.1.70.	Floating Point Pt. Reference
4038	Last_Reading[2]	.69.1.71.	Floating Point Pt. Reference
4039	Last_Reading[3]	.69.1.72.	Floating Point Pt. Reference
4040	Cal_Density[0]	.69.1.139.	Floating Point Pt. Reference
4041	Cal_Density[1]	.69.1.140.	Floating Point Pt. Reference

Register No.	Register Name	Point ID	Point Type
4042	Density_Strm[0]	.69.1.21.	Floating Point Pt. Reference
4043	Density_Strm[1]	.69.1.22.	Floating Point Pt. Reference
4044	Density_Strm[2]	.69.1.23.	Floating Point Pt. Reference
4045	Density_Strm[3]	.69.1.24.	Floating Point Pt. Reference
4046	Density_Input_1	.69.1.178.	Floating Point Pt. Reference
4047	Density_Input_2	.69.1.179.	Floating Point Pt. Reference
4048	Density_Input_3	.69.1.180.	Floating Point Pt. Reference
4049	Density_Input_4	.69.1.181.	Floating Point Pt. Reference
4050	Strm_Flow	.69.1.25.	Floating Point Pt. Reference

Table J–7. Table_97, Entry-10 (Modbus Slave Comm Block Entry #10)

Register No.	Register Name	Point ID	Point Type
40001	Averaged_Reading	.69.1.75.	Floating Point Pt. Reference
40002	Hi_Alarm_1	.69.1.197.	Discrete Point Pt. Reference
40003	Malfunction_Alarm	.69.1.141.	Discrete Point Pt. Reference
40004	Purge_Alarm	.69.1.54.	Discrete Point Pt. Reference
40005	Lamp_V	.69.1.126.	Floating Point Value
40006	Stop_Injection	.69.1.190.	Discrete Point Pt. Reference
40007	ValidateStart	.69.1.106.	Discrete Point Pt. Reference

Appendix K
User Programmable Screen Installation and Startup

Installation of User Programmable Screens

SOLA iQ's are shipped with User Programmable Screen XML's that allow users to access the internal parameters of the SOLA iQ through the AutoCFG Windows program. It is mandatory that these files be installed correctly for the AutoCFG program to work properly. This procedure documents the installation of these xml files. This procedure also assumes the AutoCFG program has been installed successfully on an available PC. These files will be installed into the AutoCFG installation directory.

The flash drive shipped with the SOLA iQ from the factory contains a file called "9-0755-008_Unified_SOLAiQ_XML.zip" (version can vary depending on the release).

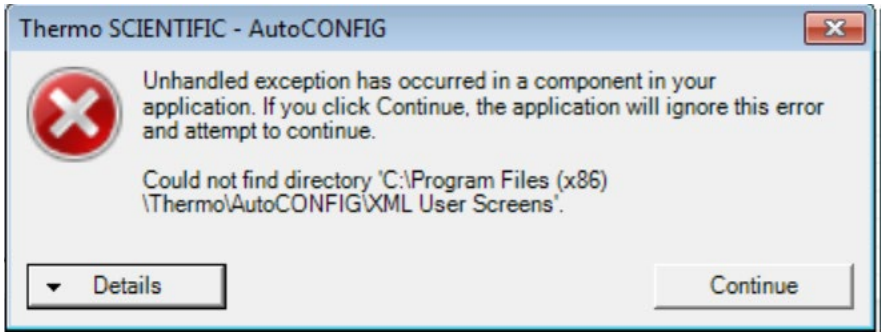
Unzip the file and you will see the following files (The revision numbers may be different depending on the release):

AutoExecTable.xml	XML Document
DMC_screen_rev36.xml	XML Document
FlowP_screen_rev17.xml	XML Document
SOLA III Params.xml	XML Document
SOLAIO_30.xml	XML Document
TemperatureControl_04.xml	XML Document

To install these files to the AutoCFG program, copy the "AutoExecTable.xml" to the AutoCFG installation directory, e.g. C:\Thermo\AutoConfig.

Copy the remaining files (not including "AutoExecTable.xml") to a subdirectory called "XML SOLAiQ User Screens" in the AutoCFG installation directory, in this case: C:\Thermo\AutoConfig\XML SOLAiQ User Screens.

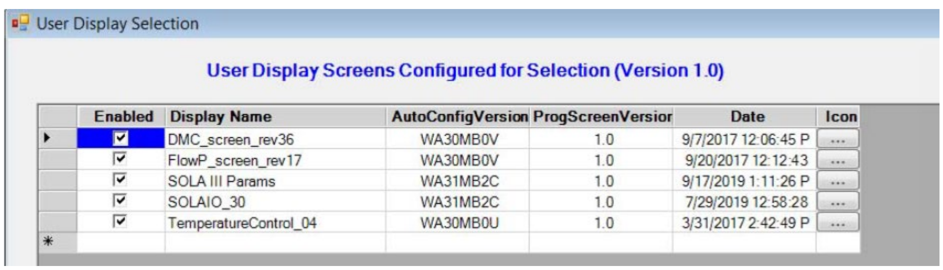
Note If "XML SOLAiQ User Screens" doesn't exist in the AutoCFG installation directory, launch AutoCFG.exe. Once the AutoCFG window opens up, check again for "XML SOLAiQ User Screens" in the AutoCFG installation directory. It should have been created automatically by the AutoCFG program. In rare cases for certain PCs due to write permission, you may see an error as shown below. ▲



In this case, select "Continue" to dismiss the error, but the "XML SOLAiQ User Screens" should have been created for you in the AutoCFG installation directory. Proceed with the copy of the XML's as stated above.

Activate and Start User Programmable Screens

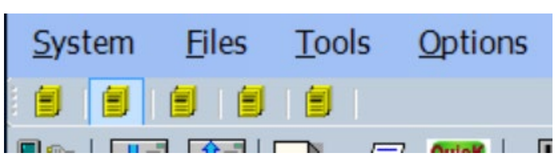
In the AutoCFG menu bar, select "Programmable Screen", click "User Display Screen Setup". This opens another window that lists the XML's you just copied. Check the boxes under Enabled to enable these XML's as shown below.


User Display Selection

User Display Screens Configured for Selection (Version 1.0)

Enabled	Display Name	AutoConfigVersion	ProgScreenVersior	Date	Icon
☑	DMC_screen_rev36	WA30MB0V	1.0	9/7/2017 12:06:45 P	...
☑	FlowP_screen_rev17	WA30MB0V	1.0	9/20/2017 12:12:43	...
☑	SOLA III Params	WA31MB2C	1.0	9/17/2019 1:11:26 P	...
☑	SOLAIO_30	WA31MB2C	1.0	7/29/2019 12:58:28	...
☑	TemperatureControl_04	WA30MB0U	1.0	3/31/2017 2:42:49 P	...

While still in the AutoCFG program, under "Programmable Screen", check "User Display Screen". This adds a space populated with user programmable screen icons as shown below, one icon for each XML selected.



You may now click the icons to access the installed user programmable screens.

Revision History

Revision Level	Date	Comments
A (Initial Release)	3-2018	ECO 9432
B	5-2018	ECO 9475
C	12-2018	ECO 9520
D	12-2020	ECO 10011
E	10-2022	ECN 20078
F	1-2023	ECN 20383
G	7-2023	ECN 20531

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