TOC User Guide

Total Organic Carbon Analyzer User Guide (from TOC_UG_20100429)

Manual Information

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User Guide Contents

Introduction
Theory of Method
The Total Organic Carbon (TOC) instrument analyzes liquid samples by physically combusting the samples at 680°C for TOC or by chemically combusting the samples in 25% phosphoric acid for inorganic carbon (IC). The instrument measures the amount of carbon degraded to CO_2 using nondispersive infrared gas analysis at 4.3 µm wavelength, calculated based on Lambert-Beer's law.
Total Carbon (TC)
To analyze for Total Carbon (TC) a sample is delivered to the TC combustion tube filled with platinum catalyst and heated to 680°C. Carrier gas (purified air or oxygen) , along with the CO_2 generated by combustion, flows through the reaction vessel to the dehumidifier and scrubber, where it is cooled, dried, and purified. It then it passes into the nondispersive infrared detector, which generates an analog signal that is digitized and processed by the TOC Control software. The peak area is proportional to the concentration of total carbon in the sample.
Inorganic Carbon (IC)
During inorganic carbon analysis the liquid sample is introduced into the reaction vessel, which is half filled with 25% phosphoric acid. The sample is purged with carrier gas (high purity air) through the acid solution. The phosphoric acid reacts only with inorganic carbon components (CO_3^{2-} and HCO_3), transforming them to CO_2. The CO_2 is carried fromthe IC vessel through the dehumidifier and scrubber to the NDIR detector.
Total Organic Carbon
TOC concentration can be obtained by subtracting the IC concentration from the TC concentration.
Note: Before operating the TOC system every operator must get either additional training from a senior technician or carefully study all three manufacturer TOC/ASI/Software manuals.
Apparatus, Reagents, & Materials
Laboratory Apparatus

- 50 mL Shimadzu autosampler glass vials, 10 pc
- 6 mL Shimadzu autosampler glass vials, 50 pc
- Wax paper
- Plastic ring caps for 50 mL autosampler vials
- Disposable caps for 6 mL autosampler vials
- 1000 mL, and 50 mL volumetric flask

Reagents

- Zero water: Fresh distilled water from the filtering system, carbon (TC) free, stored in a CO_2-free container. Use this water to rinse vials, make calibration standards, and run blanks. Do not expose the fresh distilled water to air to prevent dissolution of CO_2 into it.
- Potassium hydrogen phthalate, reagent grade
- Sodium hydrogen carbonate, reagent grade
- Sodium carbonate, reagent grade, heated 1 hr at 285°C and cooled in a dessicator
- Phosphoric acid, 25%

Standard Solutions
Standard solution concentrations are not stable because of instant absorption of CO2 from the atmosphere. To slow down this process, standard solutions should be stored in airtight containers in the refrigerator. 1000 ppm stock solutions can be stored for 2 months; 100 ppm diluted standards can be stored for 1 week.

- Total Carbon Stock
- 1000 mg C/L (1000 ppm C) stock solution: dissolve 2.125 g of potassium hydrogen phtalate in zero water in a 1L volumetric flask.
- *At room temperature, potassium hydrogen phtalate doesn't dissolve in water very quickly, and it's grains are almost transparent, so the technician needs to make sure the solution is homogeneous before using it.*
- 100 mg C/L (100 ppm) intermediate stock solution: dilute 10 mL of the the 1000 ppm standard stock solution in zero water in a 100 mL volumetric flask.
- Inorganic Carbon Stock
- 1000 mg C/L (1000 ppm C) stock solution: dissolve 3.50 g of sodium hydrogen carbonate and 4.41 g of sodium carbonate in zero water in a 1 L volumetric flask.
- 100 mg C/L (100 ppm C) intermediate stock solution: dilute 10 mL of the 1000 ppm standard stock solution in zero water in a 100 mL volumetric flask.

Hardware

- Shimadzu TOC-5000A instrument
- Shimadzu ASI-5000A Autosampler
- HPxw 4400 PC workstation (shared with GC2 system)
- Whatman/Parker Balston TOC 78-40 Gas Generator (UHP air tank can be substituted)
- **TOC-5000A System Components.**

TOC-5000A Analyzer
The TOC-5000A analyzer is configured to directly determine the content of total carbon (TC) and inorganic carbon (IC) in 2–10 mL aqueous samples within a carbon range of 200 ppb to 1000 ppm.
Total organic carbon (TOC) cannot be measured directly in samples but can be calculated:
TOC = TC – IC
Samples run on the TOC-5000A system are analyzed for TC and IC sequentially, followed by automatic software calculation of TOC.
Figures 1-2 and 1-3 show the general configuration of the TOC-5000A hardware.

Instrument	Specification
Method	Combustion/nondispersive infrared gas analysis
Combustion temperature	680°C
Measurement range	4 ppb to 4000 ppm
Anaysis time	2–3 min each for TC and IC
Repeatability	<2000 ppm: 1% of full scale 2000–4000 ppm: 2% of full scale
Sample introduction	Automatic injector
Injection volume	50–2000 µL
Ambient temperature	5°–35°C
Dimensions	480 mm W x 520 mm D x 480 mm H
Weight	~46 kg

Figure 1-2. Schematic of TOC-5000A Interior (Front View).

Figure 1-3. Photograph of TOC-5000A Interior (Front View).

Figure 1-4. Close-up Front View Flow Lines in Upper Right.

Autosampler
The autosampler allows automated carbon analysis in multiple samples.

Figure 1-5. Autosampler Back View.

Figure 1-6. Autosampler Closeup.

Gas Generator
The Parker Balston (Whatman)78-40 TOC Gas Generator (***Figure 1-7***)converts compressed air into high purity carrier/combustion gas for the TOC analyzer with hydrocarbon levels < 0.1 ppm and CO_2 level < 1 ppm.
The Gas Generator should be fed from the air compressor, not from an air tank, because of the high rate of air consumption. Incoming air should be relatively free of dust and water (typical air compressor produced air should meet these requirements).

Figure 1-7. TOC Gas Generator.

Instrument Calibration/Verification

Preparing Calibration Standards

Total Carbon

In a 100 mL volumetric flask, make up the following calibration levels to bracket general expected TC levels from the 100 ppm intermediate stock solution:

- 100 ppb: 0.1 mL of 100 ppm + 99.9 mL zero water
- 500 ppb: 0.5 mL of 100 ppm + 99.5 mL zero water
- 1 ppm: 1.0 mL of 100 ppm + 99 mL zero water
- 2 ppm: 2.0 mL of 100 ppm + 98 mL zero water
- 5 ppm: 5.0 mL of 100 ppm + 95 mL zero water

Inorganic Carbon

In a 100 mL volumetric flask, make up the following calibration levels to bracket general expected IC levels from the 100 ppm intermediate stock solution:

- 100 ppb: 0.1 mL of 100 ppm + 99.9 mL zero water
- 500 ppb: 0.5 mL of 100 ppm + 99.5 mL zero water
- 1 ppm: 1.0 mL of 100 ppm + 99 mL zero water
- 2 ppm: 2.0 mL of 100 ppm + 98 mL zero water
- 5 ppm: 5.0 mL of 100 ppm + 95 mL zero water

Setting up the Sample Table for Calibration Curve

Step	Action
1	From the **TOC Control** screen select **File > Open Sample Table** and open a new or previously saved calibration Sample Table (Fig 8).
1	Click in the first line of the Sample Table and select **Edit > Insert Standard**.
2	On the TOC Control screen toolbar, select **View > Calibration Curve List**.
3	On the *Calibration Curve List* dialog box, select **New** (Fig 9).
4	On the **Conditions** tab (Fig 10), enter the following: • *Title* and *File Name* for the calibration • *Analysis Type* (TC or IC) • Change *Calculation Method* to **Lin. Regression without Zero Shift** (FIG). • The *Range* and *Injection Volume* fields will be autofilled after completing information in the **Data** tab.
5	Select the **Data** tab and enter information requested into the data table.
6	Click **OK** and save the calibration information and **Yes** to use as method default parameters.
7	Save the Sample Table.

Figure 1-8. Calibration Sample Table.

Figure 1-9. Calibration Curve List Dialog Box.

Figure 1-10. Calibration Curve Conditions Tab.

Running a Calibration Curve

Step	Action
1	Place calibration curve standards in autosampler spaces S1–S8.
2	Verify status of instrument and baseline: **View > Background Monitor** then close *Background Monitor* screen.
3	Select **Measure > Start** or click **Start** on the instrument control bar. When the *Standby* screen opens, select **Keep Running** and click **OK**.
4	To monitor the status of the measurements, select **View > Realtime Window** or select **Realtime Window** on the toolbar.
5	When the calibration runs are complete the instrument status bar will indicate **Ready**.

Evaluating the Calibration Curve

Step	Action
1	Select **View > Calibration Curve** or click the **Calibration Curve** button on the toolbar.
2	Select the **Curve** tab to see the curve data in graphical format. . [Author: Need a screen shot of this.]
3	Check the correlation coefficient (R^2), which was calculated using the linear relationship of the concentration vs. area. R^2 > **0.995** indicates an acceptable calibration.
4	Select the **Data** tab to view standard deviation and coefficient of variation statistics. [Author: Need screen shot.]
5	Individual peaks or injections can be viewed using **View > Peak Profile > Display**.
6	If the calibration is acceptable, specify the calibration file (CAL) name in the method and close the *Calibration* window.

Running a Calibration Verification

Step	Action

1	Run a midpoint curve standard as an "unknown" sample in the Sample Table.
2	Apply the calibration curve to calculate the sample results.
3	Open **View > Injection Table** or click the **Injections** button on the toolbar to examine the sample results in the Concentration column and the result of the Outlier Test. For acceptable calibration verification, CV should be **>0.90**.
4	Close the *Injection Table* screen.

Sample Preparation

Overview
Samples are prepared by squeezing interstitial waters from sediment cores. Total organic carbon is run on unfiltered interstitial water samples; dissolved organic carbon (DOC) is run on interstitial water samples filtered through a 0.45 µm membrane.
Interstitial waters are diluted ~1:5 before running on the TOC analyzer and the analyzer is calibrated for quantitation of sample results. Running samples involves the following steps:

Step	Action
5	Set up hardware (see Setting up the Sample Table for Calibration Curve)
6	Set up software (see Preparing TOC Software)
7	Set up autosampler (see Preparing the Autosampler)
8	Set up sample table (see Setting up a Sample Table and Selecting a Calibration Curve)
9	Run samples (see Running Samples)

Preparing TOC Analyzer Hardware

Step	Action
1	Make sure tubing and cables are connected properly to the instrument.
2	Check compressed air feed line (65–80 psi) for the Gas Generator (if using an ultra-high purity air tank the delivery pressure be set to 80 psi (not to exceed 100 psi).
3	Check that the Gas Generator is in ready condition. THC light green and no **CHECK SYSTEM/ OVERFLOW** lights on. [Author: Need photo of green light on Gas Generator.]
4	Fill the humidifier with distilled water until the water level is between the white lines. Make sure the rubber stopper is fully plugged in.

5	Fill IC vessel with 75–100 mL of 25% phosphoric acid solution.
6	Make sure all drain lines have a negative slope alignment. Empty the drain container, if required.
7	Check position of three-way cock arm. The cock arm should be in the left position (Fig 4).
8	Ensure TOC main power switch is turned on and black switch on front top right side (behind instrument door) is in **PC CONTROL** position.

Figure 1-11. Software TOC Control Screen with Blank Sample Table.

Preparing TOC Software

Step	Action
1	Click on the *TOC Control* icon on the computer desktop (see #**1** on Fig 11). Type **DAQ** for username and password to open the *TOC Control* screen.
2	From the Toolbar on the *TOC Control* screen, select **Measure > Connect** (#**3** on Fig 11), and at the bottom of the *Control* screen click the **TOC** button (#**4** on Fig 11). The message bar (#**5** on Fig 11) should say **Connected**.
3	Check the carrier gas flow meter and pressure gage on the front panel of the TOC analyzer. [Author: Need a photo of this meter and pressure gage.] Flow should be 150 mL/min, and pressure should be ~450 kPa. Adjust flow or pressure to target values using the **Carrier gas pressure controller** and **Carrier gas flow controller** next to the flow meter (see Fig 4).
4	On the *TOC Control* screen, select **View > Background Monitor** (#**6** on Fig 11) to open a background window.
5	Wait ~2 min and then make sure all parameters read **OK** on screen (exception: oven temperature will take ~30 min to reach 680°C). [Author: Need a screen shot of the Background window.] Close the **Background** window.

6	On the *TOC Control* screen select **Options > Instrument Conditions** (#**7** on Fig 1) to set up and/or verify *TOC*, *ASI*, and *RS232* settings as follows: TOC • Furnace = on • Auto ranging = on • Inj volume = on • Auto regenerating = on • Syringe size = 250 µm ASI • ASI used = on • High sensitivity vials = on • Rinse = on • No. of washes = 4 RS232 • RS232 = COM1 • Baud rate = 2400 • Parity = none • Stop bits = 1

Preparing the Autosampler

Step	Action
1	Fill autosampler rinse bottle (Fig 5) with fresh zero water.
2	Fill high-sensitivity 50 mL autosampler glass vial with zero water and place it to S1 tray position. Remove tray cover or make sure it's in the correct position. • Each vial in the autosampler tray must be filled to the top and covered immediately with wax paper or sealed with special caps to prevent CO_2 penetration. After the sealed surface is pierced by the autosampler needle, the vials will remain usable for only a limited time (usually a few hours).
3	Remove bubbles from the syringe (Detect Zero point): on the *TOC Control* screen select **Options > Maintenance > Zero point detection.** The ASI arm and tray will start moving and the syringe/4-port valve will perform the bubble removing procedure.

Setting up a Sample Table and Selecting a Calibration Curve

Step	Action
1	From the *TOC Control* screen select **File > Open Sample Table** to create a new Sample Table (#**8** in Fig 11) or open an old Sample Table (#**9** in Fig 8).
2	Fill in the Sample Table with sample type, name, ID, and analysis.
3	To specify a method on the Sample Table, select **View > Methods** on the *TOC Control* screen to open a saved method or create a new method.
4	Fill in information on the **General** and **Method** tabs of the *Method* screen (Fig 12).

5	To specify a calibration curve to apply to the samples, select **View > Calibration** on the *TOC Control* screen to open a dialog box showing a list of calibration curves saved in the CALIBR folder (Fig 9).
6	On the *Calibration Curve List* dialog box, click **Open** to select a saved calibration curve.
7	Save the Sample Table.

Figure 1-12. IC Method Tabs.

Sample Analysis

Running Samples

Step	Action
1	Load the sample vials into the autosampler in positions that correspond to the Sample Table.
2	Verify status of instrument and baseline: **View > Background Monitor,** then close *Background Monitor* screen.
3	Select **Measure > Start** or click **Start** on the instrument control bar. When the *Standby* screen opens, select **Keep Running** and click **OK**.
4	To monitor the status of the measurements, select **View > Realtime Window** or select **Realtime Window** on the toolbar.
5	When the sample runs are complete the instrument status bar will indicate **Ready**.
6	Sample results calculated from the loaded calibration file will display in the **Sample Table** Mean Area and Result columns.

Quality Assurance/Quality Control

Analytical Batch

Blanks
The TOC analyzer has an automated TC Blank Check Program that runs zero water blanks from 4 different vials a total of 10 times.

Step	Action
1	Place vials filled with zero water in autosampler positions S1–S4.
2	On the autosampler control panel, open the *Maintenance* screen and select **TC Blank Check**.

3	The autosampler injects S1 twice, S2 three times, S3 three times, and S4 twice and then returns to Home.

Calibration
Calibration Verification
Precision
Accuracy

LIMS Integration

Overview
TC/IC/TOC analysis results are manually entered into the LabWare LIMS client by the technical staff once the scientist(s) is (are) finished reducing the data.
LIMS Components
Results are stored in the LIMS database associated with an analysis code and an analysis component. Analysis codes and their components, definitions, and units are listed below.

Analysis	Component	Definition	Unit
TOC	carbon_total	Concentration	ppm
	inorganic_carbon_total	Concentration	ppm
	organic_carbon_total	Concentration	ppm
	run_test	link to calibration test	
TOC_QAQC	carbon_total	Concentration	ppm
	inorganic_carbon_total	Concentration	ppm
	organic_carbon_total	Concentration	ppm
	run_test	link to calibration test	
	cal_filename	calibration file	
	method_filename		
	run_filename		

Health, Safety, & Environment

Safety

The list of TOC operation safety rules, issued by general chemistry laboratory safety, oven safety, handling of concentrated H_3PO_4 and automatic machine operation safeties as well, should be as following:

- Handle TOC oven with caution and carefully watch all warning and safety signs around and inside instrument.
- Carefully read all three Shimatzu TOC/ASI/Software manuals, which are provided both in hard and soft copies about issues related to personal and instrument safety.
- Prepare 25% phosphoric acid from concentrated phosphoric acid under while wearing acid gloves, closed-toed shoes, protective clothing, and safety glasses.
- Label interim and stock solutions with the chemical name, concentration, operator name, and date.
- Ensure proper operation with gas tanks:
- Prevent the tank from dropping by tightening it with strong belt to the stable support
- Never attempt to disassemble the high pressure regulator on the top of the tank
- Do not disassemble gas tubing until inside pressure drops to close to atmospheric pressure; uptight fitting slightly and let pressure release from gas lines before further operations.
- Do not place your fingers or other parts of your body under autosampler needle working area, especially during autosampler operation.
- Follow the main safety rules for operation with electronics:

- check proper cable setting
- Avoid contact with electronic parts inside instrument during "power on" condition

Pollution Prevention
Waste Management

- The contents of the waste bottle (when it's full) need to be checked for neutral pH, corrected if necessary to neutral point with sodium carbonate, and disposed to the sink.

Maintenance & Troubleshooting

Scheduled Maintenance

Daily

- Check water level in humidifier and dehumidifier pot
- Check acid level in IC reaction vessel
- Inspect drain line positions and empty drain jar, if necessary
- Refill autosampler rinse bottle with distilled water
- Keep a lint-free environment when cleaning; even small sized particles can clog the sample needle, tubing, or 4-port valve!
- Use **only** distilled water for cleaning procedures--**no other solvents.** Wipe surfaces with a water-dampened cloth.
- **Always make sure the oven has cooled down (~30 min) before the TOC ventilators go off.**
- Proper care must be taken at all times when the TOC is switched off. Usually the TOC combustion oven is working when instrument power with ventilator is going down.
- In case of an emergency power black out, remove the TOC cover panels to let heat escape from the oven without significant warming-up of electronic and plastic TOC parts.

Weekly/Monthly

- Check the gas lines for leaks by comparing flow-meter readings at incoming and outgoing (L-line for CO_2 absorber) tubing connections.
- Note: All connections in the TOC are finger-tight, so **NO TOOLS** should be applied to avoid improper pressure!

Annual

- Replace CO2 absorber (PN 630-00999).

When Needed

- Replace halogen scrubber (PN 630-00992) when it turns blue, green, or black. After replacement, wait about an hour for baseline to stabilize.
- Replace or regenerate high-sensitivity TC catalyst when sensitivity and repeatablility become unacceptable.
- Wash TC combustion tube interior with 1+2 HCl solution, rinse in water, and dry when washing or replacing catalyst.
- Replace TC combustion tube when it becomes broken or cracked or leaks gas. Regardless of the color or transparency of the glass tube, it can be used until it begins to leak.

Hardware Troubleshooting

Unstable Baseline

- Leak in carrier gas
- TC catalyst needs to be replaced

- Dehumidifier not operating correctly
- Environmental: vitration, ambient temperature, power supply
- NDIR defective

Bubbles in Sample/Syringe Tubing
Bubbles in the sample tubing affect the accuracy of an analysis. If bubbles are noted in the sample tubing, they need to be removed before beginning an analysis.

Step	Action
1	Select Options > Maintenance > Mechanical Check > TOC.
2	Move the syringe plunger up and down using the plunger height control on the left while changing the position of the 4-port valve to Sample, TC port, or IC port.
3	When the sample goes to the TC/IC waste line, do not bring the syringe plunger all the way up.

Peaks Are Too Broad or Are Tailing
Tailing should be considered a significant issue. Tailing is identifed by a **T** in the real-time window in the *Notes* column and means the integration was cut before the peaks curve reached the baseline. Tailing peaks can be cause by

- Contaminated tubing: check a blank analysis for a contamination peak
- Clogged or leaking tubing:
- Leaking and restricted tubing affect the outlet (CO_2 absorber L-line) flow rate. Check both the flowmeter inlet and outlet openings because the TOC and laboratory flow meters may be different. Lower flow at the outlet suggests and clog or leak that must be isolated and fixed.
- Connect both L and S tubes of the CO_2 absorber in one line. In this configuration, the operator should see immediate bubbling in the dehumidifier drain container, meaning the line has no major leak and all gas is escaping through the drain. If no bubbling occurs that means the system has a leak or is clogged. The most common places to check for the flow rate inside the instrument are the connections before the combustion tube and the cooling coil outlet.

No Peaks

- The most common reason for an absent peak is a TOC flow line leak. Check the air supply line/carrier gas flow reading and make sure the humidifier stopper is tightly plugged.

TOC/ASI Normal Analysis Routine Stopped in Middle of Run without Operator Command
This may happen because of a hardware malfunction (e.g., bent needle or 4-port valve sticking.

- If the needle is bent, unscrew it and remove it from the autosampler arm. Usually the needle can be straightened. If not, then replace the needle. When replacing the needle in the autosampler arm, ensure the needle height and alignment above the rinse/sample vials are positioned correctly before tightening down the arm.
- If the 4-port valve is stuck, take it apart and check for breakage or particle contamination, as those can cause rotation failure.

Autosampler Troubleshooting

Regenerating TC Catalyst

Step	Action

1	Place a vial containing 2 mM HCl in position S1.
2	Open the autosampler *Maintenance* screen and select **Regeneration of TC Catalyst**.
3	The sampling needle moves to the S1 vial then to the rinse water receptacle and rinses the injection needle 3 times.

Replacing Rinse Water Pump Head

Step	Action
1	After ~300 hr running time, replace the pump head assembly (PN 042-00405-11).
2	Take off the small cover attached to the side of the autosampler.
3	Pull out the pump head (white plastic) from the pump body (black plastic) by picking the claws of both sides with fingers.
4	Replace the pump head by disconnecting the elastic tubes from the Teflon tubes and connecting new ones.
5	Remount the pump head and cover.

Removing the Syringe

Step	Action
1	Unscrew the plastic plunger holder on the bottom of the syringe (may use pliers).
2	Unscrew the syringe body from the 4-port valve stand.

Shimadzu Technical Support

- 1-800-477-1227, ext 1442
- Leonardo Ponds

Software Troubleshooting

Toolbar options don't respond properly

- Make sure previous windows are closed; software version is old and can operate only with one window open in the TOC Control screen
- Close/reopen TOC Control window

- Restart software/computer

Gas Generator Troubleshooting

- Normally the Gas Generator should be connected to the TOC through blue plastic tubing. In this case, the outlet flow rate of the Gas Generator is controlled by the TOC flow controller (150 mL/min). If the Gas Generator outlet flow line is disconnected and open to the atmosphere, the flow rate will vary, depending on the inlet pressure. When outlet flow is higher than 1250 mL/min, the Gas Generator front panel overflow indication light will turn yellow. In this situation, the technician should correct the flow rate, because overflow conditions will cause the Gas Generator catalyst module to cool and will not produce appropriate quality air.
- The outlet flow reading may drop below 150 mL/min or have no flow at all. This will significantly affect the TOC flow rate. The most common reason for such a malfunction is the final filter or other filters are clogged. Replace the filters to fix this problem.
- If the **CHECK SYSTEM** light located on the bottom of the front panel starts flashing, and especially when it turns to a permanent yellow light, the catalyst unit needs to be exchanged for a new one. Normally happens once every 2–3 yr of constant Gas Generator use.
- Every 4–5 min a pneumatic switch triggers audibly between the dryer and co-remover towers on the back of the Gas Generator. If the interval time between switches is ~10 min, there may be problems with the Gas Generator.

Software Guide

TOC-Control Screen Toolbar Functions

- **New File:** Closes the current Sample Table and brings up a blank Sample Table.
- **Open File:** Opens a saved Sample Table, which replaces the current Sample Table. Select a .toc file in the dialog box.
- **Save File:** Saves the data in the current Sample Table.
- **Cut:** Removes data from highlighted cells in a table and saves them to the clipboard.
- **Copy:** Copies data from highlighted cells in a table and saves them to the clipboard.
- **Paste:** Copies the contents of the clipboard to a selected location in a table.
- **Print:** Sends data from currently displayed window to the printer.
- **Run Time Report:** Toggles Run Time Report on and off.
- Configure by selecting Report > Run Time Report.
- **Recalculate:** Recalculates the currently displayed sample run after applying a new calibration curve or excluding injections from the Injection Table.
- **Show Injection Table:** Displays the Injection Table.
- Highlight a row in a Sample Table to indicate which sample run to show in the Injection Table.
- **Show Peak Profile:** Displays a Peak Profile graph.
- Highlight a row in a Sample Table to indicate which sample run to display.
- To display a peak profile for an individual injection, highlight a row in the Injection Table.
- **Show Calibration Curve:** Displays calibration curve data for a specific sample run.
- Highlight a row in the Sample Table to indicate which calibration curve to display.
- **Exclude:** Excludes the selected sample or injection from a calculation or re-includes a previously excluded sample.
- **Real Time Window:** Opens the Real Time analysis window.
- **Connect/Disconnect Instrument:** Opens or closes the elctronic connection between the instrument and the computer.

Instrument Status

Message	Procedure
Ready	Ready to receive command
Measuring	Measurement proceeding
Waiting for Ready State	Waiting: ready status condition
Washing syringe with acid	Aspirating acid
Injecting acid	Injecting acid
Washing syringe with rinse water	Rinsing syringe
ASI moving	Initializing and checking tray type
ASI pause	ASI pausing
Washing ultra pure water trap	Rinsing ultra pure water trap
Making ultra pure water	Generating ultra pure water

Measuring for blank check	Measuring for blank check
Processing for end of blank check	Processing for end of blank check
Searching for zero point	Searching for syringe home position
Regenerating	Regenerating catalyst
Residue Removal	Removing residue from catalyst
Flow line wash	Rinsing flow lines
Mechanical Check	Mechanical check processing
Monitoring	Background data being sent
Standby	Standby option selected; processing
Shutdown	Shutdown in processing
Initializing	Intializing entire instrument
TOC mech. initializing	Mechanical initializing
Moving	Syringe moving

Analysis Status

Message	Procedure
Sparging	ASI sparging on
Washing	Rinsing sample syringe
Sampling	Aspirating sample into syringe
Injecting	Injecting sample into furnace or reaction vessel
Measuring	Integrating peak profile data
Draining	Draining the sample
Waiting: Interval setting	Waiting for interval setting
Waiting: Ready status	Waiting: ready status is NG (no good)
Waiting: POC	Waiting for POC bubbler
Waiting: ESU	Waiting for ESU
Waiting: Other	Waiting for other
ASI moving	ASI moving
IC regenerating	Automatic regeneration of IC fluid
Bubbling	Bubbling (POC bubbler)

Instrument Status Bar

Instrument Control Bar Buttons

- **Start:** starts measurement
- **Stop:** stops the measurement after the current injection is complete
- **Pause:** pauses instrument operation after current injection is complete
- **Halt:** immediately interrupts measurement
- **Continue:** continues interrupted measurement sequence
- **Peak Stop:** stops current measurement