



DISCOVERY TGA THERMOGRAVIMETRIC ANALYZER



Getting Started Guide for Models 55/550/5500

Revision C Issued February 2018

Notice

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159 Lukens Drive
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Introduction

Important: TA Instruments Manual Supplement

Please click the [TA Manual Supplement](#) link to access the following important information supplemental to this Getting Started Guide:

- TA Instruments Trademarks
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Notes, Cautions, and Warnings

This manual uses NOTES, CAUTIONS, and WARNINGS to emphasize important and critical instructions. In the body of the manual these may be found in the shaded box on the outside of the page.

NOTE: A NOTE highlights important information about equipment or procedures.

CAUTION: A CAUTION emphasizes a procedure that may damage equipment or cause loss of data if not followed correctly.

MISE EN GARDE: UNE MISE EN GARDE met l'accent sur une procédure susceptible d'endommager l'équipement ou de causer la perte des données si elle n'est pas correctement suivie.

A WARNING indicates a procedure that may be hazardous to the operator or to the environment if not followed correctly.

Un AVERTISSEMENT indique une procédure qui peut être dangereuse pour l'opérateur ou l'environnement si elle n'est pas correctement suivie.

Regulatory Compliance

Safety Standards

For Canada

CAN/CSA-C22.2 No. 61010-1-12 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements.

CAN/CSA-C22.2 No. 61010-2-010-04 Particular requirements for laboratory equipment for the heating of materials.

CAN/CSA-C22.2 No. 61010-2-081-04 Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes.

For European Economic Area

(In accordance with Council Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.)

EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements.

EN 61010-2-010:2014 Particular requirements for laboratory equipment for the heating of materials.

EN 61010-2-081:2015 Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes.

For United States

UL61010-1:2012 Electrical Equipment for Laboratory Use; Part 1: General Requirements.

UL61010-2-010:2015 Particular requirements for laboratory equipment for the heating of materials.

UL 61010-2-081:2015 Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes.

Electromagnetic Compatibility Standards

For Australia and New Zealand

AS/NZS CISPR11:2015 Limits and methods of measurement of electronic disturbance characteristics of industrial, scientific and medical (ISM) radio frequency equipment.

For Canada

ICES-001 Issue 4 June 2006 Interference-Causing Equipment Standard: Industrial, Scientific, and Medical Radio Frequency Generators.

For the European Economic Area

(In accordance with Council Directive 2014/30/EC of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility.)

EN61326-1: 2013 Electrical equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General requirements, Table 3 - Immunity test requirements for equipment used in controlled EM environments, Emission requirements for Group 1, Class A equipment.

For the United States

CFR Title 47 Telecommunication Chapter I Federal Communications Commission, Part 15 Radio frequency devices (FCC regulation pertaining to radio frequency emissions).

CAUTION: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

MISE EN GARDE: Cet appareil n'a pas destiné à être utilisé dans des environnements résidentiels et ne peut pas fournir une protection adéquate à la réception radio dans de tels environnements.



Safety

WARNING: The operator of this instrument is advised that if the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

AVERTISSEMENT: L'utilisateur de cet instrument est prévenu qu'en cas d'utilisation contraire aux indications du manuel, la protection offerte par l'équipement peut être altérée.

Instrument Symbols

The following labels are displayed on the Discovery TGA system for your protection:

Symbol	Explanation
	<p>This symbol indicates that you should read this Getting Started Guide for important safety information. This guide contains important warnings and cautions related to the installation, operation, and safety of the Discovery TGA system.</p> <p>If you are not trained in electrical procedures, do not remove the cabinet covers unless specifically instructed to do so in the manual. Maintenance and repair of internal parts must be performed only by TA Instruments or other qualified service personnel.</p> <p>Ce symbole indique que vous devez lire entièrement ce guide de démarrage pour obtenir d'importantes informations relatives à sécurité. Ce guide contient d'importants avertissements et mises en garde relatifs à l'installation, à l'utilisation et à la sécurité du système Discovery TGA.</p> <p>Si vous n'êtes pas formé aux procédures électriques, ne déposez pas les couvercles de l'armoire sauf indications spécifiques contenues dans le manuel. La maintenance et la réparation des pièces internes doivent être effectuées uniquement par TA Instruments ou tout autre personnel d'entretien qualifié.</p>
	<p>This symbol indicates that a hot surface may be present. Take care not to touch this area or allow any material that may melt or burn come in contact with this hot surface.</p> <p>Ce symbole indique la présence possible d'une surface chaude. Prenez soin de ne pas toucher cette zone ou de laisser un matériau susceptible de fondre ou de brûler entrer en contact avec cette surface chaude.</p>

Please heed the warning labels and take the necessary precautions when dealing with those parts of the instrument. The *Discovery TGA Getting Started Guide* contains cautions and warnings that must be followed for your own safety.

Electrical Safety

You must unplug the instrument before doing any maintenance or repair work; voltages as high as 120/240 VAC are present in the instrument.

DANGER: Risk of electric shock. High voltages are present in this instrument. Maintenance and repair of internal parts must be performed only by TA Instruments or other qualified service personnel.

DANGER: Risque de choc électrique. Présence de tensions élevées dans cet instrument. La maintenance et la réparation des pièces internes doivent être effectuées uniquement par TA Instruments ou tout autre personnel d'entretien qualifié.

WARNING: Protective earthing is provided through the mains power cord. Use of a grounded mains power outlet is required.

AVERTISSEMENT: Mise à la terre de protection est assurée par le cordon d'alimentation secteur. Utilisation d'une prise d'alimentation secteur terre est nécessaire.

Chemical Safety

WARNING: Do not use hydrogen or any other explosive gas in the TGA furnace.

AVERTISSEMENT: N'utilisez pas d'hydrogène ou tout autre gaz explosif dans le four TGA.

WARNING: Oxygen can be used as a purge gas in the TGA. However, the furnace must be kept clean so that volatile hydrocarbons, which may combust, are removed.

AVERTISSEMENT: L'oxygène peut être utilisé comme gaz de drainage dans le TGA. Toutefois le four doit rester propre pour que les hydrocarbures volatils, qui peuvent brûler, soient éliminés.

WARNING: If you are using samples that may emit harmful gases, attach a compatible tube to the purge gas exit to transfer the gas to an exhaust or other suitable protective device.

AVERTISSEMENT: Si vous utilisez des échantillons qui émettent des gaz nocifs, fixez un tuyau compatible à la sortie du gaz de drainage pour transférer le gaz vers un échappement ou vers tout autre dispositif de protection approprié.

Thermal Safety

WARNING: After running an experiment, allow the open furnace and thermocouple to cool down before you touch them. Allow the furnace to cool down before removing the lower furnace (thermocouple) assembly of the 5500.

AVERTISSEMENT: Après une expérience, laissez le four ouvert et le thermocouple refroidir avant de les toucher. Laissez le four refroidir avant de déposer l'ensemble du four inférieur (thermocouple) assemblage de la 5500.

Mechanical Safety

WARNING: Keep your fingers and all other objects out of the path of the furnace when it is moving. The seal is very tight.

AVERTISSEMENT: Écartez vos doigts et tous les autres objets du chemin du four lorsqu'il est en mouvement. L'étanchéité est très hermétique.

Lifting the Instrument

The Discovery TGA is a heavy instrument. In order to avoid injury, particularly to the back, please follow this advice:

WARNING: Use two people to lift and/or carry the instrument. The instrument is too heavy for one person to handle safely.

AVERTISSEMENT: Demandez à deux personnes de soulever et/ou de porter l'instrument. L'instrument est trop lourd pour qu'une seule personne le manipule en toute sécurité.

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Chapter 1:

Introducing the Discovery TGA

Overview

Your TA Instruments Discovery Thermogravimetric Analyzer (Discovery TGA) is used in conjunction with a controller computer and associated software to make up a thermal analysis system.

The Discovery TGA measures the amount and rate of weight change in a material, either as a function of increasing temperature or isothermally as a function of time, in a controlled atmosphere. The TGA can be used to characterize any material that exhibits a weight change and to detect phase changes due to decomposition, oxidation, or dehydration. This information helps the scientist or engineer identify the percent weight change and correlate chemical structure, processing, and end-use performance.

Your controller is a computer that performs the following functions:

- Provides an interface between you and the analysis instrument
- Enables you to set up experiments and enter parameters
- Stores experimental data
- Runs data analysis programs.



Figure 1 Discovery TGA system (TGA 5500 shown).

NOTE: For technical reference information, theory of operation, and other information associated with the TGA not found in this manual, see TRIOS software Online Help.

TGA System Components

The Discovery TGA is comprised of the following major hardware components:

- The Tru-Mass™ balance, which provides precise measurement of sample weight. The balance is the key to the TGA system.
- The heating system, or furnace (wire-wound for TGA 55 and TGA 550, infrared for TGA 5500), which controls the sample temperature.
- The Autoloader or Autosampler, which loads and unloads the sample to and from the balance. The Autosampler platform has a built-in pan punching mechanism (standard on the TGA 5500 and optional on the TGA 550) that is used in conjunction with the optional sealed aluminum pans (also standard on the TGA 5500 and optional on the TGA 550).
- The heat exchanger, which dissipates heat from the furnace.
- The gas delivery module (GDM), which controls the purge gas to the balance and furnace.

The next few pages briefly describe the components of the TGA.

Balance Assembly

The TGA balance assembly is a null balance system consisting of the balance meter movement, the balance arm, the balance position sensor, the hang-down wire assemblies, the sample pan, and the tare pan.

- The balance meter movement is a taut-band meter movement to which the balance arm is attached.
- The balance arm is an assembly constructed of beryllium copper alloy attached to the meter movement.
- The balance position sensor is comprised of an LED source and a pair of photodiodes on printed circuit boards that detect the null position of the meter movement.

The TGA has two hang-down wire assemblies: one for the tare pan and one for the sample pan. Each assembly consists of a hang-down wire and beryllium copper decoupler loop. The hang-down wire has hooks on each end used to connect the pan to the loop. The loop connects the hang-down wire to the balance arm. The longer hang-down wire is for the sample side.

The tare hang-down wire, tare pan, and any counterbalance weight mechanically balances the weight of the sample pan and sample hang-down wire.

Wire-Wound Furnace for TGA 55 and TGA 550

The wire-wound furnace comes installed on the Discovery TGA 55 and TGA 550. The wire-wound and EGA furnaces can be exchanged as directed in the Online Help. The wire-wound furnace is a resistance heater wound on alumina ceramic, which allows sample zone temperatures as high as 1,000°C with heating rates up to 100°C/min. The housing is mounted to a furnace base that raises and lowers the furnace for sample loading and unloading. A Platinel II® thermocouple is positioned in the furnace, just above the sample pan, where it monitors the sample environment temperature.



Figure 2 Wire-wound furnace cut-away diagram.

EGA Furnace for TGA 55 and TGA 550

The Evolved Gas Analysis (EGA) furnace is an optional accessory for the Discovery TGA 55 and TGA 550 that allows you to connect a spectrometer to the instrument so that the gases evolved by sample decomposition can be analyzed. The EGA furnace and the Wire-wound furnace can be exchanged as directed in the Online Help.

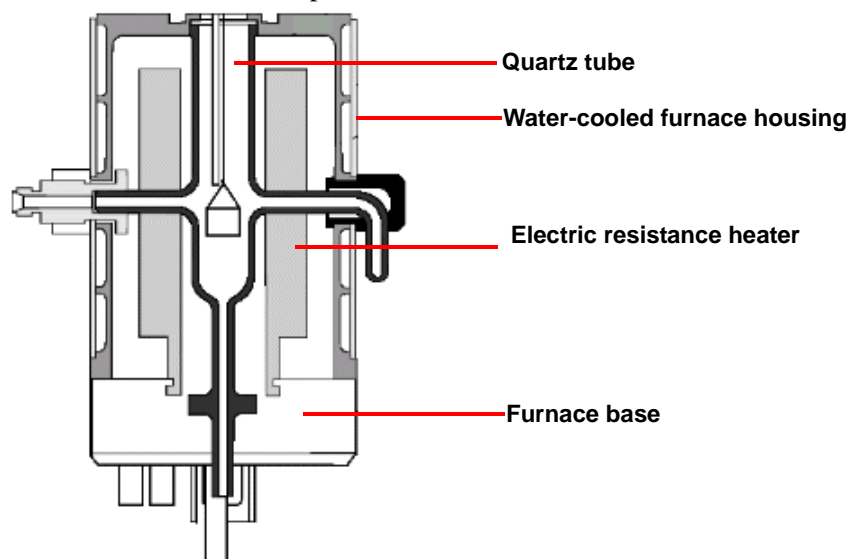


Figure 3 EGA furnace cut-away diagram.

The EGA furnace consists of a quartz glass sample tube surrounded by an electric resistance heater, both of which are contained within a water-cooled furnace housing. The housing is mounted to a furnace base that raises and lowers the furnace for sample loading and unloading.

The sample tube has a purge gas inlet that passes through the right side of the furnace housing. A fitting on the left side of the housing allows connection of a transfer line to carry exhaust gas to a spectrometer such as a mass spectrometer. Because the heater is external to the sample tube, evolved gases from sample decomposition within the sample tube do not come in contact with the resistance elements or the furnace ceramic refractory.

Cooling air enters through the furnace base and passes upward between the outside of the sample tube and the inside of the furnace, completely separating the cooling air from the sample and the sample zone. The furnace is a resistance heater wound on alumina ceramic, which allows sample zone temperatures as high as 1000°C with heating rates up to 50°C/min. A Platinel II® thermocouple is positioned in the furnace, just above the sample pan, where it monitors the sample environment temperature.

The furnace base moves the furnace assembly up around the sample pan to the closed position, or down away from the sample pan to the open position.

Infrared (IR) Furnace for TGA 5500

The IR furnace (shown below) uses quartz halogen lamps as the heat source. Four lamps are arranged in a circular pattern surrounding the quartz tube that encloses the sample area. Infrared energy from the lamps is directed toward the sample area by a water-cooled, gold-plated reflector consisting of four elliptical surfaces.

The sample area is enclosed by a cylinder inside of the quartz tube. This cylinder absorbs radiation from the lamps and heats the sample, pan, and thermocouple.

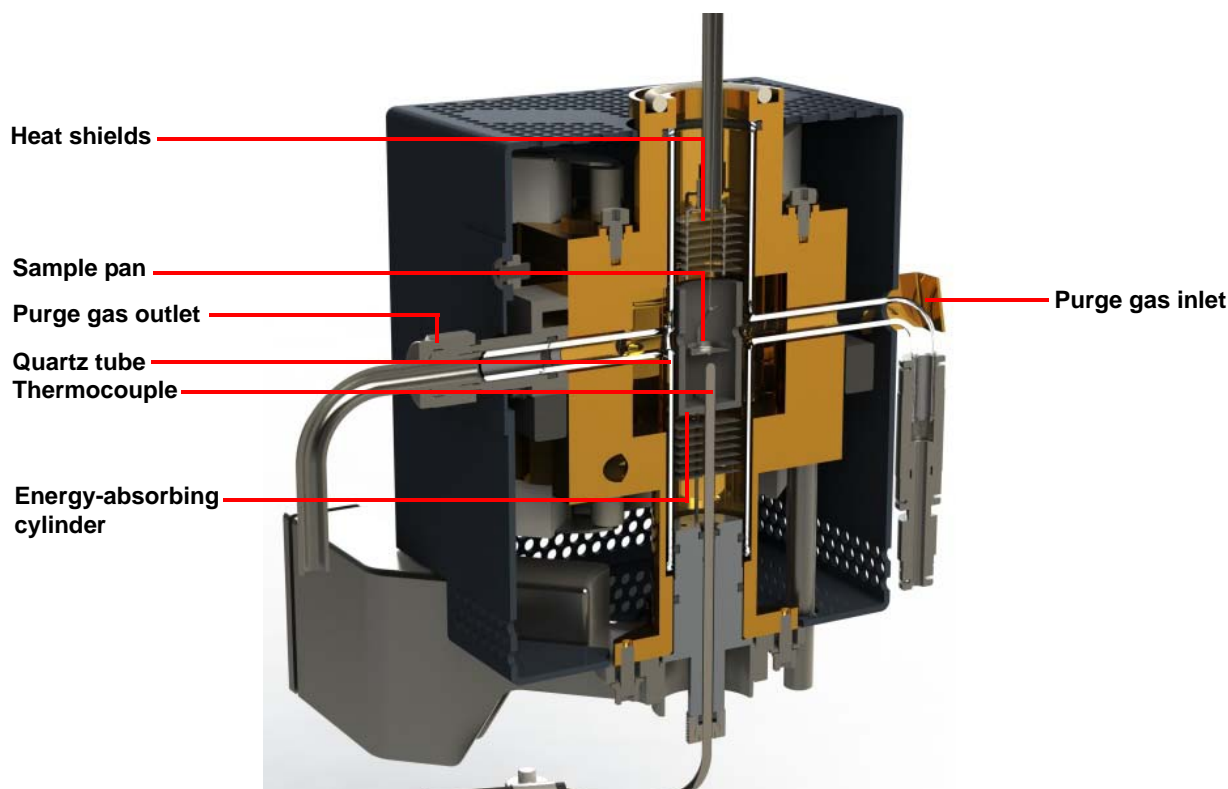


Figure 4 IR furnace cut-away diagram.

Temperature is measured and controlled by a thermocouple assembly under the sample pan. The thermocouple assembly includes a second independent thermocouple to protect the furnace from excessive temperature.

Heat shield assemblies above and below the energy-absorbing tube reduce heat losses from the ends of the furnace.

Purge gas enters the sample area through a tube within the quartz tube, passes through a hole in the wall of the absorber across the top of the sample pan, through another hole in the wall of the absorber, and exits via a second tube in the quartz tube.

A magnetic coil surrounding the furnace generates a field that acts on magnetic samples in the sample pan. This facilitates automated temperature calibration using Curie point standards and Curie point studies.

Rapid cooling of the furnace at the end of an experiment is facilitated by air that enters the furnace chamber through the bottom of the furnace.

Discovery TGA Autoloader or Autosampler

Autoloader

The TGA 55 and TGA 550 come standard with an Autoloader (shown below) that automatically loads the pan at the touch of a button or at the start of the run. On the TGA 550 the Autoloader can be upgraded to the Autosampler.



Figure 5 Autoloader.

To calibrate the Autoloader, refer to TRIOS Online Help.

Autosampler

The Discovery TGA Autosampler (shown below) allows you to place multiple samples on the platform for automatic loading and run sequencing. Using the standard pan tray, up to 25 samples can be accommodated. Experiments are performed as normal, but samples can be run on a continual basis.

See [“Discovery TGA Sampling System” on page 25](#) for the pans that can be used with the Discovery TGA Autosampler:



Figure 6 Discovery TGA Autosampler (Discovery TGA 550 shown).

The sample can be sealed in a special aluminum pan and opened (exposed to the environment) immediately before being loaded into the balance via the Autosampler's optional punching mechanism. The punching mechanism ensures that only punched pans are loaded onto the balance. If punching is not successful, the pan will not be loaded.

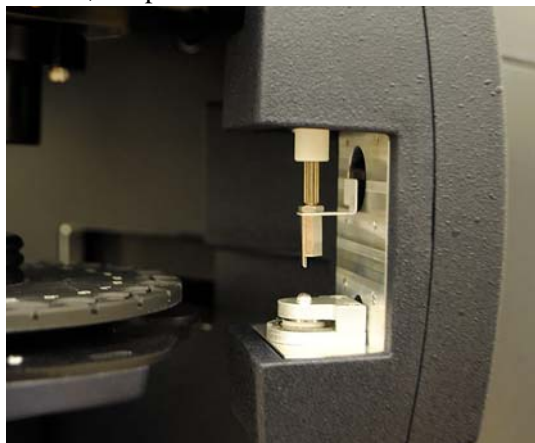


Figure 7 Optional punching mechanism.

To calibrate the sample tray and punching mechanism, refer to [“Calibrating the Discovery TGA” on page 57](#) of this manual and TRIOS Online Help.

Hi-Res™ TGA

The TA Instruments Hi-Res™ TGA technique differs from alternative control techniques in that the heating rate of the sample material is dynamically and continuously modified in response to changes in the rate of decomposition of the sample so as to optimize both weight change resolution and time of analysis. This TGA technique (supplied with the Discovery TGA 5500, available as an upgrade for TGA 550) allows the use of very high heating rates in baseline regions where no weight changes are occurring, but automatically slows the heating rate during weight changes. Once the weight change(s) are complete, the system returns to the selected ramp heating rate. Typical Hi-Res ramps often take the same or less time to complete than a comparable constant heating rate experiment run at a lower heating rate, while providing improved resolution.

Some of the benefits provided by the Hi-Res option are:

- Improved transition resolution
- Faster scans
- Enhanced signature analysis capability
- Transition temperatures closer to isothermal values
- Increased method programming versatility

Modulated TGA™ (MTGA™)

TA Instruments Modulated TGA (MTGA) is an innovative option that is used with Thermogravimetric Analyzers. This option is used to study the same decomposition or volatilization properties as conventional TGA. However, MTGA provides unique capabilities that increase the amount of information obtained from a single TGA experiment, thereby improving the quality of interpretation.

These unique capabilities include:

- continuous determination of activation energy
- verification of single kinetic mechanism
- verification of first-order kinetic model.

MTGA is an enhancement of TGA that provides the same information as traditional TGA, plus new information that permits unique insights into the behavior of the weight loss reaction.

Specifically, MTGA provides an alternative way to obtain kinetic information about one or more weight losses, in a shorter period of time than the multiple heating rate approach.

In addition, MTGA provides continuous determined values for activation energy throughout the weight loss reaction, not just at specific reaction levels. The ability to obtain activation energy continuously allows you to follow changes in the activation energy during the reaction, as a function of temperature or conversion. The calculation of activation energy is “model free” – no knowledge about the form of the kinetic equation is required.

The assumption of a first-order kinetic model (a reasonable assumption for many decomposition reactions), permits the calculation of natural logarithm of the pre-exponential factor in the same manner as the continuous determination of activation energy.

Other Discovery TGA Accessories

The TGA can be interfaced with many standard analytical accessories offered by various manufacturers such as FTIR spectrometers, mass spectrometers, gas chromatographs, and evolved gas analyzers.

For the TGA 5500, to assist in the performance of mass spectrometer analysis and to prevent condensation between the IR furnace and the transfer line to the other coupled instrument, the standard connector at the outlet can be replaced by an optional heated connector. Purge gas, exiting the balance chamber above the furnace, exits by the same route.

If desired, a vacuum pump can be connected to the standard 1/4-inch Swagelok connector of the IR furnace or the 1/8-inch Swagelok connector of the EGA furnace at the furnace gas outlet.

Consult the appropriate local instrument manufacturer for further information.

The Discovery TGA User Interface

The Discovery TGA includes an integrated user interface display for local operator control. The functions of the user interface change depending upon the view displayed. This section briefly describes the basic layout of these functions.

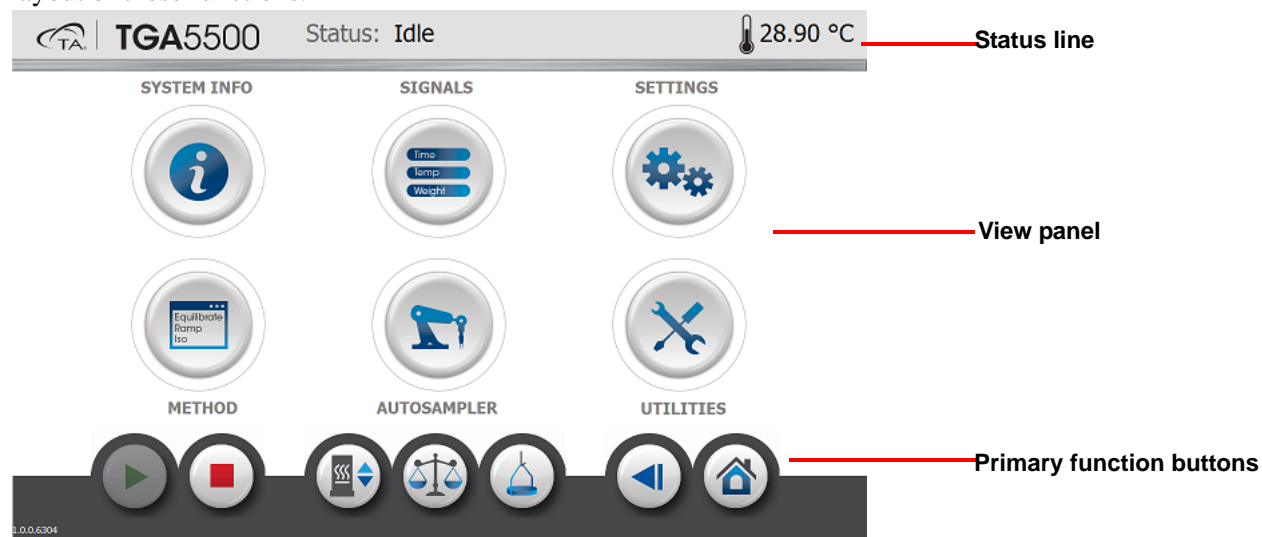


Figure 8 Discovery TGA user interface display (TGA 5500 shown).








The instrument user interface has three basic sections:

- The status line along the top of the display indicates the current instrument status and sample temperature.
- The primary function buttons allow for easy access of common functions.
- View panel allows for real-time instrument status and associated actions.

Primary Function Buttons

Use the following buttons for the main functions of the instrument.







Table 1: Primary Function Buttons on the User Interface

Key Name	Description
Start 	<p>Begins the currently-programmed experiment. This is the same function as Start on the instrument control software. Start automatically loads the selected sample pan and closes the furnace, if necessary, before beginning the experiment.</p>
Stop 	<p>If an experiment is running, this button ends the method normally, as though it had run to completion; i.e., the method-end conditions go into effect and the data that has been generated is saved. This is the same function as Stop on the instrument control software. If an experiment is not running (the instrument is in a standby or method-end state), the Stop button will halt any activity (air cool, all mechanical motion, etc.). If an Autosampler sequence is in progress, Stop will halt the sequence.</p>
Furnace Open/Close 	<p>Toggles between opening and closing the TGA furnace.</p>
Tare 	<p>Autoloader: Zeros the weight of an empty sample pan.</p> <p>Autosampler: Displays a screen that allows you to choose the sample pan to tare.</p>
Pan Load/Unload 	<p>Autoloader: Loads and unloads a sample pan.</p> <p>Autosampler: Displays a screen that allows you to choose the pan position to load/unload.</p>
Back 	<p>Returns you to the previous page used</p>
Home 	<p>Returns you to the Main screen.</p>



View Panel

The view panel provides real-time instrument status and additional functionality pertinent to the selected operation. A list of available functions is described below.

Table 2: View Panel Functions on the User Interface

Button Name	Description
System Info 	Displays instrument information such as the serial number, IP configuration, and network configuration.
Signals 	User can select signals to display the real-time signal data generated directly from the instrument.
Settings 	Displays options for manual controls, such as Event, Air Cool, and Heat Exchanger.
Autosampler/Autoloader 	<p>Autosampler: Displays a graphical representation of the Autosampler tray, indicating the status of the active sequence (e.g., which pan positions have been configured in the active sequence and which runs are active or pending). In addition, this panel provides access to other Autosampler operations such as calibration functions and utilities (manually loading pans).</p> <p>Autoloader: Provides access to calibration, load/unload pan, and reset operations.</p>
Method 	Provides a summary of the sample and method information for the current run and allows the user to manually advance the method.
Utilities 	Displays system health and shut down button.

Additional Function Buttons

Button Name	Description
Help 	The Help button can be found on the lower right side of some screens, and displays information regarding use of the currently displayed touch-screen.
Motion Stop 	Displayed while the Autosampler or furnace is in motion. Pressing this button will stop the motion.

Instrument Specifications

The tables found below contain the technical specifications for the Discovery TGA 55, TGA 550, and TGA 5500 units and sampling system.

Discovery TGA Instrument Characteristics

Table 3: Discovery TGA Technical Specifications

Item/Area	Specifications
Dimensions	Depth: 56 cm (22 in) Width: 56 cm (22 in) Height: 61 cm (24 in)
Weight of instrument	34 kg (76 lbs)
Mains Power	100–240 VAC 47–63 Hz 1200 W
Operating environmental conditions	Temperature: 15 to 35°C Relative humidity: 5 to 80% (non-condensing) Installation Category II Pollution Degree 2 Maximum altitude: 2000 m The degree of protection for this instrument according to IEC 529 is IP20.
Temperature range TGA 55 TGA 550 TGA 5500	Room temperature to 1000°C Room temperature to 1000°C Room temperature to 1200°C
Purge gases	Helium, nitrogen, oxygen, air, argon
Purge flow rate	Up to 500 mL/min. Recommended flow rates are: <ul style="list-style-type: none">• Wire-wound furnace: 60 mL/min for sample, 40 mL/min for balance• EGA furnace: 90 mL/min for sample, 10 mL/min for balance• IR furnace: 25 mL/min for sample, 10 mL/min for balance
Thermocouple	Platinel II*
Heating rate	TGA 5500: Linear heating rates from 0.1 to 500°C/min (Ballistic heating > 1500°C/min) TGA 55 and TGA 550: <ul style="list-style-type: none">• Wire-wound furnace linear heating rates from 0.1 to 100°C/min.• EGA furnace linear heating rates from 0.1 to 50°C/min.

**Platinel II is a registered trademark of Engelhard Industries.

WARNING: Do not use corrosive gases, hydrogen, or any other explosive gas in the TGA furnace.

AVERTISSEMENT: N'utilisez pas de gaz corrosifs, d'hydrogène ou tout autre gaz explosif dans le four TGA.

WARNING: Oxygen can be used as a purge gas in the TGA. However, if you use oxygen as a purge gas, you must make sure the furnace is cleaned of hydrocarbons that could combust.

AVERTISSEMENT: L'oxygène peut être utilisé comme gaz de drainage dans le TGA. Toutefois le four doit rester propre pour que les hydrocarbures volatils, qui peuvent brûler, soient éliminés.

Discovery TGA Sampling System

The following tables contain the specifications associated with the TGA sample pans, balance mechanism, and furnace.

Table 4: Sample Pan Options for 25-Pan Tray

Item/Area	Specifications
Types of pans available	Platinum, ceramic (Al_2O_3), aluminum
Volume capacity and temperature range	20 μL Sealed aluminum (to 600°C) 50 μL Platinum (to 1000°C) 80 μL Aluminum (bottom of sealed pan, to 600°C) 100 μL Platinum (to 1000°C) 100 μL Platinum-HT (to 1000°C) 100 μL Ceramic (to 1200°C) 250 μL Ceramic (to 1200°C)
Number of pans per tray	25 Pans

Table 5: Balance Mechanism

Item/Area	Specifications
Weighing capacity (sample)	1.0 gram
Dynamic weighing range	Low range: 100 mg High range: 1000 mg
Resolution	0.01 μg
Accuracy	$\leq \pm 0.1\%$ of value or 10 μg , whichever is greater

Chapter 2:

Installing the Discovery TGA System

Unpacking/Repacking the TGA

The instructions needed to unpack and repack the instrument are found as separate unpacking instructions in the shipping box and in the online help associated with the instrument control software. You may wish to retain all of the shipping hardware, pallets, and boxes from the instrument in the event you wish to repack and ship your instrument.

WARNING: Have an assistant help you unpack this unit. Do not attempt to do this alone.

AVERTISSEMENT: Faites-vous aider par une personne pour dépoter cet appareil. N'essayez pas de le faire tout seul.

Installing the Discovery TGA System

Before shipment, the TGA is inspected both electrically and mechanically so that it is ready for operation upon proper installation. Installation involves the following procedures:

- 1 Inspecting the system for shipping damage and missing parts
- 2 Choosing a location for instrument installation
- 3 Preparing the Discovery TGA for installation, which includes removing the shipping bracket and unpacking the balance
- 4 Setting up system communication between the instrument and computer (controller)
- 5 Connecting purge gas lines to the GDM
- 6 Connecting the heat exchanger cable and water lines
- 7 Connecting the TGA power cable
- 8 Installing the Upper Reflective Assembly (TGA 5500 only)
- 9 Installing the Autosampler tray
- 10 Installing the hang-down wires
- 11 Leveling the instrument and aligning the hang-down wires
- 12 Installing the lower furnace assembly (TGA 5500 only)
- 13 Closing up the balance and conditioning the balance
- 14 Filling the heat exchanger reservoir and purging the heat exchanger system of air

It is recommended that you have your TGA installed by a TA Instruments Service Representative; call for an installation appointment when you receive your instrument.

CAUTION: To avoid mistakes, read this entire chapter before you begin installation.

MISE EN GARDE: Pour éviter de commettre des erreurs, lisez tout le chapitre avant de commencer l'installation.

Inspecting the System

When you receive your Discovery TGA system, look over the instrument and shipping container carefully for signs of shipping damage, and check the parts received against the enclosed shipping list.

- If the instrument is damaged, notify the carrier and TA Instruments immediately.
- If the instrument is intact but parts are missing, contact TA Instruments.

Choosing a Location

Because of the ultra-high sensitivity of the Discovery TGA microbalance, it is important to choose a suitable location for the instrument using the following guidelines. The Discovery TGA system should be:

In

- A temperature-controlled area. Temperatures should be in range 20 to 35°C.
- A clean, vibration-free environment, preferably on the ground floor in the building. It should be located away from pumps, motors, or other devices which produce vibrations.
- An area with ample working and ventilation space.

On

- A stable work surface. A marble table is recommended for optimum performance. Isolation mounts on a standard lab bench are not recommended.

Near

- A power outlet (120 Vac, 50 or 60 Hz, 15 amps; or 230 Vac, 50 or 60 Hz, 10 amps).
- Your TA Instruments controller.
- Compressed lab air and purge gas supplies with suitable regulators and filters, if required.

Away from

- Dusty environments.
- Exposure to direct sunlight.
- Direct air drafts (fans, room air ducts).
- Poorly ventilated areas.
- Noisy or mechanical vibrations.
- High traffic areas, where constant movements from passing personnel could create air currents or mechanical disturbances.

NOTE: Allow free air to circulate around both enclosures. Do not place equipment against walls or cabinets that might impede air flow. Leave at least 7.5 cm (3 in) clearance around the Discovery TGA.

WARNING: For safety, position the equipment in a manner that allows access to the power cord for emergency disconnection.

AVERTISSEMENT: Par mesure de sécurité, placez l'équipement de sorte qu'il permette d'accéder facilement au cordon d'alimentation en cas de débranchement d'urgence.

Preparing the Discovery TGA for Installation

After the TGA instrument has been removed from the box and placed on the bench, use these steps to prepare your instrument for installation:

Removing the Shipping Bracket

This step is also covered in the unpacking instruction sheet shipped with the instrument. It is repeated here for your convenience, or in the event that the step was not completed previously.

To remove the shipping bracket:

- 1 Cut the wire-tie securing the air cool line to the water circulator tubing, then loosen the foot of the furnace shipping bracket. See the figure below.

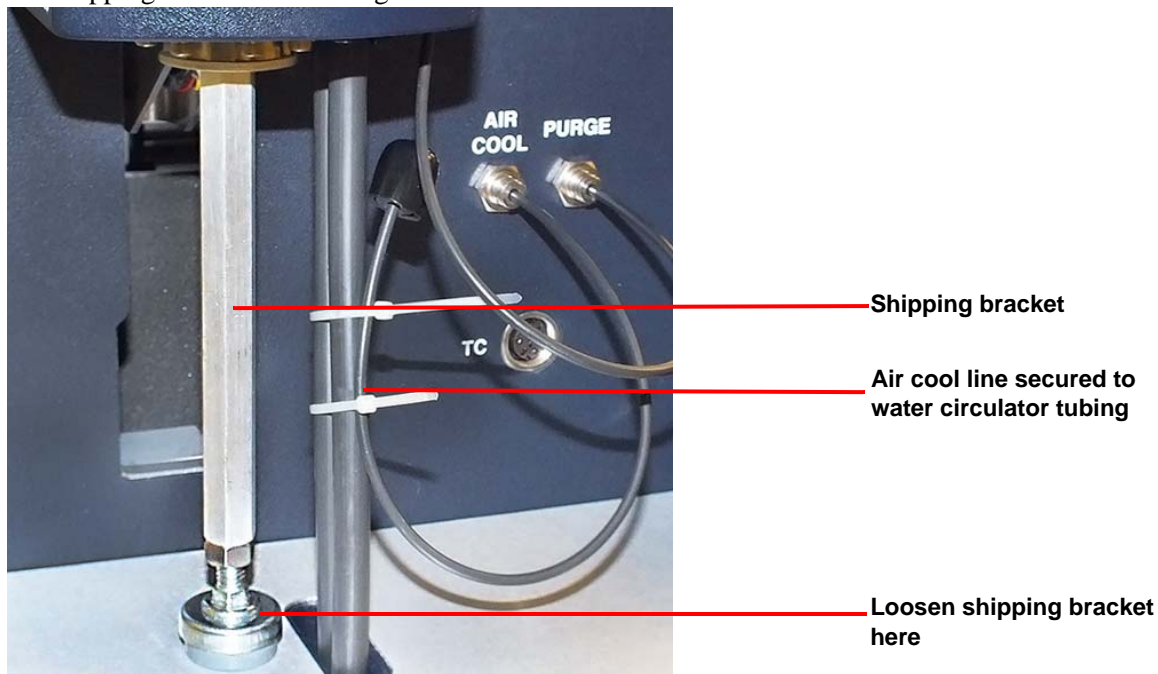


Figure 9 Shipping bracket on Discovery TGA (TGA 5500 shown).

- 2 Raise the foot of the bracket and remove the entire bracket.
- 3 Retain this bracket in case the instrument needs to be shipped in the future.

Unpacking the Balance

After removing the bracket, you can proceed to unpack the balance. **This very important procedure must be completed before you can use the Discovery TGA.**

- 1 Carefully remove the balance housing cover by loosening the screws.



Figure 10 Removing the balance housing cover.

- 2 Loosen the thumbscrews and remove the balance cover shown in the figure below.

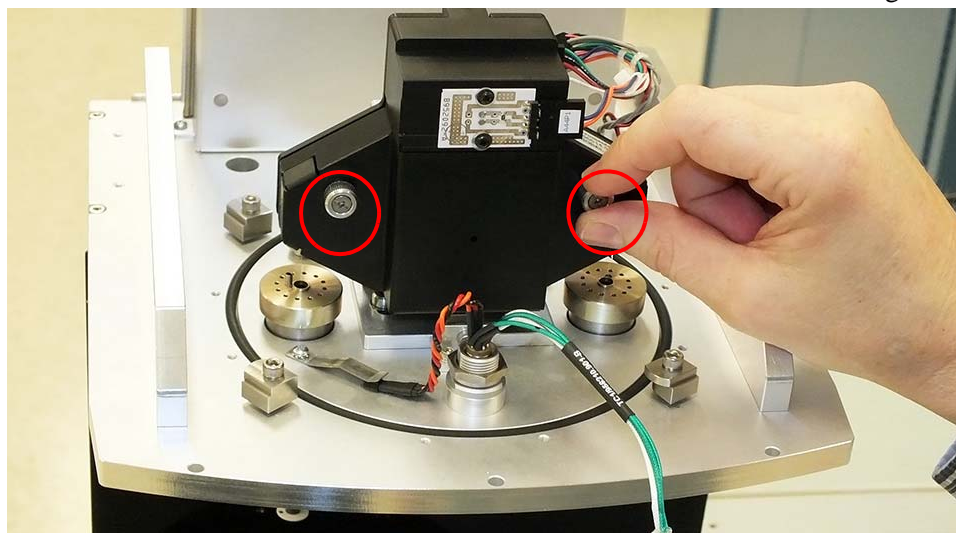
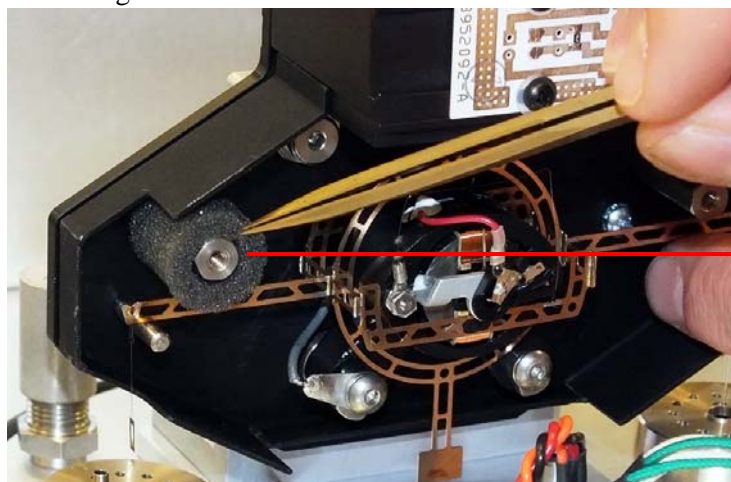


Figure 11 Loosen thumbscrews.

- 3 Using tweezers, compress the foam and rotate it 90 degrees to eliminate contact with the beam. Gently remove the foam inserts from the sample and tare sides, being careful not to touch the balance. Refer to the figure below.



Carefully remove this foam

Figure 12 Removing the foam inserts.

- 4 Put the balance cover back into place, tightening the screws to secure it. See [Figure 11](#) above.

Connecting the Discovery TGA to the Controller

To connect the TGA system, you will need access to the Discovery TGA instrument's back panel.

NOTE: Connect all cables before connecting the power cord to an outlet.

CAUTION: Whenever plugging or unplugging power cords, handle them by the plugs, not by the cords.

MISE EN GARDE: Chaque fois que vous branchez ou débranchez les cordons d'alimentation, tenez-les par les fiches et non par les cordons.

WARNING: Protect power and communications cable paths. Do not create tripping hazards by laying the cables across access ways.

AVERTISSEMENT: Protégez les chemins de câble électriques et de câbles de télécommunication. Ne créez pas de risques de déclenchement en posant des câbles sur les voies d'accès.

The Discovery TGA back panel has fifteen ports; the table below provides a description of the function of each port.

Table 6: Discovery TGA Back Panel

Port	Function
Power Entry Module (power cord and switch)	Provides power and protective earthing to the system.
Fuses	Provides overcurrent protection.
REACTIVE GAS	Port for introducing an additional gas directly into the vicinity of the sample and reference. External flow regulation required. Maximum pressure is 140 kPa gauge (20 psig).
GAS 1	Gas inlet port controlled by the gas delivery module. Used for the sample and balance purge gas. Maximum pressure is 140 kPa gauge (20 psig).
GAS 2	Gas inlet port controlled by the gas delivery module. Used for the secondary sample purge gas. Maximum pressure is 140 kPa gauge (20 psig).
COOLING GAS	Provides the furnace with air for post-run cooling. Maximum pressure is 140 kPa gauge (20 psig).
RS-232 Port	Provides communications with external accessories.
CAN Communications Port	Provides communications with external accessories.
Ethernet	Provides communication between controller and TGA instrument.
USB 2.0 Port	Provides communications with external accessories.
Micro USB 2.0 Port	Provides communications for external accessories.
SD memory card slot	For TA Instruments Service use only.

Table 6: Discovery TGA Back Panel

Port	Function
Audio Jack	External speaker communication
EVENT	Capable of providing a general purpose relay contact closure.
24 VDC OUT	Enables control of heat exchanger.

WARNING: If connecting oxygen, it should ONLY be connected to the GAS 2 and REACTIVE GAS ports.

AVERTISSEMENT: En cas de connexion de l'oxygène, il ne doit être connecté aux ports GAS 2 et gaz réactif.

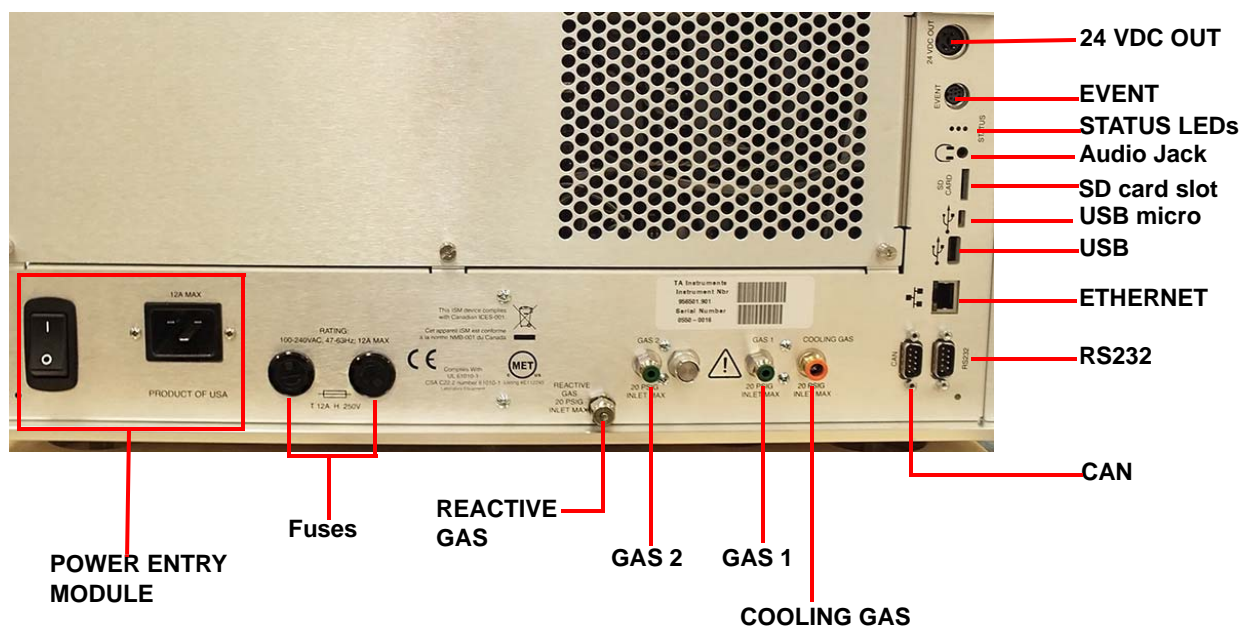


Figure 13 Discovery TGA rear panel connections.

Setting Up System Communication

In order to connect the instrument to a network, you will need to connect the controller computer to a router, then connect the computer to a LAN.

Refer to the TRIOS Software Installation Instructions for more details.

Connecting Lines to the Gas Delivery Module

DANGER: The gas delivery module (GDM) o-rings (on the interior of the GDM) are sealed using Krytox[®] vacuum grease. This grease may be harmful or fatal if ingested. Avoid contact with eyes and skin. For additional important safety information, refer to the Krytox MSDS.

DANGER: Les joints toriques (à l'intérieur du GDM) du module d'alimentation en gaz (GDM) sont scellés à l'aide de la graisse à vide Krytox[®]. En cas d'ingestion, cette graisse peut être nocive ou fatale. Évitez tout contact avec la peau et les yeux. Pour obtenir des renseignements supplémentaires sur la sécurité, reportez-vous à la fiche technique santé-sécurité du Krytox.

It is important to accurately control the sample atmosphere during Discovery TGA experiments. This is achieved by connecting purge gases to the system. Purge gas is distributed separately to two parts of the TGA: the furnace (sample) and the balance chamber. The Discovery TGA is equipped with Gas Delivery Manifold (GDM) to control the flow rates of the gases. Nitrogen is typically used for **GAS 1**. Follow these instructions to connect the purge lines. Refer to [Figure 13](#) for gas port locations.

Connecting Purge Gas Lines

CAUTION: Do not use any liquid in the purge lines.

MISE EN GARDE: N'utilisez aucun liquide dans les conduites de gaz de drainage.

WARNING: Use of flammable or explosive gas as a purge gas is dangerous and is not recommended for this instrument.

AVERTISSEMENT: L'utilisation d'un gaz inflammable ou explosif comme gaz de drainage est dangereuse et n'est pas recommandée pour cet instrument.

NOTE: If you are using a “house” laboratory supply rather than bottled gas, it is highly recommended that you install an external drier and a 5-µm filter.

- 1 Locate the **GAS 1** port on the back of the Discovery TGA. The **GAS 1** port is used to purge both the sample and balance areas. As such, an inert gas such as nitrogen should be used in this port.
- 2 Locate the **GAS 2** port. The **GAS 2** port is also used to purge the sample area and is used when a purge gas other than **GAS 1** is desired or when gas switching during an experiment is needed.

- 3 Connect the primary gas line to the **GAS 1** port. If desired, connect a secondary gas to the **GAS 2** port. Refer to [Figure 14](#) for reference.

WARNING: If connecting oxygen, it should ONLY be connected to the GAS 2 port.

AVERTISSEMENT: Tout raccordement de l'oxygène doit s'effectuer UNIQUEMENT sur l'orifice à gaz 2.

NOTE: The flow rate is controlled through settings chosen using the instrument control software.

- 4 Connect the 1/8-inch Teflon TFE tubing from the instrument to the purge gas inlet, as shown below.



Figure 14 Gas connections on rear of Discovery TGA.

- 5 Make sure that the pressure of your purge gas source is regulated between 70 and 140 kPa gauge (10 and 20 psig, respectively).

CAUTION: The GAS 1 and GAS 2 lines feed into a pressure relief valves that are set to 140 kPa gauge (20 psig). The source pressure setting should not go above this value.

MISE EN GARDE: Les conduites de gaz 1 et 2 alimentent une soupape de détente de pression réglée à 140 kPa (pression manométrique) (20 psig). Le réglage de la pression à la source ne doit pas dépasser cette valeur.

- 6 Specify the connected gas on the **Discovery TGA > General** page of the **TRIOS Options**.
- 7 Set the sample flow rate to the recommended value for your experiments (depending on furnace type) through the Control Panel options within TRIOS instrument control software. Refer to Table 3 on page 24 for a list of recommended purge rates for the different furnaces.

Connecting the Air Cool Line

Use the following steps to install the Cooling Gas line:

- 1** Locate the **COOLING GAS** fitting on the back panel of the Discovery TGA, marked with a 140 kPa gauge (20 psig) warning label.
- 2** Make sure your compressed air is regulated between 138 to 172 kPa gauge (20 psig) and is free of water and vapors.

CAUTION: The COOLING GAS line feeds into a pressure relief valve that is set to 140 kPa gauge (20 psig). The source pressure setting should not go above this value.

MISE EN GARDE: La conduite de refroidissement de l'air alimente une soupape de détente de pression réglée à 140 kPa (pression manométrique) (20 psig). Le réglage de la pression à la source ne doit pas dépasser cette valeur.

- 3** Connect the 1/4-inch O.D. tubing from the compressed air source to the **COOLING GAS** fitting.

NOTE: The cooling gas flows up through the furnace cavity. If you are analyzing oxygen-sensitive materials, it is recommended that you use nitrogen as your cooling gas.

Connecting the Heat Exchanger Cable and Water Hoses

Follow these instructions to connect the heat exchanger cable and water hoses:

- 1 Locate the **24 VDC** output connector on the rear of the TGA instrument and connect the heat exchanger cable to the connector. The heat exchanger cable is the only cable that fits into this connector.
- 2 Remove the water hoses from the packaging.
- 3 Obtain the water hose marked **SUPPLY**. Connect one end of this hose to the connector labeled **SUPPLY** on the side of the instrument.



Figure 15 **SUPPLY** and **RETURN** connectors on the side of the instrument.

- 4 Connect the other end of the water hose marked **SUPPLY** to the connector labeled **SUPPLY** on the heat exchanger.
- 5 Connect one end of the unmarked water hose to the connector labeled **RETURN** on the side of the instrument.
- 6 Connect the other end of the unmarked water hose to the connector labeled **RETURN** on the heat exchanger.

NOTE: Air trapped in the heat exchanger system must be purged before starting the first run. See [“Purging Air from the Heat Exchanger System” on page 52](#) after completing installation of the Discovery TGA.

Connecting the Power Cable

NOTE: A <HAR>-marked (harmonized) power cable with an IEC 60320 C19 style connector meeting the standards of the country of installation is required for the European Economic Area.

Install the power cable as follows:

- 1 Make sure the power switch is in the Off (0) position, as shown in [Figure 16](#).
- 2 Plug the power cable into the power entry module (shown below).



Figure 16 Power cable in power entry module on back panel of the instrument.

- 3 Plug the power cable into the wall outlet.

Installing the Autosampler Tray

Follow the steps below to install the Autosampler tray:

- 1 Install the Autosampler sample tray (found in the accessory kit). Use the guide pin to orient the tray correctly.
- 2 Select **Autosampler Reset** from the user interface or from the instrument control software.
- 3 If necessary, calibrate the Autosampler as described in [“Autosampler and Autoloader Calibration” on page 57](#).

Installing the Hang-Down Wires

The procedures below describe how to install the tare and sample hang-down wires. The following procedures assume that the instructions found in [“Preparing the Discovery TGA for Installation” on page 28](#) have been completed.

CAUTION: During installation, take care not to bend the hang-down wires or damage the hang-down loops.

MISE EN GARDE: Pendant l'installation, prenez soin de ne plier les fils suspendus et de ne pas endommager les boucles suspendues.

Installing the Tare Hang-Down Wire

Install the tare hang-down wire as follows:

- 1 Verify that the instructions found in [“Preparing the Discovery TGA for Installation” on page 28](#) have been completed. Both the balance housing cover and balance cover should already be removed at this point in the installation.
- 2 Loosen the three screws (circled below) on the tare cap, which is located on the underside of the balance chamber. Remove the cap and put it aside to reinstall later.

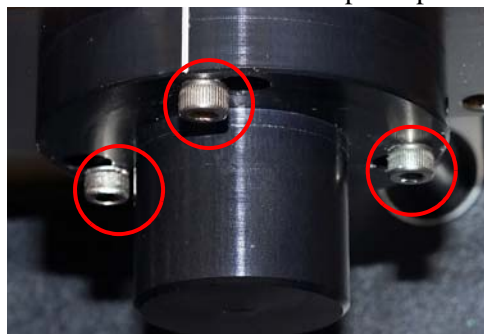
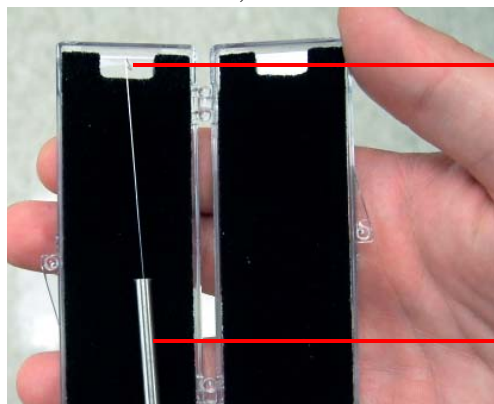


Figure 17 Removing the tare cap.

- 3 Locate the tare hang-down wire and tare hang-down installation tool in your TGA Accessory Kit. The tare hang-down wire is the shorter of the two wires. For now, leave the tare hang-down wire in its case.
- 4 Position the hang-down wire case so that the wire's double bend hook is at the top.
- 5 With the tare hang-down wire still in its case, insert the bottom of the wire into the tare hang-down installation tool, as shown below. Then remove the installation tool and wire from the case.



Double bend hook

Installation tool

Figure 18 Inserting tare hang-down wire into installation tool.

- 6 Insert the wire and installation tool vertically into the tare tube, being careful not to bend the wire.

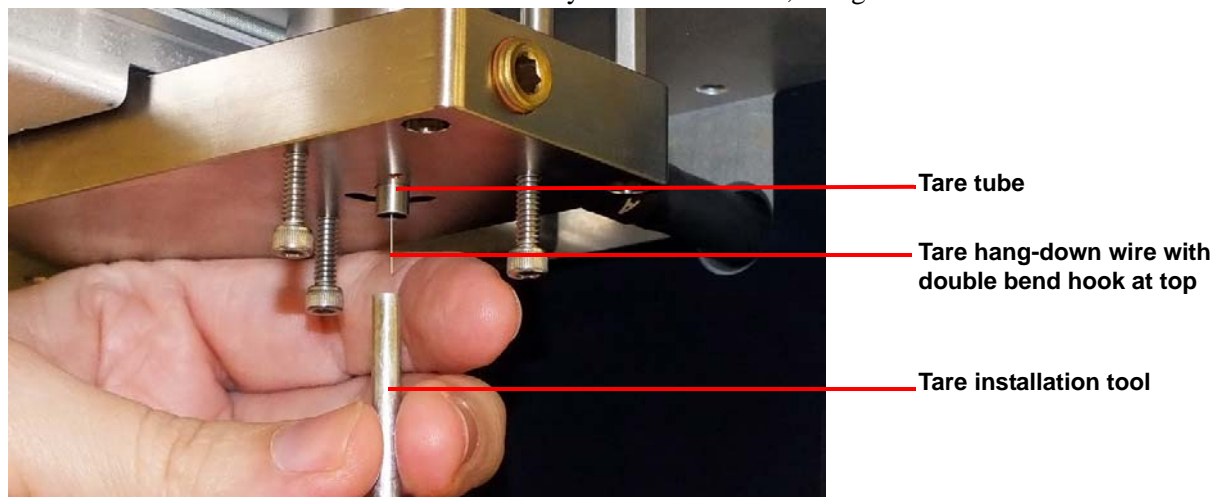


Figure 19 Inserting hang-down wire into tare tube.

- 7 Continue to raise it slowly until the top of the wire protrudes from the opening in the purge control cap. Be sure to hold the installation tool in place, as it will fall out of the tare tube opening if released.

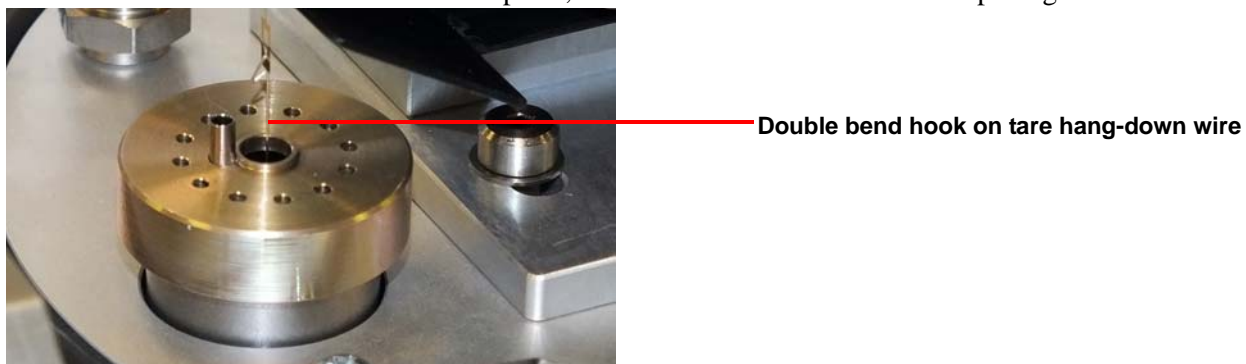


Figure 20

- 8 Using tweezers, gently hang the double-bend hook (pointing to the left) on the hang-down loop. Maneuver the hook until it is fully inserted through the loop. Be very careful to avoid bending the hang-down loop.
- 9 Remove the tare hang-down installation tool.

- 10 Use the alignment gauge (shown below) to ensure that the length of the tare tube extends 0.381-cm (0.150-inch) below the cooling plate. Push it up or pull it down to adjust the length.

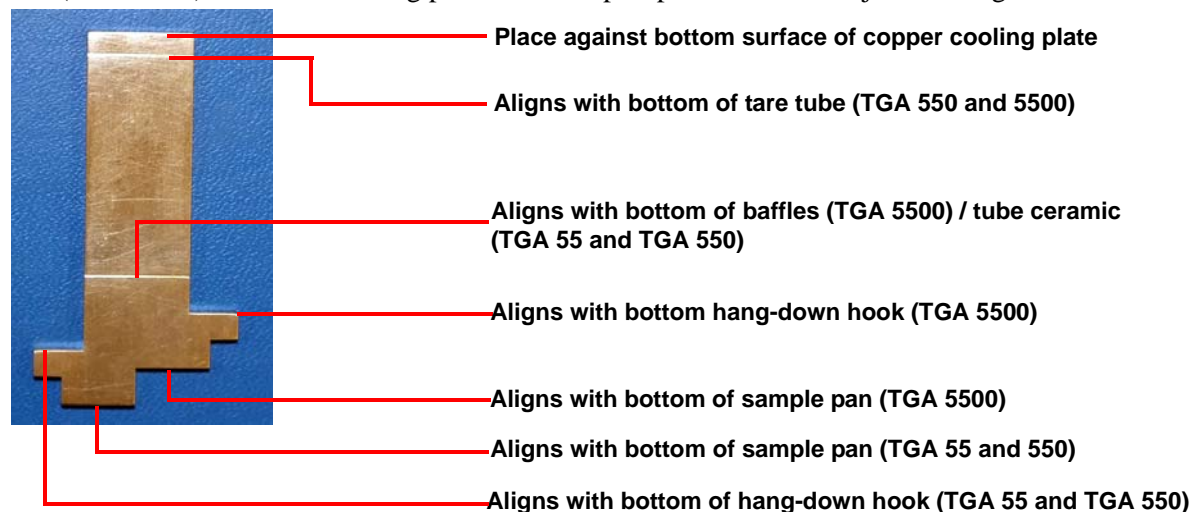


Figure 21 Alignment gauge. The long edge (shown here as the left edge) is used for TGA 55 and TGA 550, and the short edge (shown here as the right edge) is used for the TGA 5500.

- 11 Hang the desired sample pan on the hook. Choose the same type of pan that will be used for your experiments.
- 12 Replace the black tare cap over the tare side pan. Tighten the three screws holding the tare cap on.

Installing the Upper Reflective Assembly and Sample Hang-Down Wire on the TGA 5500

Before you can install the sample hang-down wire, you must install the sample tube (upper reflective assembly) that surrounds the wire. Follow these steps:

- 1 Locate the upper reflective assembly in the accessory kit.
- 2 Lower the furnace to its fully open position.
- 3 Cover the furnace opening with a flat object (such as a business card) to prevent anything from falling inside.
- 4 Holding the assembly by the tube section, install the upper reflective assembly by inserting it straight

up inside the sample side hole in the cooling plate, being sure not to bend the baffles.

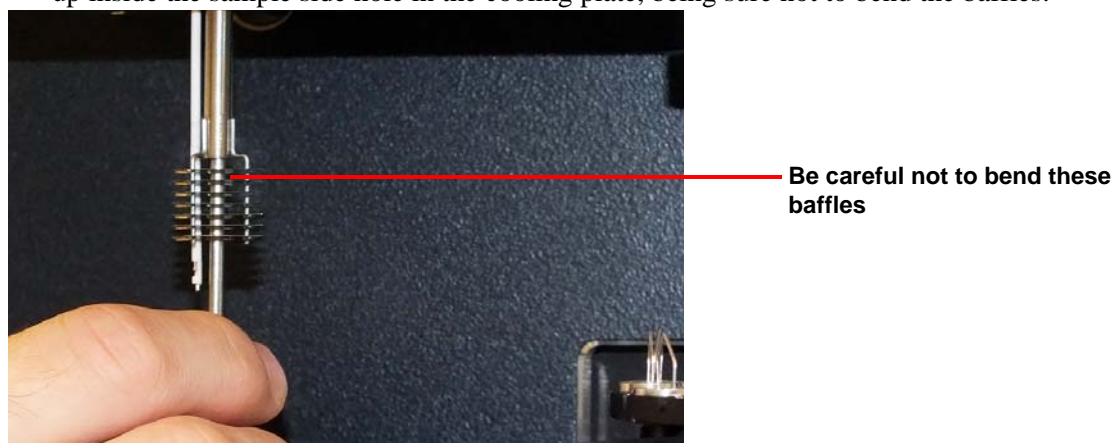


Figure 22 Installing the upper reflective assembly.

- 5 With the upper reflective assembly in place, carefully install the DTA thermocouple.

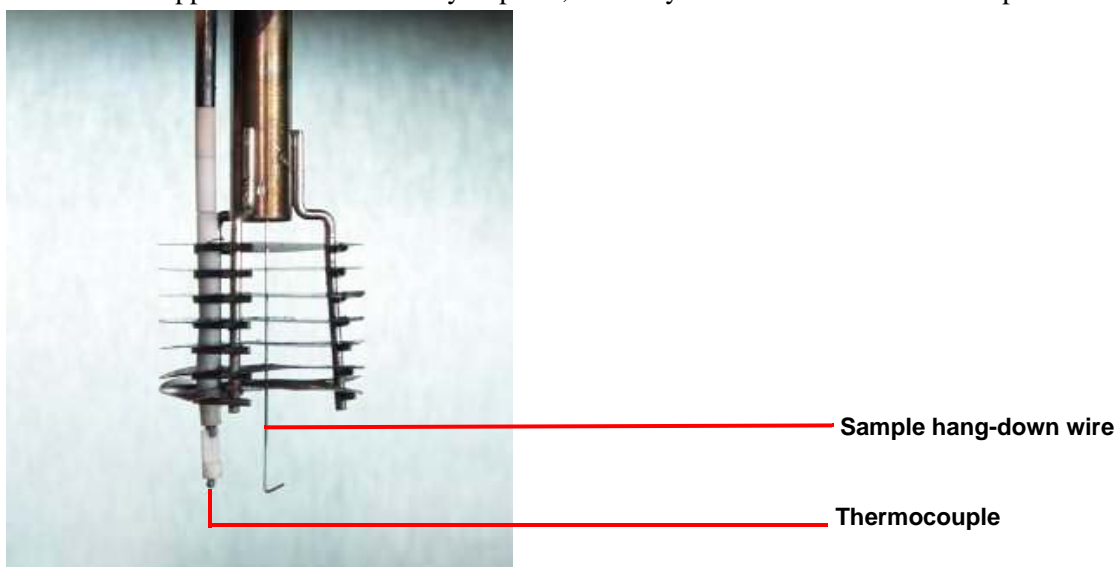


Figure 23 Thermocouple installed.

- 6 Proceed to install the sample hang-down wire as instructed in the following steps. Please note that you will not need to adjust the length of the upper reflective assembly tube until the sample hang-down wire has been fully installed.

CAUTION: During installation, take care not to bend the hang-down wires or damage the hang-down loops.

MISE EN GARDE: Pendant l'installation, prenez soin de ne plier les fils suspendus et de ne pas endommager les boucles suspendues.

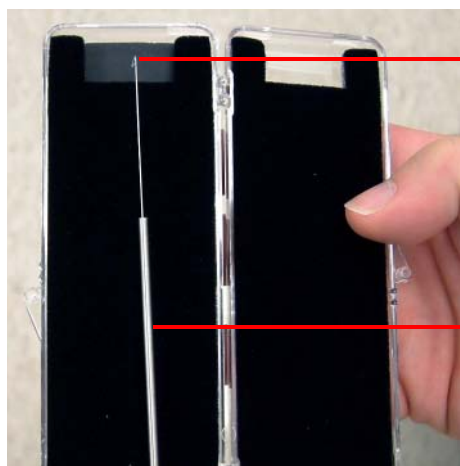
- 7 Placing a finger under the upper reflective assembly, push the tube up slowly until it stops moving; be careful not to bend the baffles.
- 8 Locate the sample hang-down wire and the sample hang-down installation tool (shown below), which

are found in the accessory kit. For now, leave the sample hang-down wire in its case.



Figure 24 Sample hang-down wire installation tool.

- 9 Position the hang-down wire case so that the wire's double bend hook is at the top.
- 10 With the sample hang-down wire still in its case, insert the bottom of the wire into the sample hang-down installation tool, as shown below. Then remove the installation tool and wire from the case.



Double bend hook

Installation tool

Figure 25 Inserting sample hang-down wire into installation tool.

- 11 Remove the flat object covering the furnace opening and lower the furnace to its fully open position.

- 12 Carefully angling the sample hang-down installation tool, lower the bottom into the furnace opening until you have enough clearance to hold the tool and wire vertically **without bending the wire** (very important).

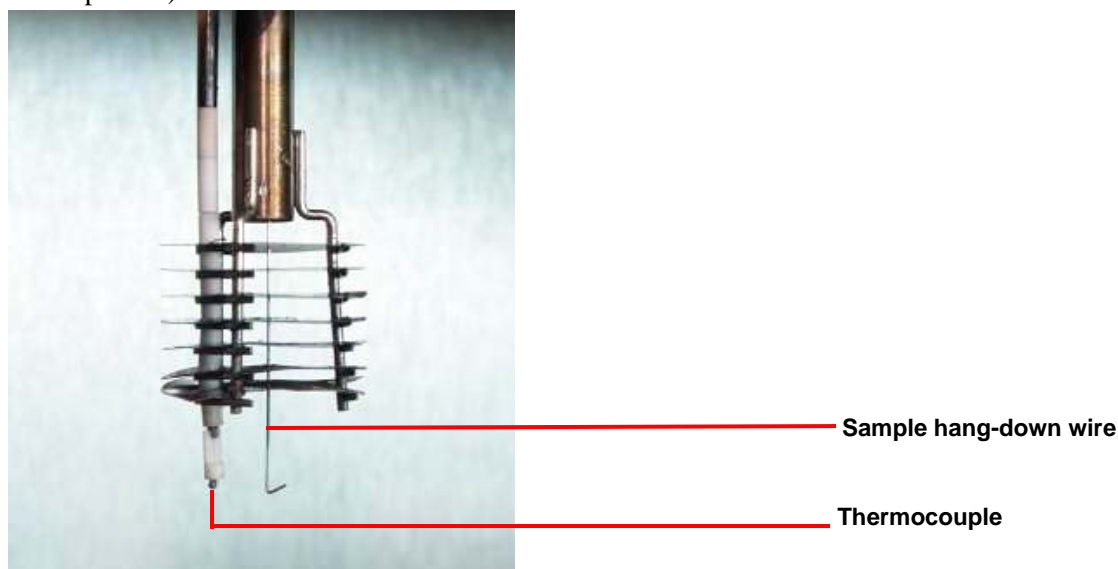


Figure 26 Sample hang-down wire.

- 13 Insert the wire and sample hang-down installation tool vertically into the sample tube, being careful not to bend the wire. Continue to raise it slowly, feeding it through the purge control cap until the top of the wire protrudes from the opening in the cap.
- 14 Cover the furnace opening with a flat object that will completely block the opening.
- 15 Position the sample hang-down wire so that the double-bend hook is pointed to the left. Grasp the hang-down wire with brass tweezers, being careful not to bend the wire.
- 16 Using tweezers, gently hang the double-bend hook (pointing to the left) on the hang-down loop. Maneuver the hook until it is fully inserted through the loop.

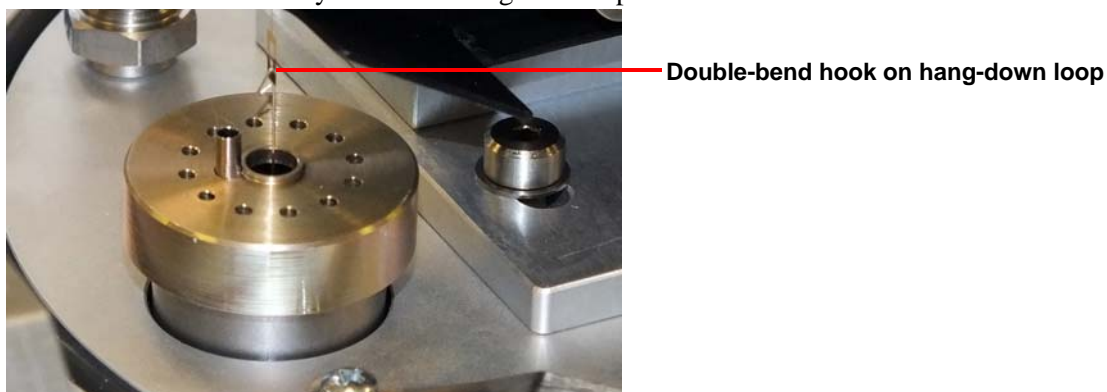


Figure 27 Hanging the sample hang-down wire.

- 17 Slide the installation tool down to remove it from the upper reflective assembly. The hang-down wire, if properly installed through the loop, will remain in position. Be careful not to bend the hang-down wire.
- 18 Adjust the length of the upper reflective assembly by pulling it down. The length from the bottom of the baffle to the cooling plate should be 1.6 in (4.1 cm), which can be determined using the supplied gauge. See the figure below.

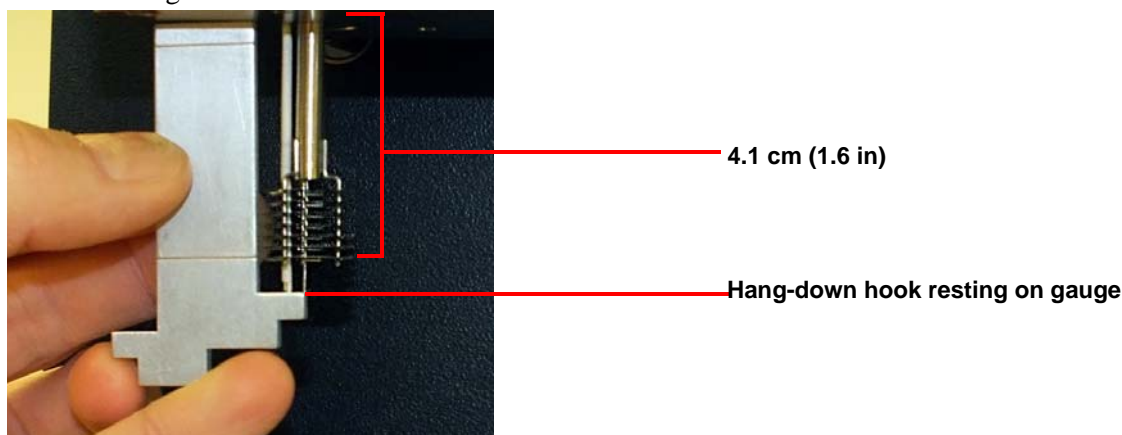


Figure 28 Proper positioning of alignment gauge and upper reflective assembly.

- 19 Hang the desired sample pan from the hook. Choose the same type of pan that will be used for your experiments.

Installing the Sample Hang-Down Wire on the TGA 55 and TGA 550

CAUTION: During installation, take care not to bend the hang-down wires or damage the hang-down loops.

MISE EN GARDE: Pendant l'installation, prenez soin de ne plier les fils suspendus et de ne pas endommager les boucles suspendues.

- 1 Verify that the instructions found in [“Preparing the Discovery TGA for Installation” on page 28](#) have been completed. Both the balance housing cover and the balance cover should already be removed at this point in the installation.
- 2 Press the FURNACE button to lower the furnace.
- 3 Locate the sample hang-down wire in your TGA Accessory Kit.
- 4 Hold the wire in your hand so that the doubly bent top hook is pointing to the left and the bottom hook is pointing to the right.
- 5 Carefully insert the bottom of the hang-down wire into the top of the furnace far enough so that you can insert the top of the wire into the thermocouple tube **without bending the wire**.
- 6 Thread the hang-down wire up through the thermocouple tube into the balance chamber, and hook the top of the wire over the top of the tube.
- 7 Grasp the top hook of the hang-down wire with brass tweezers. Being careful to keep the top hook pointing to the left, pass the double bend through the hang-down loop so the wire is hanging from the loop.

Leveling the Discovery TGA and Aligning the Balance

To avoid weight signal noise, the TGA instrument must be level so that the sample pan and hang-down wire hang inside the furnace without touching the sides. The angle at which the pan hangs is very sensitive to slight irregularities in benchtop surfaces, so it is required that the instrument is installed on a marble bench.

Once you have your TGA in a satisfactory location, you will need to adjust the top and bottom of the sample hang-down wire and level the instrument using the following procedures. These procedures are performed with pans loaded on the hang-down wires.

Leveling the Instrument

Place a level across the rails of the instrument as shown below

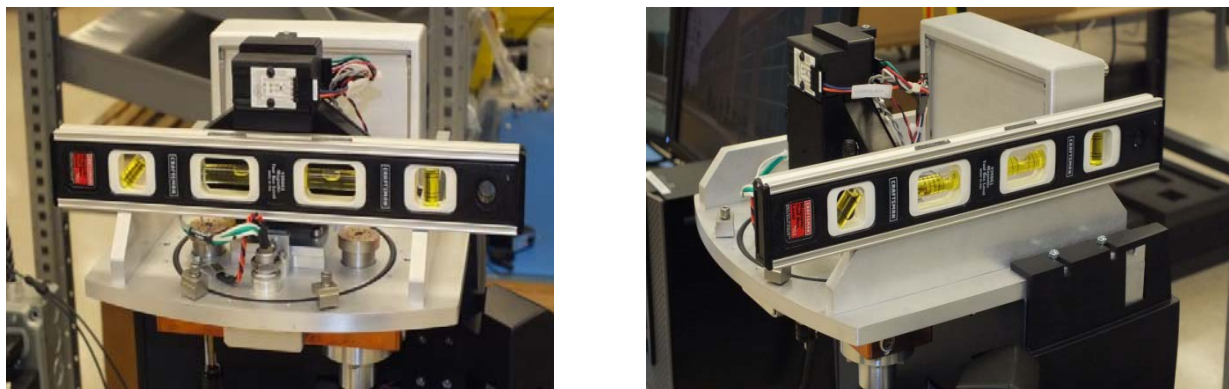


Figure 29 Leveling the instrument.

Aligning the Sample Hang-Down Wire

- 1 Load a pan on the sample hang-down wire.
- 2 Adjust the position of the hang-down wire and pan until the bottom of the pan is 2.2 in. (5.6 cm) from the cooling plate as follows:
 - a Turn the center balance assembly hex head screw until it touches the floor of the chamber; this is done to prevent the balance assembly from dropping in step b.
 - b Adjust the balance up or down by turning the height adjustment screw. After the height is adjusted, retighten the two locking screws.

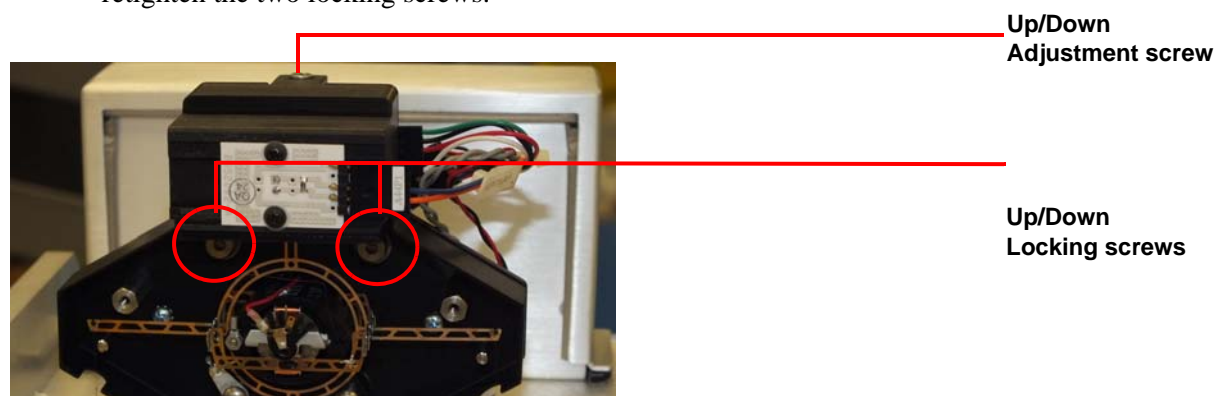


Figure 30 Adjust the balance.

NOTE: The position of the hangdown and tare wires was set at the factory. If the instrument is level, no adjustment is necessary. If you need to adjust the balance towards the front or back side, loosen the four horizontal set screws, realign, and then retighten the set screws.

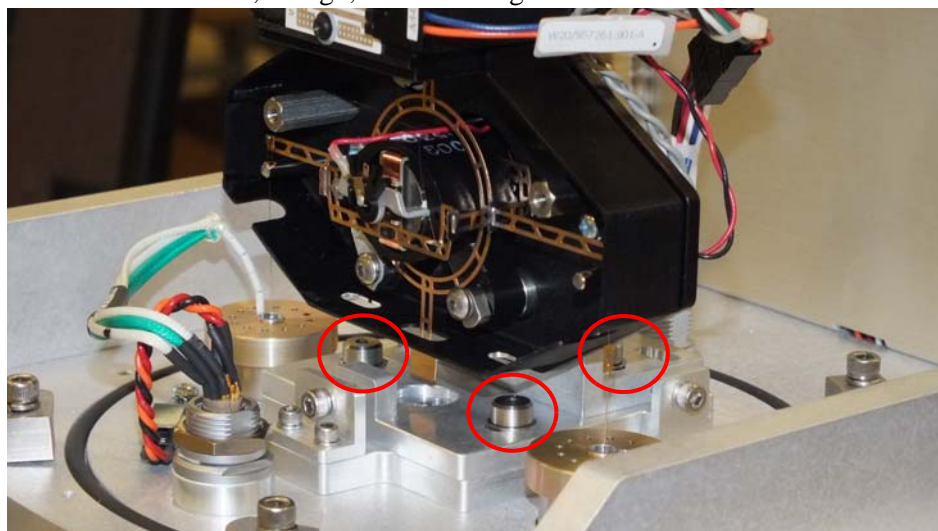


Figure 31 Balance alignment locking screws (3 shown).

- c Turn the center balance assembly hex head screw until the pan height is at the correct distance. Make your adjustments using the alignment gauge as a guide.

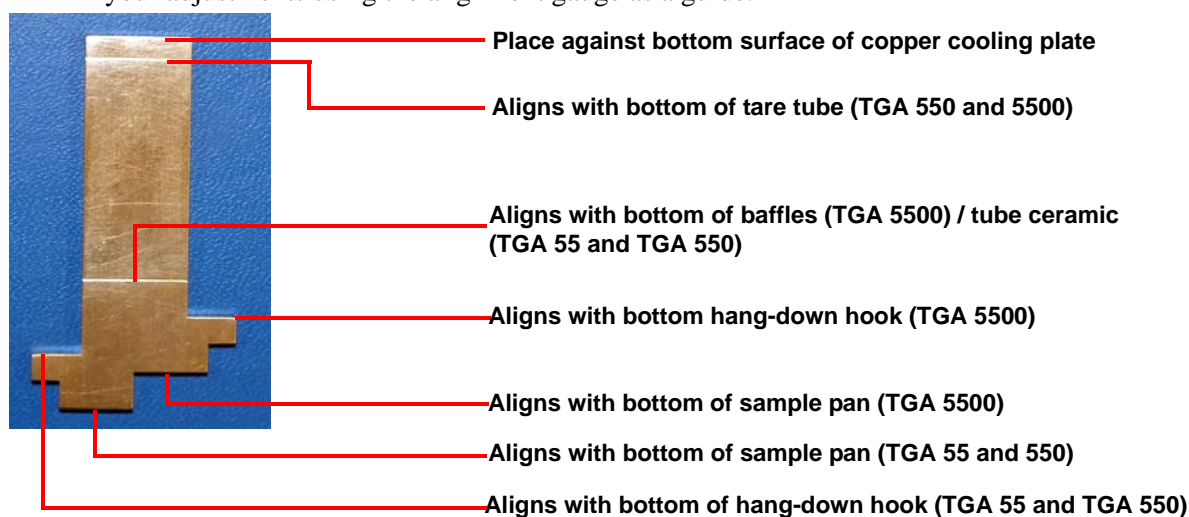


Figure 32 Alignment gauge. The long edge (shown here as the left edge) is used for TGA 55 and TGA 550, and the short edge (shown here as the right edge) is used for the TGA 5500.

- d Tighten the up/down screws to lock them in position.
 - e Turn the center balance assembly hex head screw all the way up until it is tight against the balance assembly.
- 3** Adjust the side-to-side position of the sample hang-down wire as follows:
- a Loosen the two outer left/right balance adjustment locking screws shown in [Figure 31](#).

- b Manually position the balance assembly left or right until the hang-down wire is centered in the purge cap at the top and in the sample tube at the bottom.
- c Tighten the screws to lock them in position.

Aligning the Bottom of the Sample Hang-Down Wire

The purpose of this procedure is to center the sample pan within the furnace so that its movement is not hindered as the furnace is opened and closed.

- 1 Use the user interface **Furnace Open/Close** button to slowly raise the furnace just to the bottom of the sample pan, and touch **STOP**.
- 2 Check the alignment of the sample pan within the furnace. It should hang freely, centered, and should not be touching the sides of the furnace (shown in the figure here).

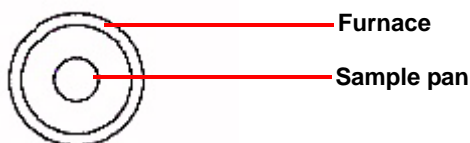


Figure 33

- 3 If the sample pan is not centered and hanging freely within the furnace, level the instrument by adjusting the two front feet on the bottom. Turn the feet clockwise to lengthen or counterclockwise to shorten the legs, making sure the front feet and the rear stabilizer bar contact the table securely. Continue adjusting until the pan hangs correctly.
- 4 Use a 7/16-inch wrench to tighten the locking nuts up against the bottom of the cabinet when the instrument is level to fix the position of the mounting feet in place. See the figure below.

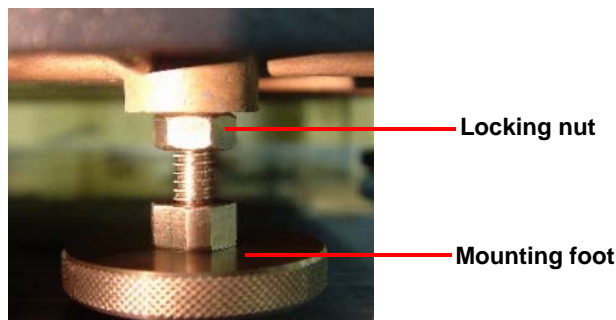


Figure 34 Locking nut position shown.

- 5 Raise the furnace slowly again to ensure the sample tube baffles clear the furnace. If the baffles come in contact with the furnace, call TA Instruments for service.
 - 6 Lower the furnace, then manually remove the pan and place it back on the Autosampler tray.
- At this point, the lower furnace assembly is ready to be installed. Proceed to the next section.

Installing the Lower Furnace Assembly on the TGA 5500

After the hang-down wires have been properly aligned, follow these steps to install the lower furnace assembly.

- 1 Close the furnace completely.
- 2 Turn off the instrument.
- 3 Locate the lower furnace assembly in the accessory kit.
- 4 Carefully remove the lower furnace assembly from the plastic shipping tube.
- 5 Orient the lower furnace assembly (shown below) so that the air cool inlet points to the left as you slide it up into the bottom of the furnace.

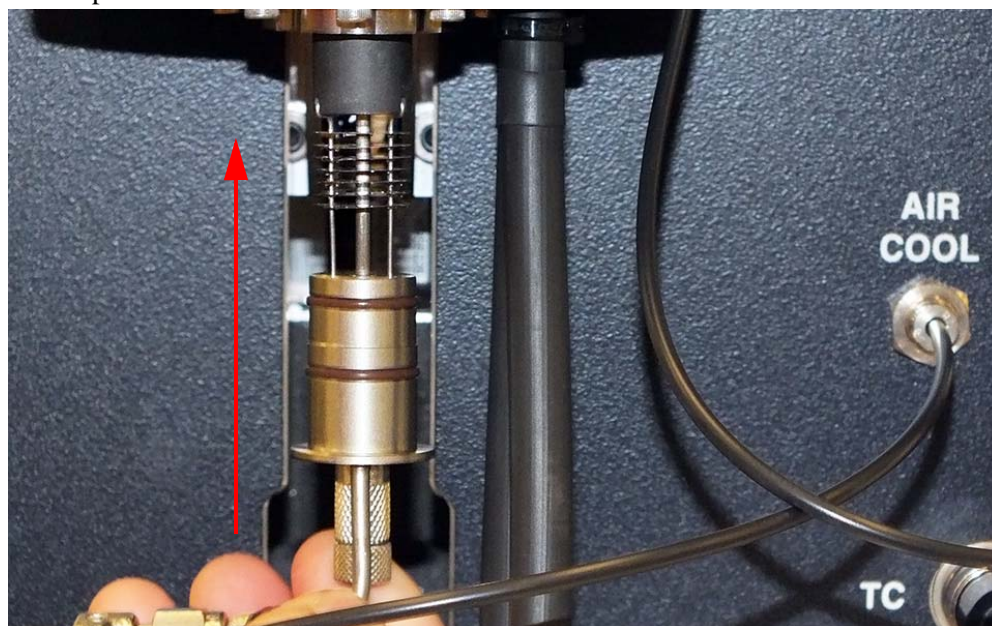
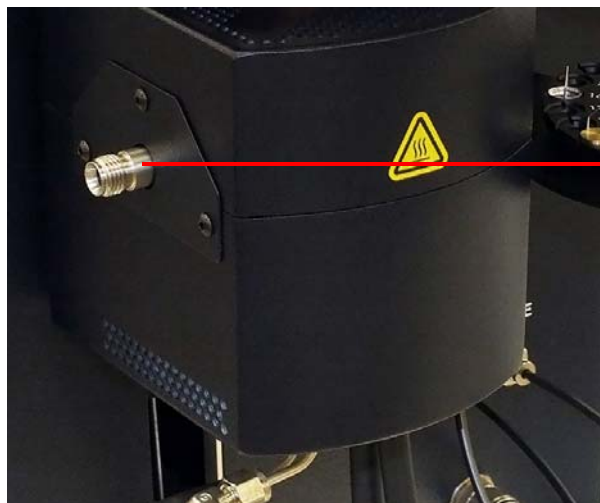


Figure 35 Lower furnace assembly parts identification.

- 6 Raise the lower furnace assembly until it goes all the way inside and until only the thumbscrew shows on the outside. The O-ring will hold the furnace assembly in place.
- 7 Turn the thumbscrew to hold the assembly in place.

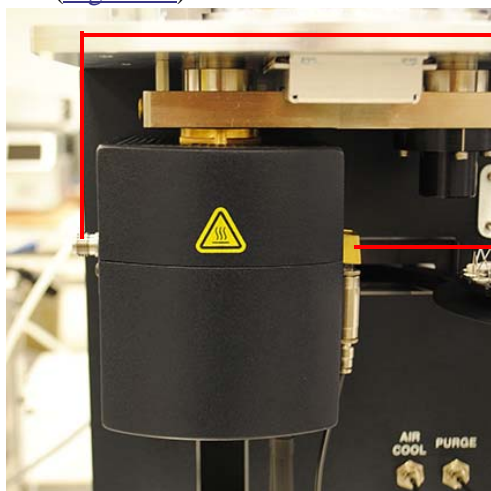
- 8 Loosen the outer nut and remove the furnace exhaust tube from the left-hand side of the furnace.



Exhaust tube removed from outlet port

Figure 36 Outlet port.

- 9 Look into the furnace outlet port ([Figure 37 A](#)). The holes in the heat-absorbing tube ([Figure 37 B](#)) should align with the inlet and outlet ports on the furnace housing, allowing for light to pass through ([Figure 38](#)). Rotate the lower furnace assembly until achieving the proper alignment.



Outlet port

Heat-absorbing tube

Inlet port

Lower furnace assembly

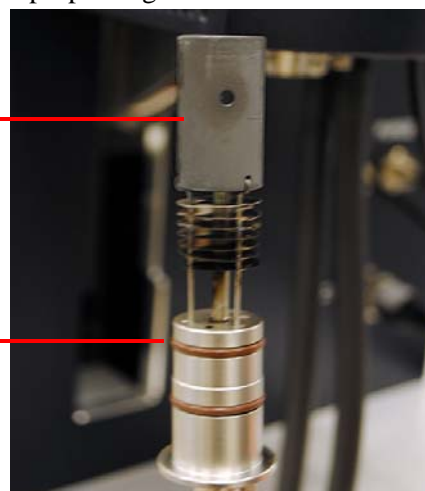
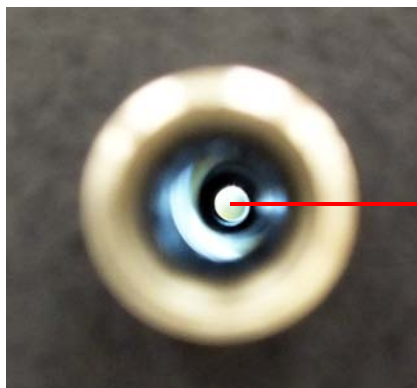


Figure 34 B: Heat absorbing tube.



Sphere of light indicates proper alignment.

Figure 38 View through the Outlet port.

- 10 Fully tighten the thumbscrew once proper alignment is achieved.
- 11 Re-install the furnace exhaust tube.
- 12 Turn off the instrument. Insert the lower furnace assembly cable connector into the connector shown below. Tighten the knurled nut.

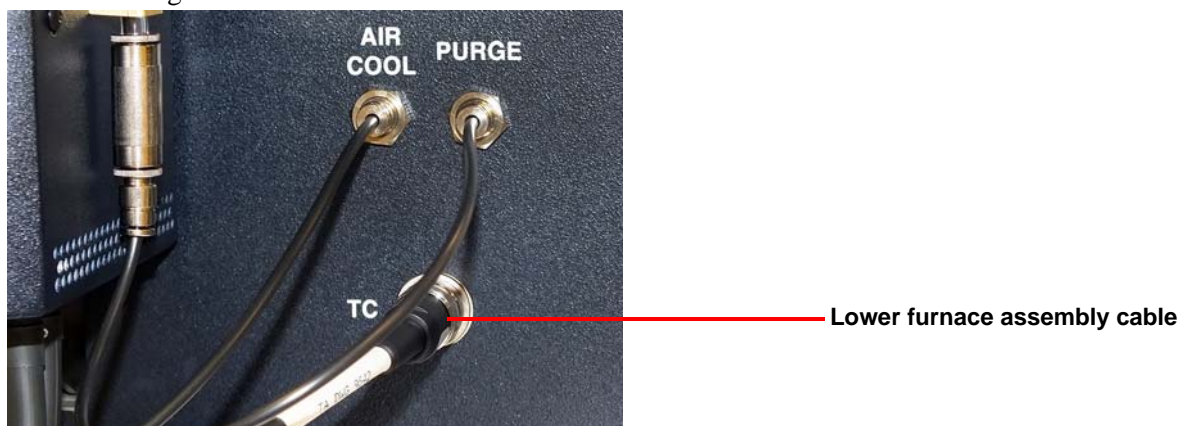


Figure 39 Lower furnace accessory cable installed.

- 13 Connect the 1/8-inch Teflon TFE tubing from the base of the instrument to the LFA air cool inlet, as shown in the figure below. Note that the figure below also displays the sample purge line, which was installed in [“Connecting Lines to the Gas Delivery Module” on page 33](#).

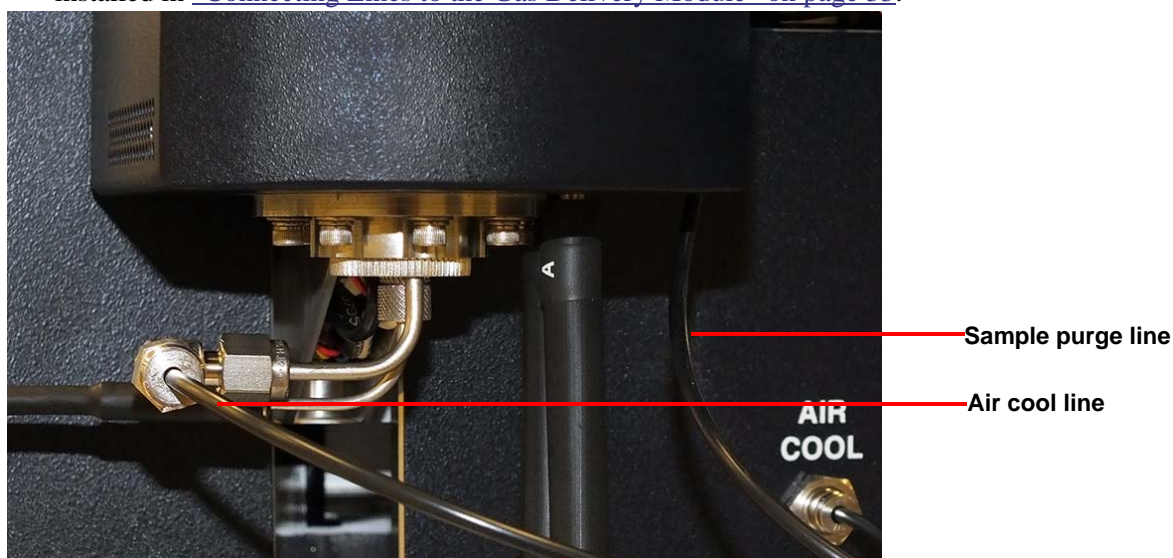


Figure 40 Lower furnace assembly fully installed.

- 14 Proceed to the next section to complete installation of the Discovery TGA.

Closing the Balance Assembly

After you have finished the procedures on the previous pages, lower the balance cover carefully over the balance assembly and tighten the two screws as shown in [“Unpacking the Balance” on page 29](#). Then place the Autosampler cover over the tray.

The installation procedure is now complete. However, since the balance housing has been opened during this installation, balance conditioning is required.

Balance Conditioning

Balance conditioning is required for the Discovery TGA in order to achieve optimum performance from your instrument and keep the balance housing dry. Perform a balance conditioning when:

- The instrument is first installed
- Whenever the balance housing is opened
- Whenever the instrument is powered off for an extended period of time.

For more information related to conditioning the balance, see [“Conditioning the Balance” on page 63](#) for detailed instructions.

Filling the Heat Exchanger Reservoir

The heat exchanger contains a liquid reservoir that supplies the instrument with coolant to dissipate heat from the furnace. The coolant exits the heat exchanger through the supply line, circulates to the furnace, and returns to the reservoir via the return line. To fill the heat exchanger, follow the directions given below.

For instructions on how to connect the water lines, see [“Connecting the Heat Exchanger Cable and Water Hoses” on page 36](#).

- 1 Disconnect the heat exchanger control harness and water lines from the instrument cabinet.
- 2 Unscrew and remove the water reservoir cap.



Figure 41 Water reservoir cap.

- 3 Drain the coolant and flush out the system as follows:
 - a Lift the heat exchanger and dump out the contents of the water reservoir.
 - b Fill the reservoir to 2/3 full with **distilled water only** and replace the cap.
 - c Reconnect the heat exchanger control cable and water lines to the instrument cabinet.
 - d Turn on the pump by clicking **Heat Exchanger** from the **General** Control panel, and allow the water to circulate for several minutes.
 - e Turn off the pump by clicking **Stop** from the **General** Control panel, and check the clarity of the water in the reservoir bottle.
 - f If the water clarity is still unacceptable, disconnect the heat exchanger cable and water lines from the instrument cabinet, and repeat steps a through e.
 - g Continue repeating this procedure until you are satisfied with the clarity of the water in the reservoir after it has circulated.
- 4 Dispose of the water. Add TA Instruments TGA Conditioner (P/N 952377.901) into the water reservoir. Refer to the instructions on the conditioner bottle for the amount of conditioner to add to the reservoir, then fill the reservoir to the inner rim with distilled water.

CAUTION: Do not put any liquid other than distilled water and TA Instruments' TGA Conditioner in the heat exchanger reservoir.

MISE EN GARDE: Ne versez aucun liquide autre que de l'eau distillée et l'agent de conditionnement TGA de TA Instruments dans le réservoir de l'échangeur thermique.

- 5 Turn on the pump again by clicking **Heat Exchanger** from the **General** Control panel, and circulate the water until the air bubbles disappear from the water lines, then stop the pump by clicking **Stop** from the **General** Control panel.

NOTE: After the system has been started, recheck the level of water in the reservoir and refill to the inner rim if necessary.

- 6 Replace and tighten the water reservoir cap.

Purging Air from the Heat Exchanger System

Air trapped in the heat exchanger system must be purged before starting the first run. After the initial installation of the Discovery TGA is complete, perform the following procedure:

- 1 Turn on the instrument. See [“Starting the Discovery TGA System” on page 54](#) if necessary.
- 2 Start the heat exchanger pump by either:
 - Clicking the **Heat Exchanger** icon from the TRIOS software **General** Control panel, or
 - From the user interface, press **Settings** and then set Heat Exchanger to **ON**.
- 3 Refill the coolant reservoir as needed. Repeat this process until all of the air has been purged from the system and the instrument stops reporting an error.

Installing the Autosampler Tray

When you receive your TGA, the Autosampler tray is shipped in the accessory box, separate from the instrument. After unpacking the instrument and installing the instrument completely (see instructions in this chapter), you will be ready to run samples using the Autosampler.

- 1 Locate the open slot on the Autosampler tray.

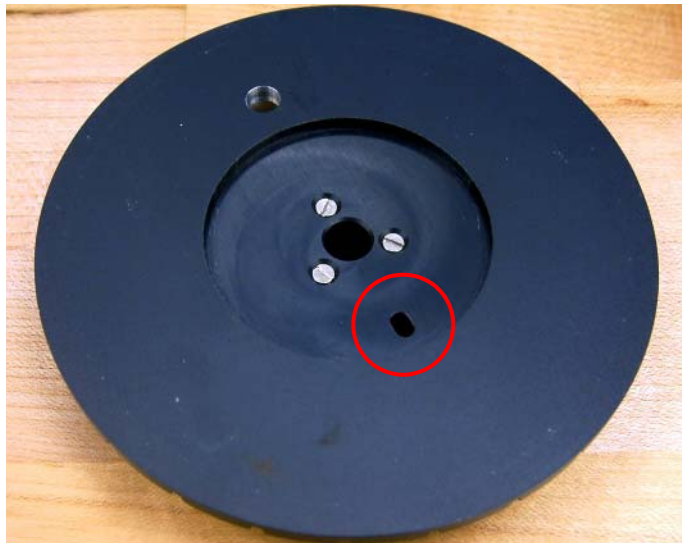


Figure 42 Slot on Autosampler tray.

- 2 Locate the guide pin on the instrument Autosampler.

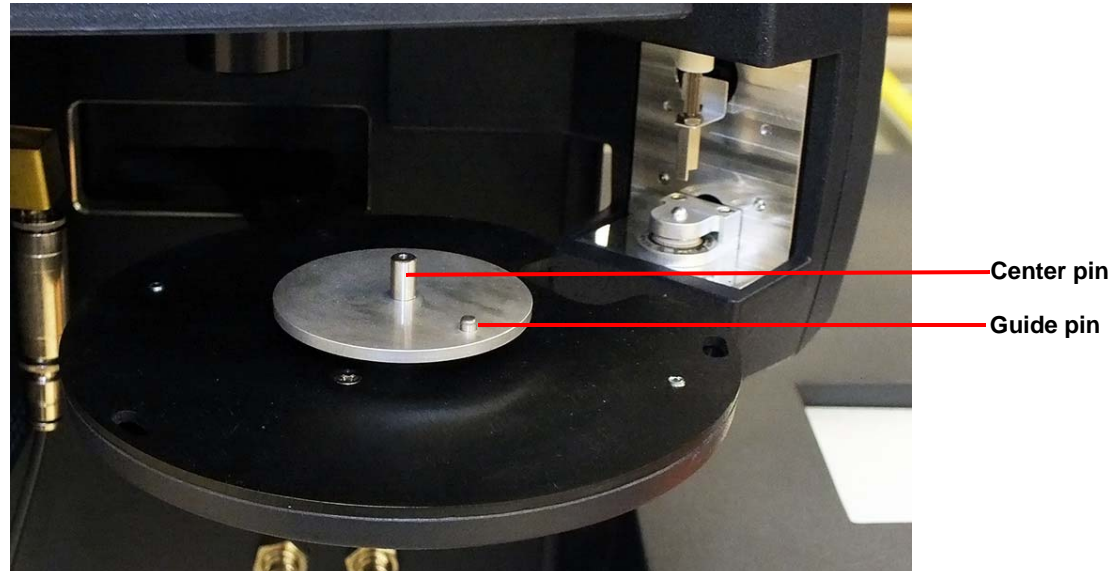


Figure 43 Guide pin on instrument Autosampler.

- 3 Grasp the tray by the center knob and lower it onto the instrument Autosampler, aligning the open slot on the tray with the guide pin on the Autosampler.

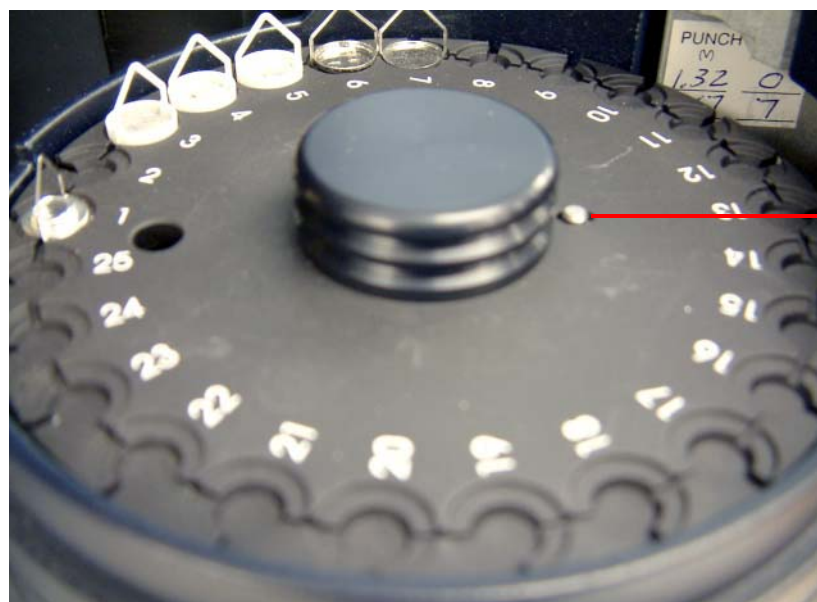


Figure 44 Autosampler tray installed on instrument.

Starting the Discovery TGA System

The power switch is located at the back panel of the instrument. It is part of the assembly called the power entry module, which also contains the power cable connection and fuses. The power switch is used to turn the TGA system on and off.

To power on the system:

- 1 Check the connection between the TGA, Ethernet switch, and the controller. Make sure each component is plugged into the correct connection port.
- 2 Set the power switch to the ON (I) position.
- 3 After the proper power up sequence, the instrument user interface displays; this indicates that the instrument is ready for use.

NOTE: Allow the Discovery TGA to warm up for 60 minutes before performing an experiment in order to allow time for the temperature-controlled measurement circuitry to stabilize.

Shutting Down the Discovery TGA

Before you decide to power down your system, consider the following:

- All of the components of your thermal analysis system are designed to be powered on for long periods.
- The electronics of the TGA perform more reliably if power fluctuations caused by turning units on and off are minimized.

For these reasons, turning the system and its components on and off frequently is discouraged. Therefore, when you finish running an experiment on your instrument and wish to use the thermal analysis system for some other task, it is recommended that you leave the instrument on.

To ensure proper shutdown of the instrument, it is recommended that you execute a shutdown from the user interface or TRIOS software before turning off the power to the instrument. To shut down, perform one of the following options:

- Select **Shutdown** from the instrument user interface **Utilities** menu.
- Select **Shutdown** from the **Instrument** menu within the TRIOS software.

A confirmation message displays. Select **Yes** to continue. All communication to the instrument halts while the instrument saves any unsaved data. Once this procedure is complete, the instrument user interface screen goes blank (black), indicating that it is safe to turn off the power to the instrument.

To power down your system, set the power switch to the OFF (0) position.

Chapter 3:

Use, Maintenance, & Diagnostics

Using the Discovery TGA

All of your TGA experiments will have the following general outline. In some cases, not all of these steps will be performed. The majority of these steps are performed using the instrument control software. The instructions needed to perform these actions can be found in the online help in the instrument control program; therefore, they will not all be covered in detail here.

- Calibrating the instrument
- Selecting the pan size and material
- Selecting the purge gas and setting flow rates
- Creating or choosing the test procedure and entering experiment information in TRIOS software
- Selecting and taring the sample pan
- Loading the sample
- Starting the experiment
- Unloading the sample at the end of the experiment

To obtain accurate results, follow procedures carefully and check calibration periodically (once a month).

Before You Begin

Before you set up an experiment, ensure that the Discovery TGA system and the controller have been installed properly. Make sure you have:

- Connected the instrument with the controller
- Connected all gas lines
- Connected heat exchanger power and water lines
- Installed any desired options
- Powered up the Discovery TGA and heat exchanger
- Become familiar with controller operations
- Calibrated the Discovery TGA, if necessary

Calibrating the Discovery TGA

To obtain accurate experimental results, you should calibrate the instrument upon initial installation. For the best results, however, you should recalibrate periodically.

Several types of calibration are required for the TGA: Autosampler or Autoloader, weight, and temperature calibration. A brief description is provided below. Autosampler/Autoloader calibration is performed via the instrument user interface. Weight and temperature calibration are performed through TRIOS software.

NOTE: Please make sure that you run your experiments with the same gas that you used to calibrate the system. For example, if you calibrate using nitrogen, make your runs with nitrogen.

Calibration consists of several different types of procedures that are described briefly below. For more details on performing each type of calibration, refer to the instructions in TRIOS software Online Help.

Autosampler and Autoloader Calibration

Perform an Autosampler or Autoloader calibration after initial installation of the system, and calibrate periodically thereafter as needed.

If the Autosampler fails to pick up a sample pan correctly during an automatic loading procedure, the Autosampler may need to be calibrated.

If the Autoloader fails to pick up the sample pan correctly, the Autoloader may need to be calibrated.

Other possible causes for improper pan pickup include:

- The instrument is not level. See [“Leveling the Discovery TGA and Aligning the Balance” on page 45](#) for instructions to solve this problem.
- The hang-down wire is not straight. Replace the hang-down wire; see [“Installing the Hang-Down Wires” on page 38](#) for instructions.
- The bails on the sample pan are bent. If possible, straighten them or use new pans.

To perform Autosampler or Autoloader calibration, access the Autosampler or Autoloader panel on the user interface. Refer to TRIOS software Online Help for detailed instructions.

Weight Calibration

Weight calibration is required upon initial installation of the system. After the initial weight calibration, weight calibration should then be done periodically (once a month is recommended). This calibration can be performed manually (using an empty pan and calibration weights) or automatically (using the three weight calibration pans).

- *Semi-automatic weight calibration* is performed using known calibration weights, typically 100 mg and 1000 mg. This procedure involves weighing a pan with and without the calibration weights to calibrate the low and high weight ranges. This procedure is conducted through TRIOS software using the **Calibrate** function and clicking on the **Weight Calibration** and **Semi-Auto** tabs.
- *Automatic weight calibration* is accessed through TRIOS software by using the **Calibrate** function and clicking on the **Weight Calibration** and **Auto** tabs. In this case the pan differential is used to calibrate the weight. The weight calibration pans may only be used when a platinum tare pan is installed.

See TRIOS software Online Help for more information on weight calibration of either type.

Temperature Calibration

Temperature calibration is required for TGA experiments in which precise transition temperatures are essential. There is one technique for TGA temperature calibration recognized by the American Society for Testing and Materials. This technique is described in ASTM Standard E1582 and is based on the Curie Point of magnetic metals; it is recommended for the Discovery TGA.

In this technique, a Curie standard is heated in a sample pan in a magnetic field. The Discovery TGA IR furnace is equipped with an electromagnet to facilitate this operation. The wire-wound and EGA furnaces require a bar magnet (provided). As the standard goes through its Curie Point, its attraction to the magnet changes, appearing as a weight change. The extrapolated endpoint of this weight change is adjusted to agree with the material's known Curie Point temperature. Up to five calibration points can be entered into the temperature calibration table. A multi-point calibration is more accurate than a one-point calibration.

If the DTA option is available (standard on the TGA 5500 and optional on the TGA 550) melt standards may also be used to calibrate temperature. High purity melt standards must be used for calibration. The DTA signal setup must be complete before using this option. The extrapolated onset of the melt endotherm in the DTA signal is used as the measured value and the system is adjusted based on the known value of that specific melt standard.

See TRIOS software Online Help for more information

Running a Discovery TGA Experiment

All of your TGA experiments will have the following general outline. In some cases, not all of these steps will be performed. See TRIOS software Online Help for anything not covered in this manual.

- 1 Attaching and setting up external accessories and/or environmental conditions as required, such as the purge gas
- 2 Selecting the pan size and material
- 3 Taring the empty sample pan
- 4 Loading the sample into the pan
- 5 Entering experiment information in TRIOS software; this includes both sample and instrument information.
- 6 Creating or selecting the experimental procedure using TRIOS software
- 7 Starting the experiment

Selecting the Pan Size and Material

Choose a pan based on the desired temperature range and application. See [“Discovery TGA Sampling System” on page 25](#) for the pans that can be used with the Discovery TGA Autosampler.

Taring the Sample Pan(s)

Taring of all sample pans on the tray must be done before the sample is loaded to ensure that the balance gives you an accurate reading.

NOTE: A sample pan of the same size and type that will be used for your experiments is required on the tare side for proper operation.

- 1 Place clean, empty pan(s) on the platform. If you are using sealed aluminum pans, then you must tare the lid along with the empty pan. See TRIOS software Online Help for more information.
- 2 Specify the pan type in TRIOS software. Only pans of the same type may be run in the same sequence.
- 3 Select the **Tare** button on the user interface. Alternatively, select **Tare** from the Instrument tab within TRIOS software.
- 4 Select the desired pans, then select **Start** from the user interface or from TRIOS to initiate the tare procedure. The pan will automatically be loaded and the furnace raised to make the measurement. When the tare procedure is complete, the furnace automatically lowers and unloads the pan.

Loading the Sample Pans

Loading Open Pans

After taring the sample pan, load the sample as follows:

NOTE: This procedure does not apply to sealed aluminum pans. If you are using sealed pan, a different procedure applies. See below.

- 1 Place the sample in the sample pan and position the pan on the sample tray in its original position; this may be done with the tray on or off the instrument. The wire on the bottom of the sample pan, if present, should align with the groove in the pan recess so that the sample pan can be picked up by the sample hang-down wire.

NOTE: Always use brass tweezers to handle the sample pans.

- 2 Replace the sample tray on the Autosampler, if removed.

You can preweigh the samples prior to the start of the experiment, if desired, in order to obtain a record of the weight. A preweight is valuable for highly volatile materials. This function is performed before you start an experiment and the weight is stored within the data file record. See TRIOS software Online Help for information on this function.

Loading Sealed Pans

Consult TRIOS software Online Help for information on punch calibration and alignment for sealed aluminum pans. After taring the sample pan and lids, load the sample as follows:

- 1 Make sure the punch mechanism is correctly positioned and calibrated. This is important for consistently successful punching of sealed pans. See the figure below.

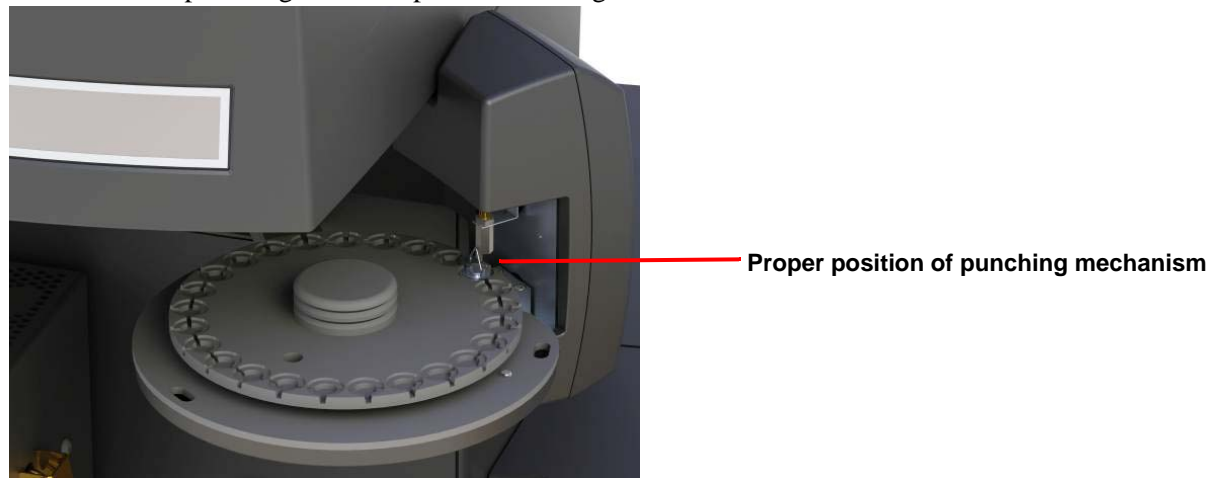


Figure 45 Autosampler tray and punching mechanism position.

- 2 Follow the procedure to load the sample and seal the sample pans using the sample encapsulating press. See TRIOS software Online Help for detailed information.

NOTE: Always use brass tweezers to handle the sample pans.

- 3 Reposition the bail/pan on the sample tray in its original pan position; this may be done with the tray on or off the instrument. The tab on the bail should align with the groove in the tray so that the sample pan can be picked up by the sample hang-down wire. Check that the bail wire is perpendicular (90°) to the bail base. This avoids failing to connect with the hang-down wire hook or interference with the punch during the pan punching process.
- 4 Replace the sample tray on the Autosampler, if removed.

Starting an Experiment

Before you start the experiment, ensure that the Discovery TGA is connected with the controller and you have entered all necessary information through the instrument control software.

Start the experiment by selecting **Start** on the instrument control software or touching the **START** button on the instrument user interface. When you start the instrument, the system automatically loads the sample pan and closes the furnace if necessary, and then runs the experiment to completion.

If multiple runs are in the sequence, the procedure repeats for the next run until the run sequence completes.

Stopping an Experiment

If you need to discontinue the experiment, you can stop it at any point by selecting **Stop** through the instrument control software or by touching the **STOP** button on instrument user interface.

NOTE: See [“Shutting Down the Discovery TGA” on page 55](#) for information on shutting down the instrument.

Removing or Reinstalling a Wire-wound or EGA Furnace

To remove or reinstall the furnace, you will have to remove the furnace arm from its connection inside the slot on the front of the instrument cabinet.

Furnace Removal

To remove the Wire-wound or EGA furnace use the following procedure.

- 1 Press the **FURNACE** button on the user interface to open the furnace completely.
- 2 Locate the two mounting screws on each side of the furnace arm connection, found in the slot on the front of the instrument. Using the ball driver supplied in your TGA Accessory Kit, loosen these four screws no more than one full turn. To reach the upper left mounting screw, insert the ball driver between the water and air connections on the left side of the furnace housing.
- 3 Unplug and remove the furnace arm/base from the instrument cabinet.
- 4 Unplug the **AIR COOL** line from the bottom of the furnace arm/base and the purge line from the side of the furnace.

NOTE: When you remove the **AIR COOL** line, do not let it slip back into the instrument cabinet.

Place a drip pan to the left of the instrument to catch the coolant that will leak from the hose connections when the furnace is removed.

Lay the furnace assembly down on the left side of the instrument so that the hose connections are positioned over the drip pan. Then carefully snip the wire ties and disconnect the cooling water lines from the housing. (A small amount of cooling water will drain out into the pan when the hoses are disconnected.)

The furnace is now completely free from the instrument.

Furnace Installation

To replace or reinstall the Wire-wound or EGA furnace use the following procedure. Refer to the figures on previous pages, if needed.

- 1 Plug the **AIR COOL** line into the bottom of the furnace arm/base.
- 2 Slip the water cooling hoses over the furnace water connections and secure them with the wire ties.
- 3 Tighten the mounting screws fully, then loosen each of them no more than one full turn, so that the flat sides of the cleats are aligned vertically.

CAUTION: Loosening the upper two mounting screws any more than one full turn may cause the screws to interfere with the inside of the instrument cabinet, causing damage to the instrument.

MISE EN GARDE: Desserrer les deux vis supérieures de fixation plus d'un tour complet peut entraîner les vis d'interférer avec l'intérieur de l'armoire de l'appareil , causant des dommages à l'instrument .

- 4 Plug the furnace arm into the connector on the carriage and tighten the four mounting screws using the ball driver. To reach the upper left mounting screw, insert the ball driver between the water and air connections on the left side of the furnace housing.
- 5 Connect the purge hose to the gas purge inlet on the right side of furnace.

CAUTION: Hold onto the glass purge tube with one hand while you install the purge hose to avoid breaking the glass on the EGA furnace.

MISE EN GARDE: Tenez le tube de purge de verre avec une main pendant que vous installez le tuyau de purge pour éviter de casser le verre sur le four EGA.

- 6 Check the Heat Exchanger reservoir water level and add water if needed. See [“Filling the Heat Exchanger Reservoir” on page 51](#) for instructions. If needed, realign the sample hang-down wire as directed on page 45.

Maintaining the Instrument

The primary maintenance procedures described in this section are the customer's responsibility. Any further maintenance should be performed by a representative of TA Instruments or other qualified service personnel. Consult TRIOS software Online Help for further information.

DANGER: Because of the high power circuitry in this instrument, untrained personnel must not attempt to test or repair any electrical circuits.

DANGER: À cause de la présence de circuits électriques de grande puissance dans cet instrument, le personnel non formé ne doit pas essayer de tester ou de réparer les circuits électriques.

CAUTION: Before using any cleaning or decontamination method except those recommended by TA Instruments, check with TA Instruments that the proposed method will not damage the instrument.

MISE EN GARDE: Avant d'utiliser une méthode de nettoyage ou de décontamination autre que celle recommandée par TA Instruments, vérifiez auprès de TA Instruments que la méthode proposée n'endommagera pas l'instrument.

Conditioning the Balance

Balance conditioning is required for the Discovery TGA in order to achieve optimum performance from your instrument and keep the balance housing dry. Perform a balance conditioning when the instrument is first installed and whenever the balance housing is opened.

In order to ensure an inert atmosphere, the balance housing will need to be flushed of air. This could take up to 12 hours.

To maintain a dry balance after conditioning, use a balance purge rate of 10 mL/min for an IR and EGA furnace or 40 mL/min for a wire-wound furnace.

Cleaning the Furnace

After extended use, the inside of the furnace may become coated with sample and therefore require cleaning. Periodic cleaning is recommended for optimum operation and performance.

See TRIOS software Online Help for furnace cleaning instructions.

Cleaning the Pans

The TGA platinum and ceramic sample pans are designed to be reusable. However, they must be thoroughly cleaned between experiments. This is typically accomplished by “burn-off” of residue with a propane torch. In some cases, soaking the pans in an appropriate solvent provides another alternative. Care must be taken not to deform the pan and bail wire during cleaning, or the TGA automatic pan pick-up process will not work.

CAUTION: The aluminum pans can not be cleaned with a propane torch. The aluminum pans are disposable; they are not meant to be reused.

MISE EN GARDE: Les bacs en aluminium peuvent être nettoyés à l'aide d'un chalumeau au propane. Les bacs en aluminium sont jetables et ne sont pas conçus pour être réutilisés.

CAUTION: Do not use an acid wash to clean the platinum-HT pans, as this may damage the pans.

MISE EN GARDE: N'utilisez pas de lavage à l'eau acidulée pour nettoyer les bacs en platine-HT, car cela risque d'endommager les bacs.

Cleaning the User Interface Screen

You can clean the TGA user interface screen as often as you like. The instrument should first be turned off in order to prevent activating the touch screen switches, which can result in unexpected instrument behavior. The user interface screen should be cleaned with a household liquid glass cleaner and soft cloth. Wet the cloth (not the user interface screen) with the glass cleaner, and then wipe off the screen and surrounding surfaces.

WARNING: Do not use harsh chemicals, abrasive cleansers, steel wool, or any rough materials to clean the user interface screen, as you may scratch the surface and degrade its properties.

AVERTISSEMENT: N'utilisez pas de produits chimiques agressifs, de nettoyeurs abrasifs, de la laine d'acier ou tout autre matériau rugueux pour nettoyer l'écran de l'interface utilisateur, car vous pourriez égratigner sa surface et dégrader ses propriétés.

Replacing Fuses

WARNING: Always unplug the instrument before you examine or replace the fuses.

AVERTISSEMENT: Débranchez toujours l'instrument avant d'examiner ou de remplacer les fusibles.

The Discovery TGA™ contains internal fuses that are not user serviceable. If any of the internal fuses blows, a hazard may exist. Call your TA Instruments service representative.

The only customer-replaceable fuses are located in the fuse holder located on the back panel of the instrument. To check or change these fuses:

- 1 Turn the instrument off and remove the power cord.
- 2 Next to the instrument power entry module, there are two standard fuse holders. Use a flat-blade screwdriver to remove the fuse carriers.
- 3 Remove old fuses and replace the fuses only with the type and rating indicated on the instrument's rear panel.
- 4 Place the fuse carriers back into the fuse holders and lock in place with the screwdriver.

Maintaining the Heat Exchanger

The heat exchanger does not require any maintenance other than to maintain the level and quality of the liquid coolant. If the level drops too low, or the coolant becomes contaminated, this could result in problems with your instrument.

CAUTION: Do not put any liquid other than distilled water and TA Conditioner in the heat exchanger reservoir.

MISE EN GARDE: Ne versez aucun liquide autre que de l'eau distillée et l'agent de conditionnement TGA de TA Instruments dans le réservoir de l'échangeur thermique.

- Check the level and condition of the heat exchanger coolant periodically. TA Instruments recommends routine checks every three to six months, depending on use of the instrument.
- Add distilled water to the reservoir, when necessary, to keep the reservoir at least 2/3 full. If algae growth is visible, drain the reservoir, refill it with distilled water, and add TA Instruments TGA Conditioner (PN 952377.901), as described in the **Maintaining the Heat Exchanger** TRIOS Online help topic.

Replacement Parts

Replacement parts for the Discovery TGA are listed below. Refer to the tables below when ordering parts.

Table 7: Fuses, Cords, and Cables*

Part Number	Description
200721.002	Power cord, 240 V
201242.001	Fuse 12-amp time delay, 250 V (T12 A H 250 V)
251470.010	Ethernet cable (10 foot, shielded)
920223.901	Event cable

*Contact your local TA Instruments representative for information on non-US style power cords.

Table 8: Discovery TGA Tools and Parts

Part Number	Description
259508.000	Brass tweezers
259509.000	Spatula, curved, 165 mm long
271621.001	O-ring, furnace housing to balance chamber
269920.006	Balldriver 9/64 hex tool
269920.004	Balldriver, 5/64-inch
269920.026	Balldriver, 7/64-inch
269920.005	Balldriver, 3/32-inch
952162.901	Heat exchanger tubing
952377.901	Heat exchanger conditioner kit
953260.901	TGA heat exchanger assembly
957515.901	Hang-down loop
956327.901	Sample hang-down wire
956328.901	Tare hang-down wire
954399.901	Lower furnace assembly
954298.901	Thermocouple replacement kit for the Lower Furnace Assembly (TGA 5500 only)
957291.901	Upper reflective assembly
200391.001	Wrench, double angle, 1/4-inch

Table 8: Discovery TGA Tools and Parts (Continued)

Part Number	Description
200392.001	Mirror, adjustable, 7/8-inch diameter
957357.001	Gauge, position, furnace/hook/pan
957357.002	IR Furnace Bulb Replacement Kit (4 bulbs) for TGA 5500

Table 9: Standard Series Pans and Lids

Part Number	Description
957099.901	25-pan tray, Autosampler (standard with TGA 5500)
957207.903 957207.904	50- μ L platinum sample pans (package of 3) 100- μ L platinum sample pans (package of 3)
957387.902	100- μ L platinum-HT sample pans (package of 3)
957329.903 957329.904	100- μ L ceramic sample pans (package of 3) 250- μ L ceramic sample pans (package of 3)
957363.901 957362.901 957364.901	80- μ L aluminum sample pans (package of 100) ^{1, 2, 3} Aluminum sample lids (package of 100) Stainless steel bails (package of 15)
957352.901	Sealed aluminum pan kit, which contains: <ul style="list-style-type: none"> 957362.901 Aluminum sample lids (package of 100) 957363.901 80-μL aluminum sample pans (package of 100)^{1,2,3} 957364.901 Stainless steel bails (package of 15) 957358.001 Sealed pan punch alignment tool 957201.001 Sealed pan crimping tool

¹ Requires 25-pan tray, P/N 957099.901.

² Requires several additional parts found in Sealed Aluminum Pan Kit, P/N 957352.901. Not available for TGA 55.

³ Requires TA Instruments blue sample press, P/N 900878.902, or Tzero sample press, P/N 901900.901, with purple die set, P/N 957450.901.

Table 10: Calibration/Reference Materials

Part Number	Description
957349.901	Mass Spectrometer Interface Kit for the IR furnace (TGA 5500 only)
271001.002	Mass Spectrometer Interface Kit for the EGA furnace (TGA 55 and TGA 550)
200413.002	Calibration weight 100 mg - Class 1
200413.001	Calibration weight 50 mg - Class 1
900905.901	Calcium oxalate monohydrate sample
952385.901	TGA nickel reference material
952398.901	TGA ALUMEL® reference material
957341.901	Autocal weight kit
952541.902	TGA/SDT ICTAC Curie Point Reference Materials Kit