DISCOVERY SERIES
DMA-RH ACCESSORY

Getting Started Guide

Revision C Issued June 2018

Notice

The material contained in this manual, and in the online help for the software used to support this instrument, is believed adequate for the intended use of the instrument. If the instrument or procedures are used for purposes other than those specified herein, confirmation of their suitability must be obtained from TA Instruments. Otherwise, TA Instruments does not guarantee any results and assumes no obligation or liability. TA Instruments also reserves the right to revise this document and to make changes without notice.

TA Instruments may have patents, patent applications, trademarks, copyrights, or other intellectual property covering subject matter in this document. Except as expressly provided in written license agreement from TA Instruments, the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

TA Instruments Operating Software, as well as Module, Data Analysis, and Utility Software and their associated manuals and online help, are proprietary and copyrighted by TA Instruments. Purchasers are granted a license to use these software programs on the module and controller with which they were purchased. These programs may not be duplicated by the purchaser without the prior written consent of TA Instruments. Each licensed program shall remain the exclusive property of TA Instruments, and no rights or licenses are granted to the purchaser other than as specified above.

TA Instruments can accept no liability for loss or damage, however caused, arising from the faulty or incorrect use of its products.TA Instruments shall not be liable for any damages caused by interactions between exogenous materials (e.g. chemicals) and parts of the instrument. This includes interactions of gaseous, liquid or solid materials with parts of the instrument.

TA Instruments — Waters LLC
159 Lukens Drive
New Castle, DE 19720

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
- TA Instruments Patents
- Other Trademarks
- TA Instruments End-User License Agreement
- TA Instruments Offices

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-22.2 No. 61010-1-04 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements + Amendments.

CAN/CSA-22.2 No. 61010-2-010-04 Particular requirements for laboratory equipment for the heating of materials + Amendments.

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 voltages.

EN61010-1: 2001 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements + Amendments.

EN61010-2-010: 2003 Particular requirements for laboratory equipment for the heating of materials + Amendments.

For United States

UL 61010-1: Electrical Equipment for Laboratory Use; Part 1: General Requirements.

UL 61010A-2-010 Part 2: Particular requirements for laboratory equipment for the heating of materials.

Electromagnetic Compatibility Standards

For Australia and New Zealand

AS/NZS CISPR11:2004 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/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonization of the laws of Member States relating to electromagnetic compatibility.

EN61326-1:2006 Electrical equipment for measurement, control, and laboratory use-EMC requirements-Part 1: General Requirements. Emissions: Meets Class A requirements per CISPR 11. Immunity: Per Table 3 Protected EM environment.

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).

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.

Accessory Symbols

The following labels are displayed on the DMA-RH Accessory for your protection:

Symbol	Explanation
	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 DMA-RH system. 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. 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 DMA-RH. 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.
	This symbol indicates that you must unplug the accessory before doing any maintenance or repair work; AC power voltage is present in this system. High voltages are present in this accessory. 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. Ce symbole indique que vous devez débrancher l'accessoire avant d'effectuer des travaux de maintenance ou de réparation ; présence d'une tension de secteur CA dans ce circuit. Présence de tensions élevées dans cet instrument/accessoire. 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 le personnel d'entretien qualifié de TA Instruments.

Symbol	Explanation
	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. 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.

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

Electrical Safety

You must unplug the accessory before doing any maintenance or repair work; voltages exceeding 120 VAC are present in this system

WARNING: High voltages are present in this accessory. 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.

AVERTISSEMENT: Présence de tensions élevées dans cet accessoire. 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.

Thermal Safety

CAUTION: After completing an experiment, allow the saturator valve and fitting (located on the back panel of the DMA-RH Accessory) to cool before touching.

MISE EN GARDE: À la fin de l'expérience, laissez la vanne et le raccord du saturateur (situés sur le panneau arrière de l'accessoire DMA-RH) refroidir avant de les toucher.

Chemical Safety

WARNING: Do not use hydrogen or any other explosive gas in the DMA-RH Accessory.

AVERTISSEMENT: N'utilisez pas d'hydrogène ou tout autre gaz explosif dans le accessoire DMA-RH.

WARNING: If analyzing samples that may emit harmful gases, vent the gases by placing the accessory near an exhaust.

AVERTISSEMENT: Si vous utilisez des échantillons qui émettent des gaz nocifs, ventilez les gaz en plaçant l'accessoire près d'un échappement.

Lifting the Accessory

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.

Table of Contents

Chapter 1:

Introducing the DMA-RH

Overview

The DMA-RH Accessory is used with the TA Instruments DMA 850 Dynamic Mechanical Analyzer. This accessory allows mechanical properties of a sample to be analyzed under controlled and/or varying conditions of both relative humidity and temperature. The DMA-RH Accessory is compatible with most DMA 850 clamps, with the specific exception of the submersion clamp. However, for best results, ensure that the sample has sufficient exposed surface area so that water vapor adsorption and desorption are not impeded. As such, the film/fiber, specialty fiber, cantilever, and three-point bend clamps are most appropriate for use with this accessory.

System Components

The DMA-RH Accessory has the following major hardware components (see Figure 1):

- The DMA-RH Accessory cabinet precisely controls the temperature and humidity of the sample environment. The accessory cabinet is the main accessory component; it receives commands from the DMA via an RS-232 cable and controls all sub-systems that are associated with generating and maintaining both temperature and humidity.
- The heated transfer line is maintained at a temperature above the dew point temperature of the purge gas in order to avoid condensation.

- The sample chamber mounts on the DMA in place of the standard furnace and encloses the sample. Its temperature is controlled by the accessory cabinet, and it has been designed to accommodate most DMA clamps associated with DMA-RH experimentation.

Figure 1 Sample chamber on the DMA 850.

Accessory Specifications

The tables below detail the DMA-RH Accessory technical specifications.

Table 1: DMA-RH Accessory Characteristics

Dimensions of control enclosure	Height: 14.5” Width: 12” Depth: 20”
Dimensions of sample chamber with attached transfer line	Height: 5 ¾” Width: 8 ¼” Depth: 7 ¼” Transfer line length: 7 feet
Weight of control enclosure	60 lbs (without water)
Weight of sample chamber with transfer line	7 lbs
Electrical inlet power requirements	Voltage: 90–265 VAC Frequency: 45– 65Hz
Energy consumption	0.400 KVA

Table 2: Accessory Gas Requirements

Gas	Filtered nitrogen with dew point of –40°C or less
Pressure	138 kPa gauge (20 PSI gauge)
Volume	3 SLPM

Table 3: Accessory Environmental Conditions

Operating temperature range	15°C to 35°C
Operating altitude	2000 meters maximum
Relative humidity	5% to 80% RH from 15°C to 31°C, decreasing to 66% RH at 35°C (non-condensing)

Table 4: Accessory Performance Specifications

Temperature range	5°C to 120°C
Temperature accuracy	±0.5°C
Heating/Cooling rate	1°C/min
Humidity range	See Figure 2 for the humidity range chart. Unless stated otherwise, specifications for humidity are at sea level. Units operated in higher elevations will have a reduced humidity operating range.
Humidity accuracy	5% to 90% RH, ±3% >90% RH, ±5%
Humidity ramp rate	2% RH/min (fixed), both increasing and decreasing (alternate RH pseudo-linear ramp rates can be achieved through programmed step-iso methods)

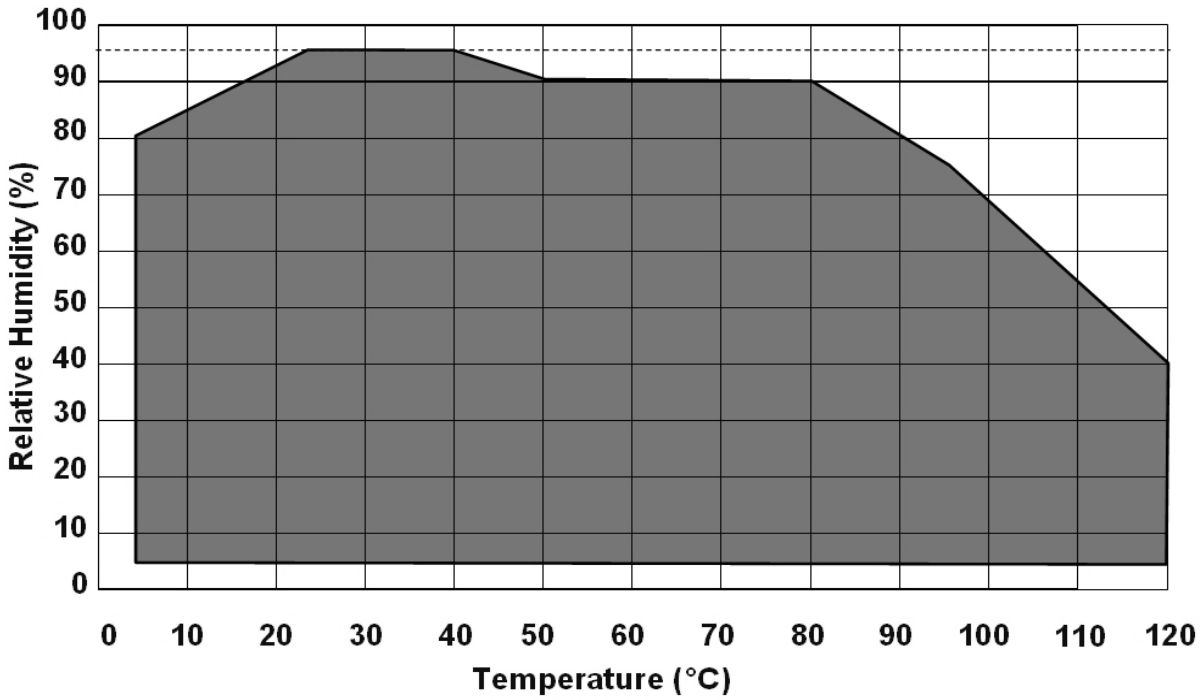


Figure 2 DMA-RH Accessory humidity range chart.

Chapter 2:

Installing the DMA-RH Accessory

Unpacking/Repacking the DMA-RH

The instructions needed to unpack and repack the accessory are found as separate unpacking instructions in the shipping box and in the online documentation associated with the instrument control software. Be sure to read and perform the unpacking instructions prior to performing any procedures in this chapter.

Retain all of the shipping hardware and boxes from the accessory in the event you wish to repack and ship your accessory.

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.

Preparing the Accessory

Before shipment, the DMA-RH is inspected both electrically and mechanically so that it is ready for operation upon proper installation. Only limited instructions are given in this manual; consult the online documentation for additional information. Installation involves the following procedures:

- Inspecting the accessory for shipping damage and missing parts
- Connecting the DMA-RH cables and lines
- Filling the reservoirs
- Priming the Temperature Control System
- Filling the saturator
- Installing the sample chamber

It is recommended that you have your DMA-RH Accessory unpacked and installed by a TA Instruments Service Representative; call for an installation appointment when you receive your accessory.

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 the DMA-RH Accessory, look over the accessory and shipping container carefully for signs of shipping damage, and check the parts received against the enclosed shipping list.

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

Choosing a Location

Choose a location for the accessory using the following guidelines. The DMA-RH Accessory should be:

In

- A temperature-controlled area.Temperatures should be in the range of 20–35°C.
- A clean environment, preferably on the ground floor in the building.
- An area with ample working and ventilation space.

On

- A stable work surface.

Near

- A power outlet (universal input; 90–265 VAC, 47–63 Hz, 400 VA).
- Your TA Instruments controller.
- A nitrogen gas source and purge gas supplies with suitable regulators and filters, if required.
- Your DMA 850, but plan to place the DMA-RH Accessory cabinet on a separate table or on the floor.
- Be sure not to place the rear of the DMA-RH enclosure too close to a wall or other obstruction. The cooling fan is an integral part of the DMA-RH, and proper air flow is required for the operation of the system. Maintain at least 12 inches between the rear of the enclosure and any obstruction.

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.

Connecting Cables and Lines

To connect the cables and gas lines, access the DMA-RH Accessory's rear panel and follow the instructions below:

CAUTION: When plugging in or unplugging power cords, handle them by the plugs, not the cord.

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. Avoid laying cables across walkways, as this can create a tripping hazard.

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.

1 A note regarding the RS-232 communication cable:

- **If this is a first-time installation,** do not yet connect the RS-232 communication cable. This will be done in subsequent steps.
- **If this is not a first-time installation** (and you are sure there is no air in the water cooling lines), connect one end of the RS-232 cable to the INSTRUMENT port on the back of the DMA-RH and the other end of the cable to the COM1 connection port on the DMA 850 instrument.

2 Connect the regulated nitrogen (15–20 psi) to the input of the supplied dryer, and connect the output of the dryer to the N2/DRY AIR inlet (shown below).

3 Connect the power cord to the DMA-RH Accessory, and plug the other end into the electrical outlet.

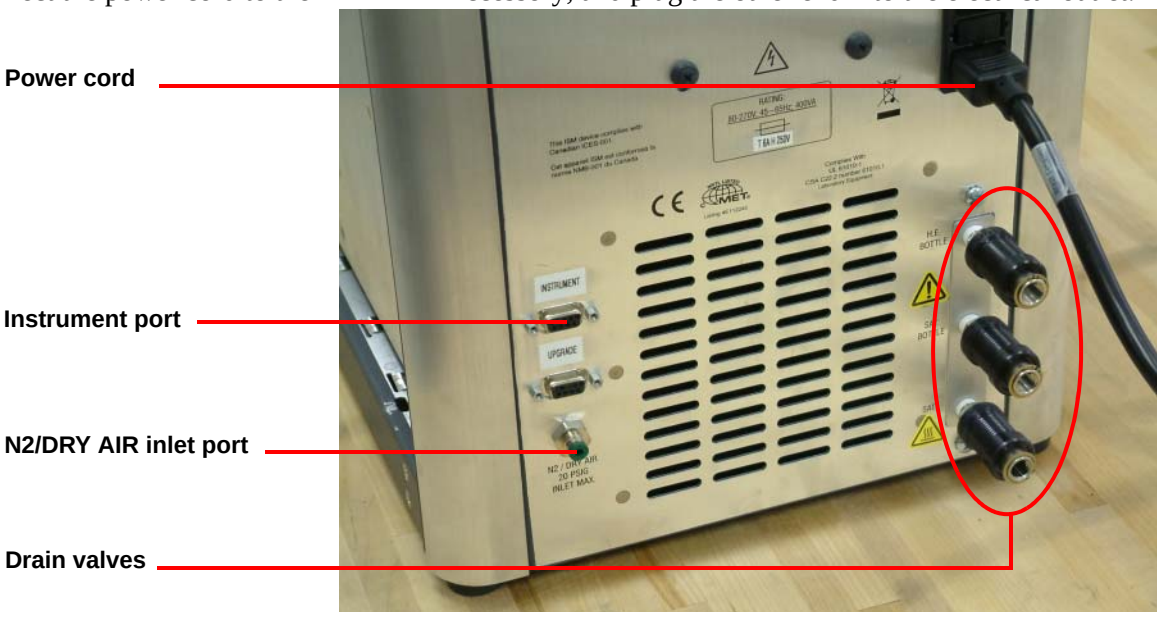


Figure 3 Connection ports and drain valves on back of DMA-RH Accessory.

Filling the DMA-RH Reservoirs

The Saturator Reservoir holds approximately 1 liter of distilled water. It can be filled at any time – even during an experiment – without adversely affecting data. The DMA-RH enclosure includes a micro-pump that automatically pumps distilled water from the Saturator Reservoir to the Saturator when it is low. It is important to maintain an adequate level of distilled water in the Saturator Reservoir to avoid an error. The Saturator Reservoir includes a liquid level sensor used to indicate a low liquid condition. If the LCD screen on the front of the DMA-RH enclosure reads "SAT RESERV LOW," fill the Saturator Reservoir with distilled water as soon as possible. An experiment will continue for some period of time (depending on experimental temperature and requested %RH) even when a low liquid condition exists. However, once the DMA-RH Accessory determines the water level in the Saturator is too low and no water is available in the Saturator Reservoir, the experiment will be terminated and the LCD screen will display "SAT WATER LOW."

The Heat Exchanger Reservoir also holds approximately 1 liter of distilled water, and supplies this as a coolant to the temperature control system. The temperatures of the Saturator and Sample Chamber are maintained by means of Peltier elements. The Peltier elements themselves are compensated by means of circulating water. The DMA-RH enclosure includes a circulating pump that moves water from the Heat Exchanger Reservoir, through the Peltier cooling blocks on the Saturator and Sample Chamber, and finally through a heat exchanger in the rear of the DMA-RH enclosure before returning it to the reservoir. It is important to maintain an adequate level of distilled water in the Heat Exchanger Reservoir to avoid termination of an experiment. The Heat Exchanger Reservoir includes a liquid level sensor used to indicate a low liquid condition. If the LCD screen on the front of the DMA-RH enclosure reads "COOLER LOW WATER", fill the Heat Exchanger Reservoir with distilled water as soon as possible. An experiment will continue even when a low liquid condition exists, as long as the system does not detect an over-temperature condition. If the water level in the Heat Exchanger Reservoir drops too low, it is possible to overheat the Peltier cooling blocks. An experiment will be terminated if the system detects an over-temperature condition.

1 Ensure that all connections in the previous section "Connecting Cables and Lines" are complete.

2 Ensure that all drain valves (circled in Figure 3 above) are closed by pushing them in as far as allowable.

3 Fill the HEAT EXCHANGER RESERVOIR and the SATURATOR RESERVOIR (located on the top panel of the DMA-RH Accessory; caps shown below) with distilled water.

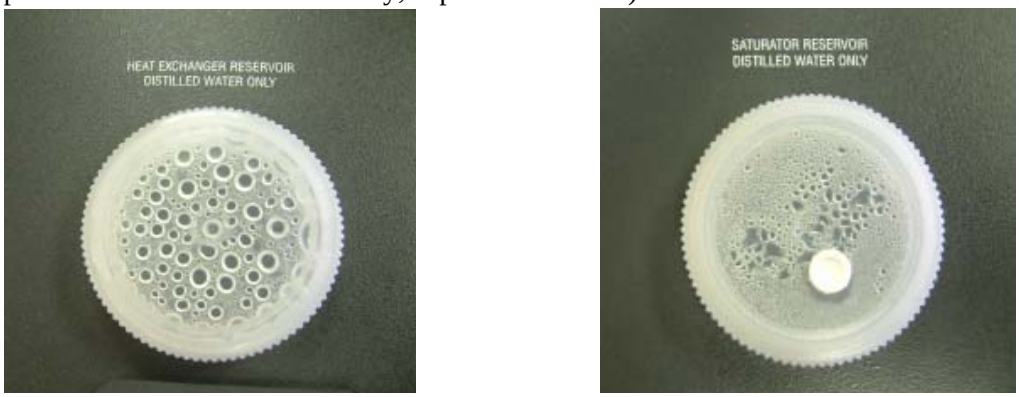


Figure 4 HEAT EXCHANGER RESERVOIR (left); SATURATOR RESERVOIR (right).

CAUTION: Do not put any liquid other than distilled water into any of the DMA-RH Accessory's reservoirs.

MISE EN GARDE: Ne versez aucun liquide autre que de l'eau distillée dans les réservoirs de l'accessoire DMA-RH.

4. Power on the DMA-RH Accessory using the On/Off switch on the back panel of the accessory.

Priming the Temperature Control System

The Temperature Control System must be purged of all air to ensure maximum efficiency of cooling and heating. This is accomplished using the Accessory Setup screen of the Humidity Accessory Test Application.

Prime the temperature control system upon initial installation, or if you suspect air has gotten into the lines.

1 Connect one end of the RS-232 communication cable to COM1 (or available serial port) on the PC. Connect the other end of the communication cable to the UPGRADE port on DMA-RH.

2 Navigate to **C:\Program Files (x86)\TA Instruments\TRIOS\Tools\RH** and then double-click the executable **DMARH.exe** to run the Humidity Accessory Application.

3 Click the **Accessory Setup** tab.

4 In the **Select Serial Port** section, select the proper **COM** port from the drop-down list and click **Open Com Port**. Ensure that the status message **Successfully opened com port** displays in the **Status** window.

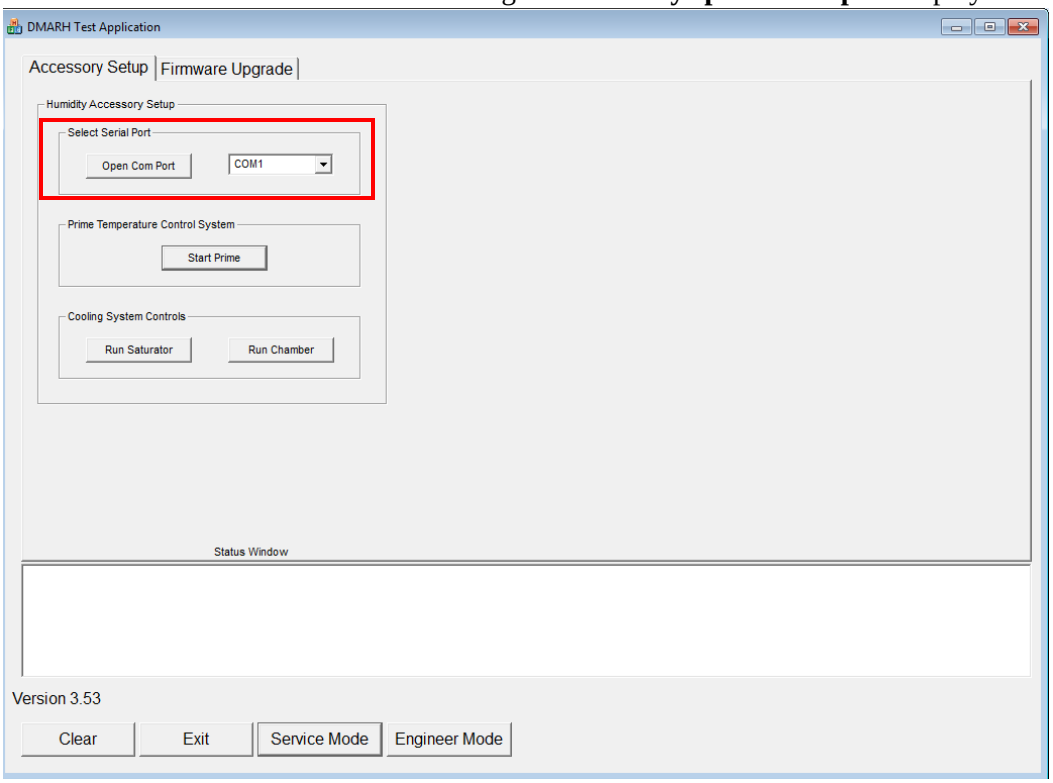


Figure 5 Open COM port.

5 Click **Start Prime** in the **Prime Temperature Control System** section. The DMA-RH begins the automated priming process, displaying each step in the **Status** window. At this time, the saturator pump will begin to click about two times per second, indicating that the pump is filling the saturator.

6 When the process is complete, **Completed prime process** displays in the **Status** window, and water flow stops (a small amount of water may continue to flow).

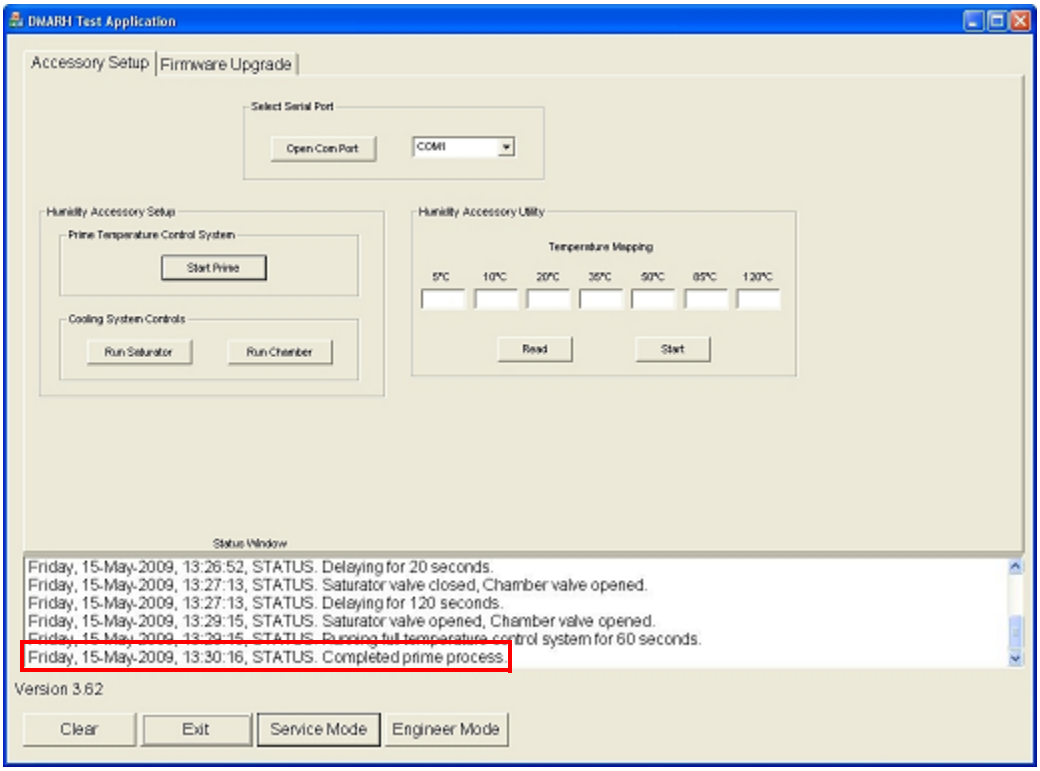


Figure 6 STATUS Completed prime process.

7 To ensure that the temperature control systems are properly primed, click **Run Saturator** in the **Cooling System Controls** section. Remove the lid from the Heat Exchanger bottle and verify water is flowing from the upper fitting into bottle. Click **Stop Saturator**.

8 Click **Run Chamber** and verify that water is flowing from upper fitting into Heat Exchanger bottle. Click **Stop Chamber**.

Filling the Saturator

1 If necessary, disconnect the communication cable from the UPGRADE port on the DMA-RH and connect it to the INSTRUMENT port. Disconnect the other end from the PC and connect it to the COM1 port on the rear of the DMA850 instrument.

2 Install the barbed fitting (included in accessory kit and shown below in Figure 7) in the SAT (saturator drain) valve (see Figure 8). Hand-tighten the fitting.

Figure 7 Saturator drain barbed fitting.

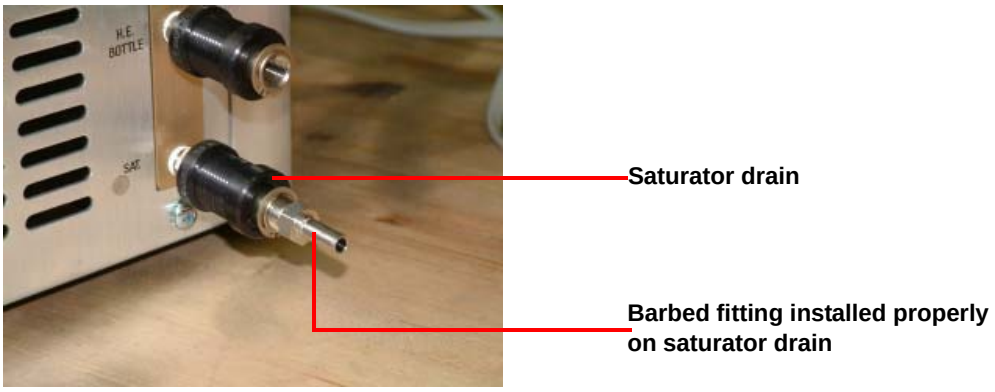


Figure 8 Fitting installed properly in saturator drain.

3 Obtain the tubing and syringe from the accessory kit. Install the tubing onto the end of the syringe, as shown below.

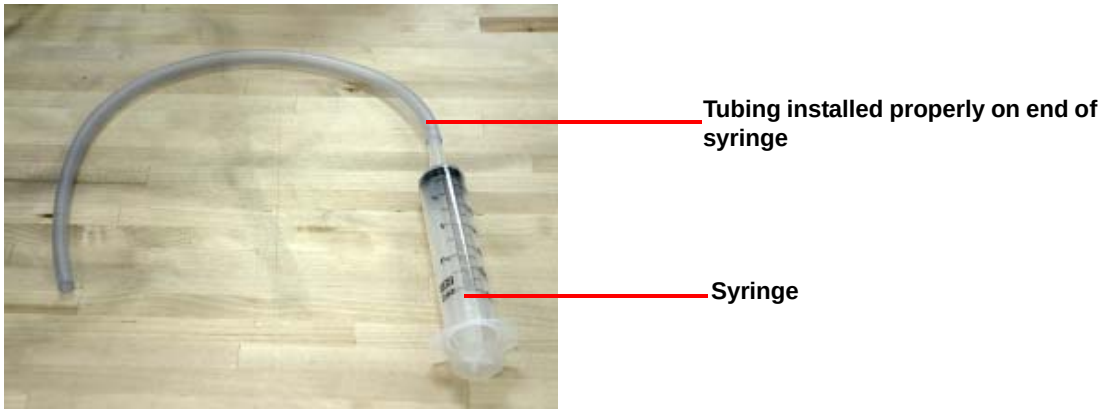


Figure 9 Proper syringe and tubing connections.

4 Fill the syringe with 60 cc of distilled water.

5 Connect the open end of the syringe tubing to the barbed fitting on the DMA-RH SAT valve.

6 Pull the valve body to open the valve and **slowly** dispense water into the DMA-RH Accessory by pushing in on the syringe.

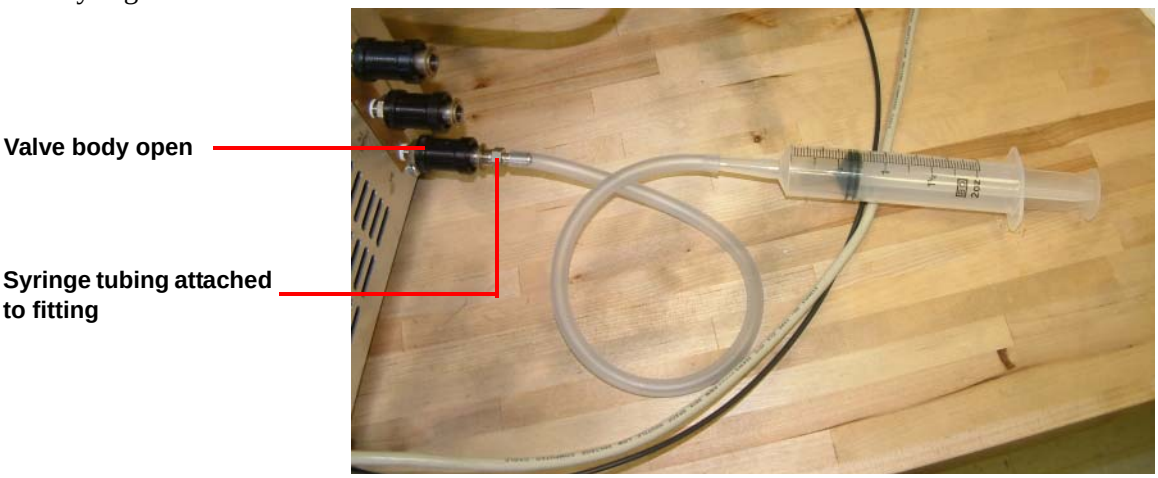


Figure 10 Filling the saturator through the saturator valve.

7 Close the saturator valve when the syringe empties and disconnect the syringe tubing from the barbed fitting.

8 Repeat step 4 through step 7 about two more times. The pump will continue to run (click) for about 15 minutes until the saturator is full.

CAUTION: Do not continue to add water if the pump stops clicking. It is possible to over-fill the saturator and push water into the sample chamber, potentially damaging the DMA.

MISE EN GARDE: Ne continuez pas à ajouter de l'eau si la pompe arrête de cliquer. Il est possible de remplir le tampon de saturation et de pousser l'eau dans la chambre à échantillon, ce qui pourrait endommager le DMA.

9 Remove the syringe tubing from the barbed fitting and, if desired, remove the fitting from the saturator valve. Again ensure that the saturator fitting valve is closed (pushed in).

CAUTION: If it becomes necessary to move the DMA-RH Accessory, it is necessary to drain some of the water out of the saturator. Failure to drain water from the saturator will result in water being pushed into the transfer line and then into the sample chamber when the purge gas is turned back on, potentially causing damage to the DMA. Follow the instructions given in "“Moving the DMA-RH Accessory” on page 34.

MISE EN GARDE: S'il s'avère nécessaire de déplacer l'accessoire DMA-RH, il faut évacuer une partie de l'eau hors du tampon de saturation. Si vous n'évacuez pas l'eau du tampon de saturation, l'eau risque d'être poussée dans la conduite de transfert et ensuite dans la chambre à échantillon lorsque le gaz de drainage est remis en marche, ce qui pourrait endommager le DMA. Suivez les instructions fournies dans la section « Déplacement de l'accessoire DMA-RH » en page 34.

Installing the DMA-RH Sample Chamber

To install the DMA-RH Accessory sample chamber onto the DMA 850 Dynamic Mechanical Analyzer, follow the instructions below:

1 If a furnace is already installed on the DMA 850, then uninstall it using the instructions given in the DMA 850 Getting Started Guide. If applicable, disconnect the air purge line and any cooling accessories from the instrument and plug the cooling accessory port with the nut that is provided with the accessory kit. If not, then proceed to step 2 below.

2 Remove any clamps that may be installed.

3 Remove the two mounting clips from the thermocouples with the hex wrench supplied in the accessory kit.

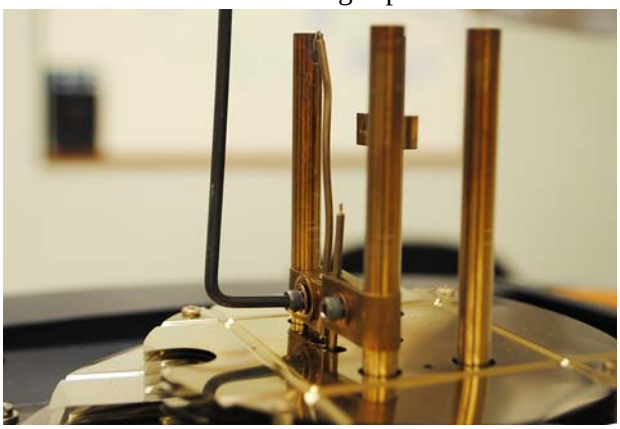


Figure 11 Remove mounting clips.

4 Insert the 1/8-inch hex wrench (provided in the kit) through the four holes in the DMA-RH sample chamber lid and loosen the captive screws until the lid can be removed.

Figure 12

5 Obtain the 1/8-inch tubing from the accessory kit, and install it on each thermocouple on the instrument.

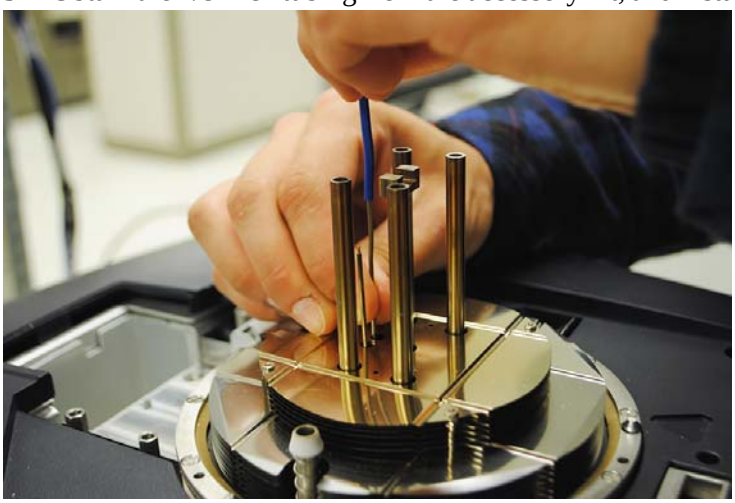


Figure 13 Install tubing on thermocouples.

6 Carefully position the DMA-RH sample chamber over the DMA 850 sample area. Guide the 1/8-inch tubing covering the thermocouples through the two holes in the DMA-RH sample chamber. Be careful not to break or damage either of the thermocouples' welded tips.

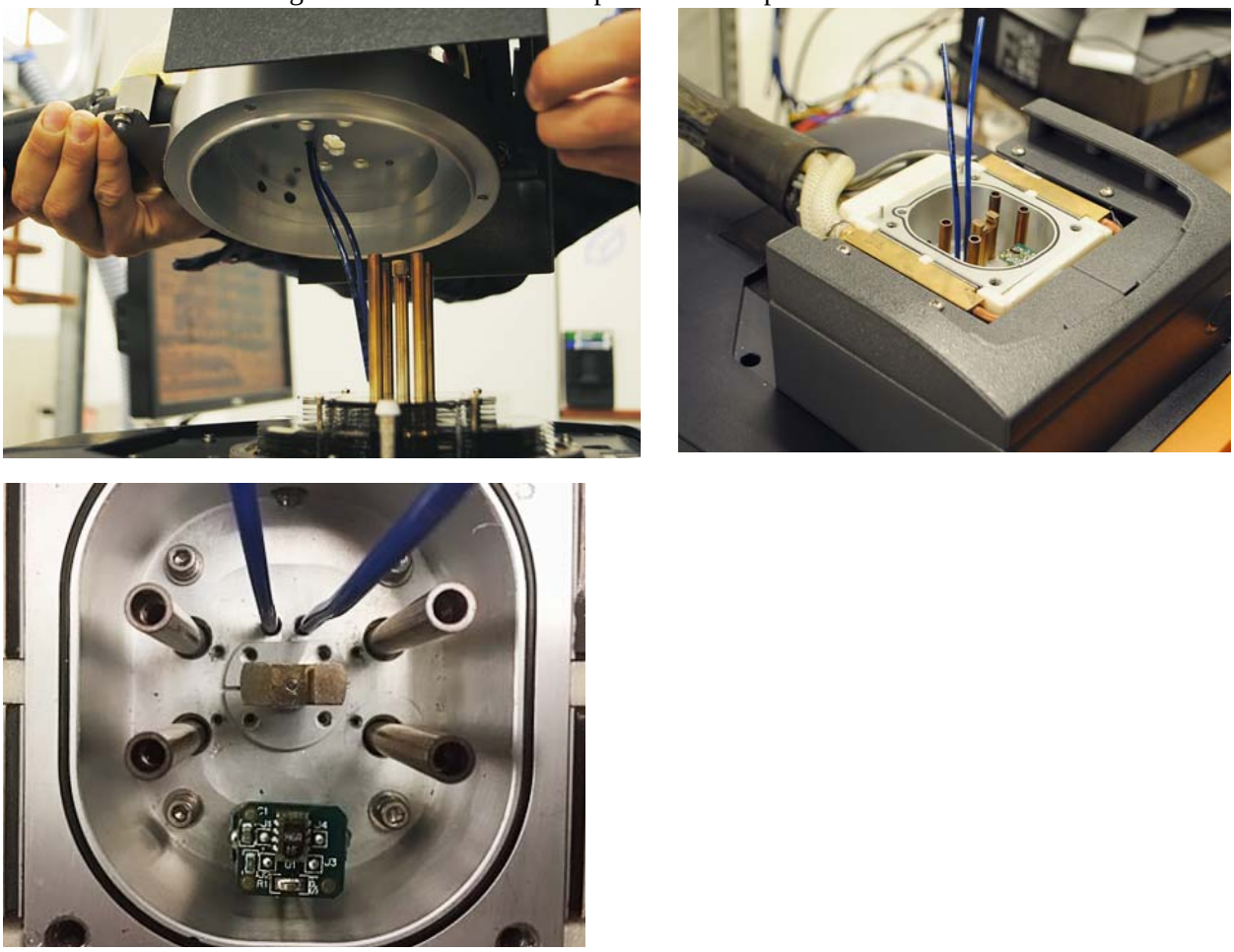
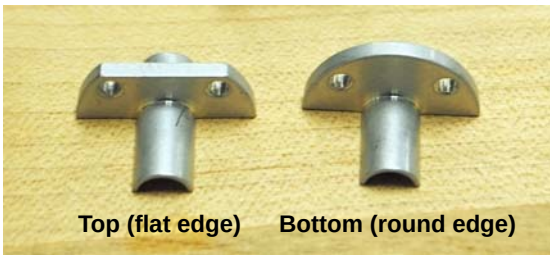


Figure 14 Top left: Guiding the tubing through the holes; Top right: Tubing threaded; Bottom: Holes where the thermocouples are guided through.

7 Make sure that the DMA-RH sample chamber is securely seated on the frame of the DMA 850, taking care to appropriately relieve stress on the DMA-RH humidity control box transfer line. When finished, remove the 1/8-inch tubing from the thermocouples and place it back in the accessory kit for future use.

8 Position the two halves of the shaft collar, minimizing the gap between the collars and drive shaft.



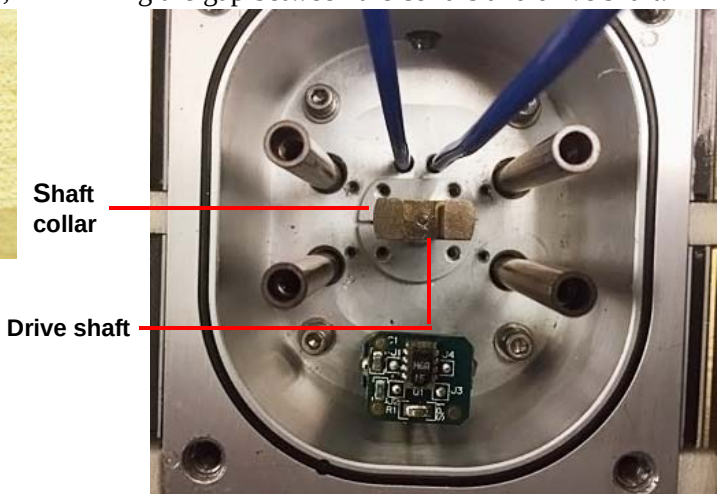


Figure 15 Left: Two halves of the shaft collar; Right: Shaft collar in place.

9 Place the shaft collar retaining ring into position on the drive shaft collar. Leave the screws loose.

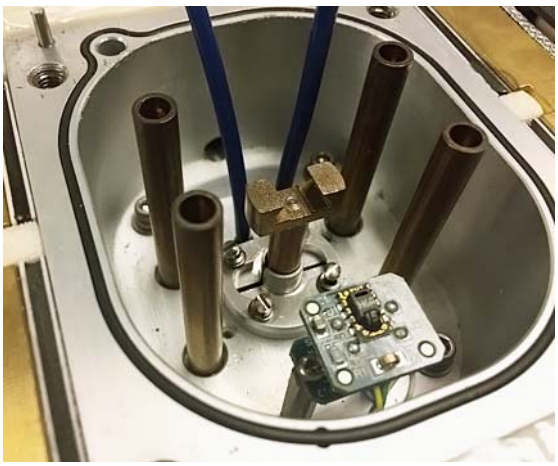


Figure 16 Left: Shaft collar retaining ring; Right: Shaft collar retaining ring in place.

10 Slide the 4 mounting collars onto the DMA 850's 4 posts. Be sure that all four collars are pushed down all the way to the bottom. Leave the set screws on the mounting collars loose.

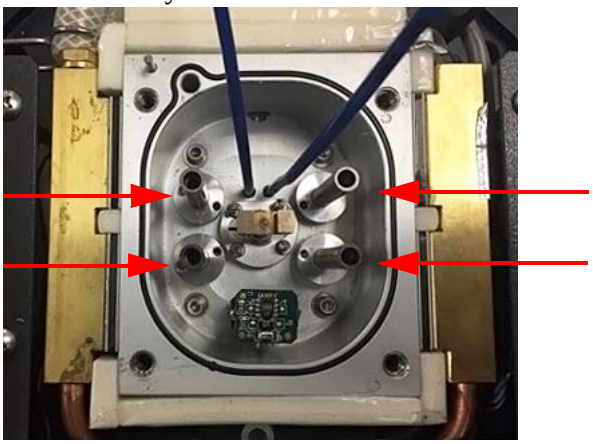


Figure 17 Mounting collars in place.

11 Install the DMA-RH mounting brackets supplied with the accessory kit. The brackets must slide into place between the two posts on each side of the DMA-RH accessory – these posts are visible behind the DMA-RH accessory. Take care to move any wires out of the way to ensure that the bracket does not pinch them when installed. Tighten the screws on the mounting brackets using a Phillips screwdriver.

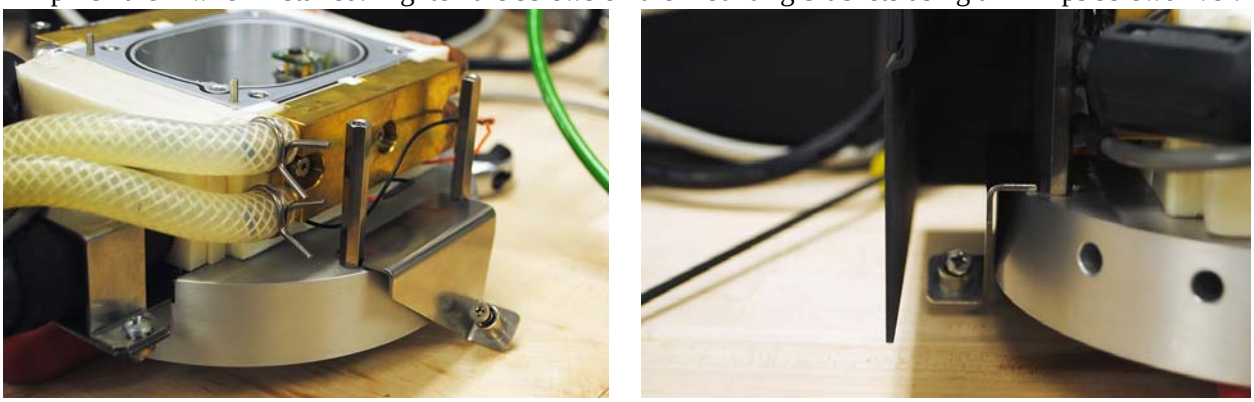


Figure 18

12 Once the mounting brackets are firmly installed, place the washers and lockdown bolts on each mounting collar.

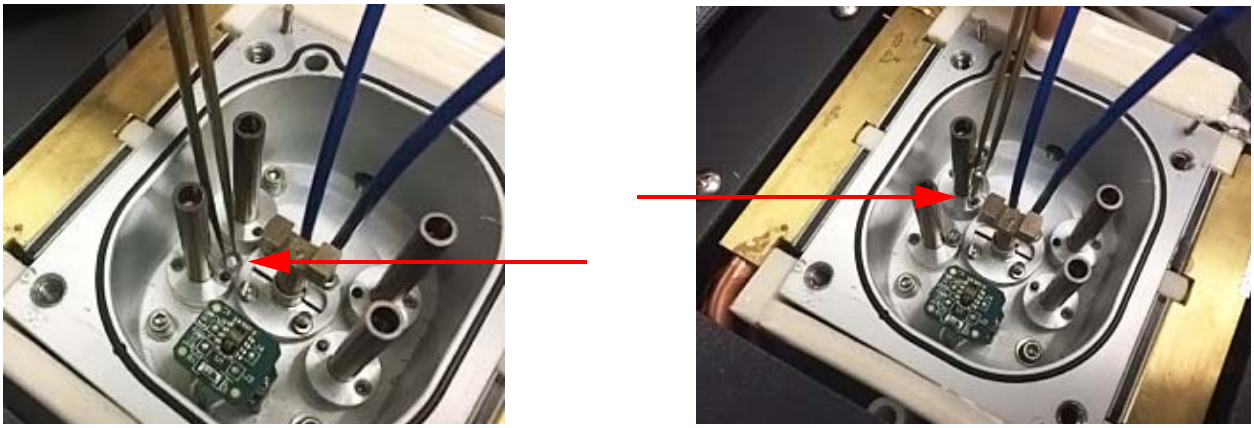


Figure 19 Left: Installing a washer; Right: Installing a lockdown bolt.

13 Slowly tighten the lockdown bolt and then the corresponding set screw, working back and forth between the set screw and lockdown bolt. Repeat for each post.

14 After all collars are tight, tighten the screws on the shaft collar retaining ring.

15 With the motor set to **Float**, make sure that the drive shaft collars are not rubbing on the drive shaft over the full range of travel.

16 Install the two thermocouple mounting clips to hold the thermocouples in place. These clips should also come in contact with the bottom of the sample clamp mounting posts.

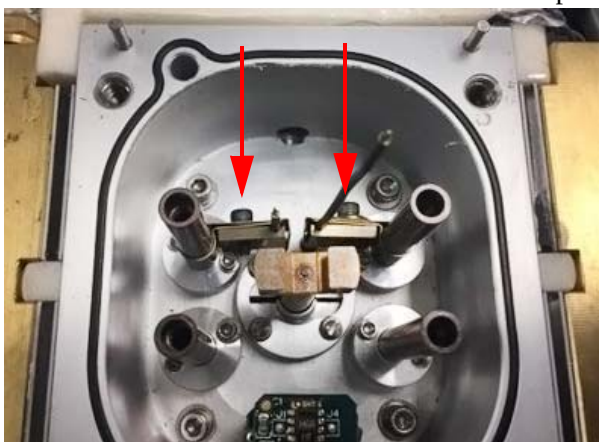


Figure 20 Thermocouple mounting clips.

17 Install and calibrate the desired DMA 850 sample clamp.

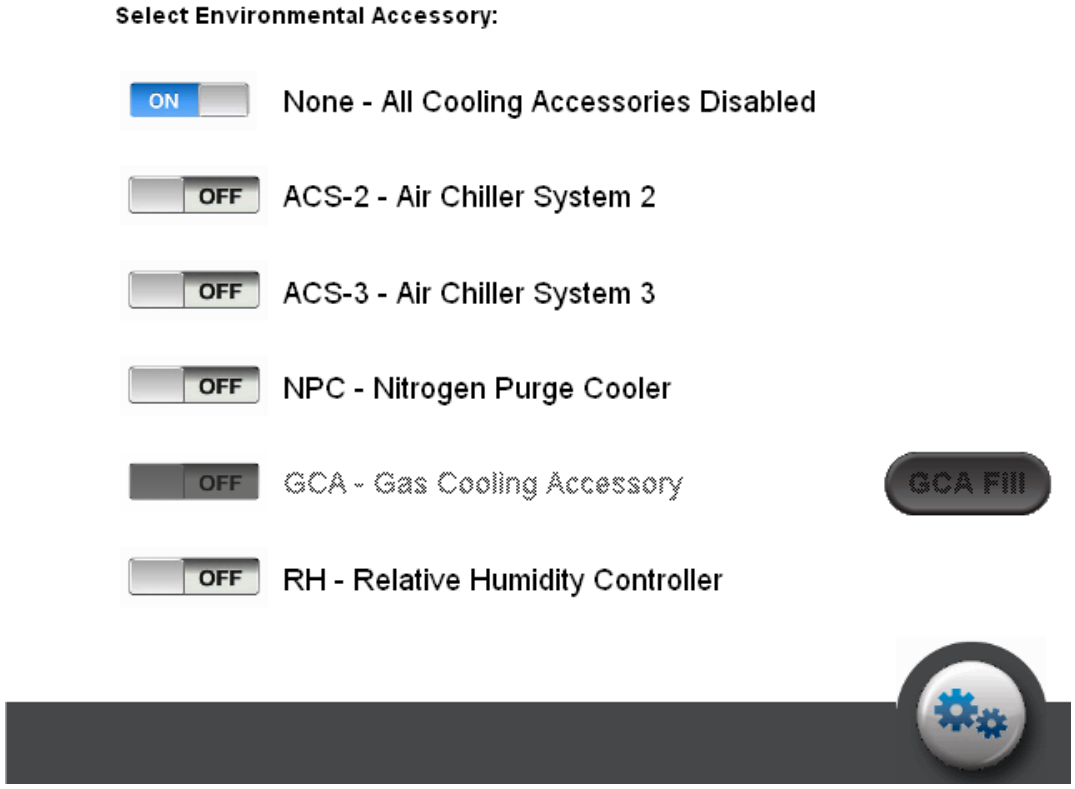
NOTE: Submersion clamps will not work when the DMA-RH sample chamber is installed. In addition, the standard compression, miniature three-point bending, and penetration clamps are also not compatible with the DMA-RH system. A specialty kit is available which contains new DMA-RH specific compression, three-point bending, and penetration clamps for use with the DMA-RH accessory.

18 Install the sample chamber lid and use the 1/8-inch hex wrench in the kit to tighten the four captive screws before running an experiment.

Setting up the DMA-RH Accessory from the User Interface

1 After successfully installing the DMA-RH accessory, access the **Settings**  screen from the user interface and select **Cooling Accessories**  .

2 Select the Relative Humidity accessory from the user interface to activate it.



Chapter 3:

Use, Maintenance, & Diagnostics

Using the DMA-RH Accessory

All of your DMA-RH Accessory experiments will follow the same 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. See the instrument control online help for instructions on performing these actions.

- Filling the saturator reservoir
- Selecting and preparing the sample
- Creating or choosing a test procedure and entering experiment information through the TA Instruments instrument control software
- Loading the prepared sample
- Starting the experiment

Before You Begin

Before using the DMA-RH Accessory, ensure that the DMA 850 is installed properly. Also make sure you have:

- Connected the RS-232 cable between the DMA 850 and the DMA-RH Accessory
- Connected enclosure power line and gas line
- Powered on each unit
- Filled the reservoirs as necessary
- Specified the DMA-RH Accessory in the instrument control software
- Become familiar with controller operations

Loading the Sample

If necessary, connect the communication cable from the INSTRUMENT port on the DMA-RH to the COM2 port on the DMA instrument.

See online help for details concerning sample preparation and loading. The same general guidelines are applicable as a standard DMA experiment.

Creating an Experimental Procedure

The DMA 850 instrument control software allows a variety of sorption analysis experiments to be run, including stepped humidity at constant temperature and stepped temperature while holding humidity constant.

See online help for details concerning setting up and running a procedure. The same general guidelines are applicable as a standard DMA experiment. Refer also to the online help topic “Combining Temperature and Humidity Steps in an Unlimited Experiment.”

After enabling control of the DMA-RH (see “‘Setting up the DMA-RH Accessory from the User Interface” on page 29), the **Conditioning Humidity** step becomes available within the DMA Unlimited procedures.

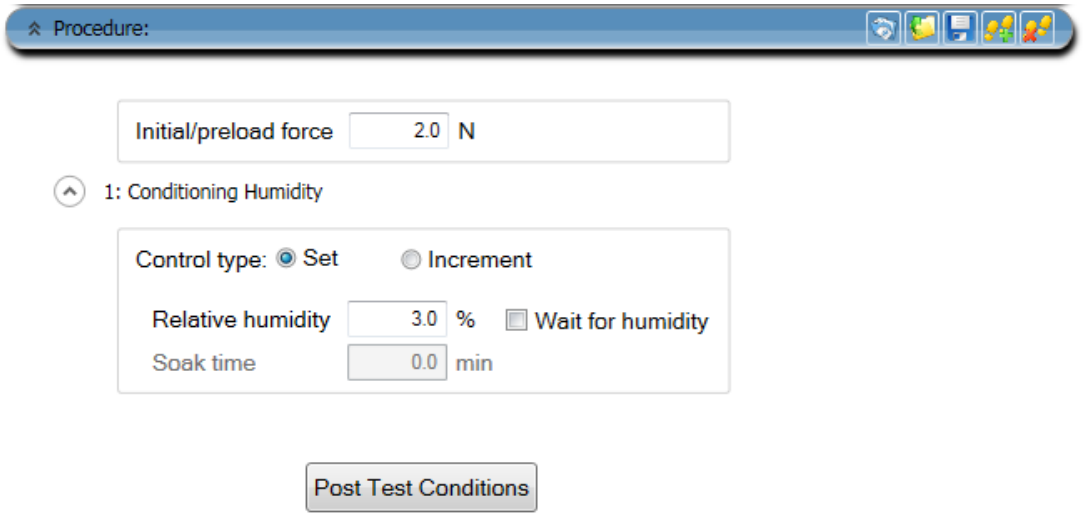


Figure 21 Conditioning Humidity step.

Please note the following conditions when operating the DMA-RH accessory:

- It is important to note that while in Standby mode, the DMA-RH Accessory purges the sample chamber with dry gas (0% RH). This is a safety feature and cannot be changed. If you prefer to keep the humidity level at a condition other than 0% RH, you must program that condition as the last step in an experiment, and keep the method active between runs.
- In DMA-RH mode, the temperature **Equilibrate** step acts similar to a temperature **Jump** step in that the software does not wait for stabilization criteria. During an **Equilibrate** step, the DMA 850 passes the requested temperature to the DMA-RH accessory and allows the accessory to control the temperature of the sample chamber. The temperature of the sample chamber is driven to a value close to the

requested value (typically within 5°C), and the DMA 850 software then moves to the next step in the method. The DMA-RH accessory eventually drives the temperature to the requested value, but it is necessary to add a **Soak time** after every **Equilibrate** step in order to give the system enough time to stabilize.

Maintaining the Accessory

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 the online documentation installed with the instrument control software for further information.

WARNING: Because of the high voltages in this accessory, untrained personnel must not attempt to test or repair any electrical circuits.

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

Draining the DMA-RH Reservoirs

The procedure below explains how to properly drain the DMA-RH Reservoirs.

1 Turn off the power switch on the accessory and unplug the power cord from the power inlet. Remove the power supply side panel (the right side panel if facing the drain valves).

2 Remove both the Heat Exchange Reservoir and Saturator Reservoir caps.

3 Install the barbed fitting (included in accessory kit and shown in Figure 7) in the SAT (saturator drain) valve (refer to Figure 8).

4 Obtain the tubing from the accessory kit. Install the tubing onto the end of the barbed fitting, and pull the SAT valve open to drain. Use a bucket or a similar apparatus to catch the draining liquid.

5 Once the draining is complete, remove the barbed fitting and tubing from the SAT drain valve.

6 Attach the fitting and tubing to the SAT BOTTLE drain valve, and pull the SAT BOTTLE valve open to drain. Again, use a bucket or a similar apparatus to catch the draining liquid.

7 Once the draining is complete, remove the barbed fitting and tubing from the SAT BOTTLE drain valve.

8 Attach the fitting and tubing to the H.E. BOTTLE drain valve. Pull the H.E. BOTTLE drain valve open to drain, using a bucket or similar apparatus to catch the draining liquid.

9 Pinch off supply line from the Heat Exchange reservoir above the “tee” fitting using the hemostat pliers supplied in the accessory kit. Refer to the figure below.

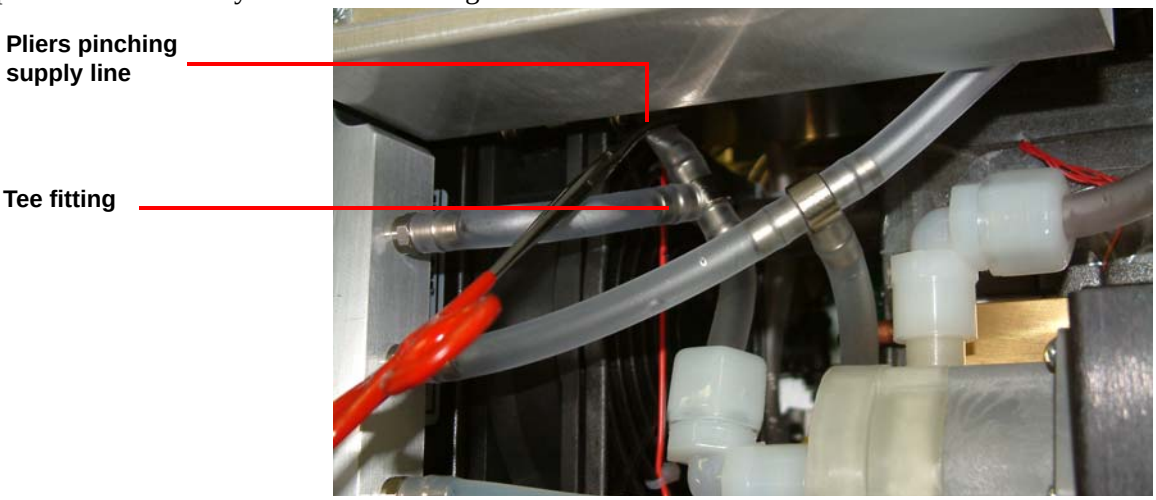


Figure 22 Hemostat pliers pinching off supply line, just above “tee” fitting.

10 Obtain the syringe from the accessory kit and retract the plunger. Attach the syringe to the tubing.

11 Push the plunger into the syringe, forcing water from the cooling system back into the Heat Exchange reservoir.

12 Close the drain valve, remove the tubing (with syringe still attached) from the fitting, and retract the plunger.

13 Reattach the tubing and syringe to the fitting and open the drain valve. Push the plunger into the syringe.

14 Repeat step 12 and step 13 (approximately 15 times) until all water is forced from the cooling system.

15 When all water is forced from the cooling system, close the drain valve, remove the hemostat pliers pinching off the supply line, and remove the syringe from the tubing. Then open the H.E. BOTTLE drain valve to drain the remaining water from the H.E. Reservoir, using a bucket or similar apparatus to catch the draining liquid.

16 When finished, replace the reservoir caps and reattach the power supply side panel.

Cleaning the Accessory

To clean the DMA-RH Accessory, wipe down the control cabinet with a damp, soft cloth.

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

MISE EN GARDE: N'utilisez pas de produits chimiques agressifs, de nettoyants abrasifs, de la laine d'acier ou tout autre matériau rugueux pour nettoyer l'armoire, car vous pourriez égratigner sa surface et dégrader ses propriétés.

Moving the DMA-RH Accessory

CAUTION: If it becomes necessary to move the DMA-RH Accessory, it is important to drain some of the water out of the saturator. Failure to drain water from the saturator will result in water being pushed into the transfer line and then into the sample chamber when the purge gas is turned back on, causing potential damage to the DMA.

MISE EN GARDE: S'il s'avère nécessaire de déplacer l'accessoire DMA-RH, il faut évacuer une partie de l'eau hors du tampon de saturation. Si vous n'évacuez pas l'eau du tampon de saturation, l'eau risque d'être poussée dans la conduite de transfert et ensuite dans la chambre à échantillon lorsque le gaz de drainage est remis en marche, ce qui pourrait endommager le DMA.

Follow these steps to drain a small amount of water from the saturator:

1. Turn off the power switch on the accessory and unplug the power cord from the power inlet.
2. Obtain a bucket or small container to collect the water that will be drained from the saturator.
3. Locate the saturator drain fitting (shown in Figure 7) and pull the valve body to open the valve and allow water to flow into the container. Drain at least 100 mL of water from the saturator prior to moving the DMA-RH.
4. Move the DMA-RH to a new location, following the guidelines found in "Choosing a Location" on page 16in this manual.
5. Reattach all cables and lines per "Connecting Cables and Lines" on page 17 found in this guide.

Downloading Firmware to the DMA-RH Accessory

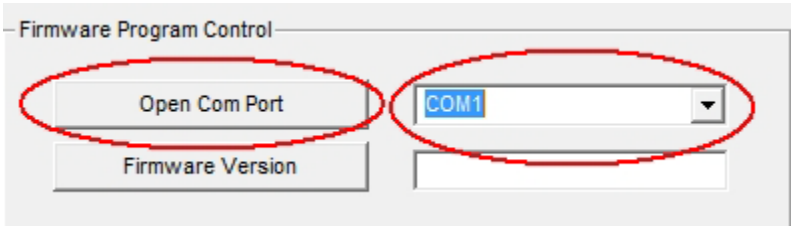
Upon delivery, the latest firmware is already installed on the DMA-RH. However, in the event that you need to update the firmware, follow the procedure below.

1. Attach a RS-232 cable to a COM port on the controller and to the COM port labeled UPGRADE on the rear of the DMA-RH Accessory.
2. Navigate to the directory **C:\Program Files (x86)\TA Instruments\TRIOS\Tools\RH**.
3. Double-click on the executable file **DMARH.exe** to open the DMAR-RH Accessory Application.
4. When the application opens, select the **Firmware Upgrade** tab.

Figure 23 Firmware Upgrade tab.

5. Verify that the **Flash Program File Selector** is set to the following path: **C:\Program Files (x86)\TA Instruments\TRIOS\Tools\RH\DMARH.exe**
6. If the **Flash Program File Selector** is set to a different path, click **Select Program File** and navigate to the path listed in step 5.
7. Under **Firmware Program Control**, click the drop-down menu to the right of **Open Com Port**. Select

the RS-232 Com Port that the cable is connected to on the controller. Then click **Open Com Port**.



A message similar to the one below displays.

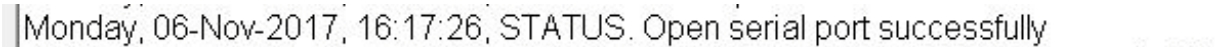


Figure 24 Status message.

8 Click **Firmware Version** to obtain the current version of firmware installed on the DMA-RH Accessory.

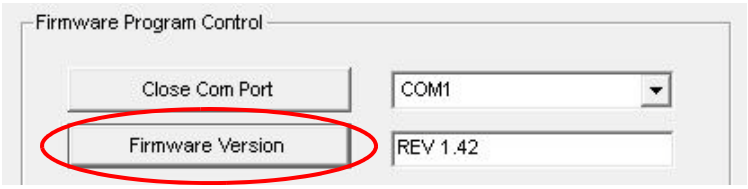


Figure 25 Firmware Version.

9 Click **Upgrade Programmed Board** to start the firmware download process.

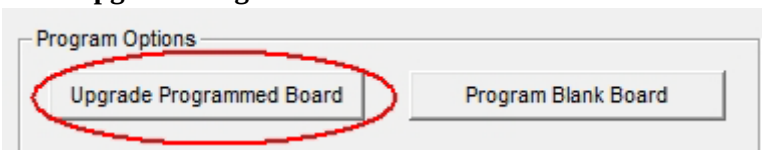


Figure 26 Upgrade Programmed Board.

A message similar to the one below displays.

Figure 27 Status message.

10 When the firmware download completes, a status message similar to the one below displays within the DMA-RH Accessory application.

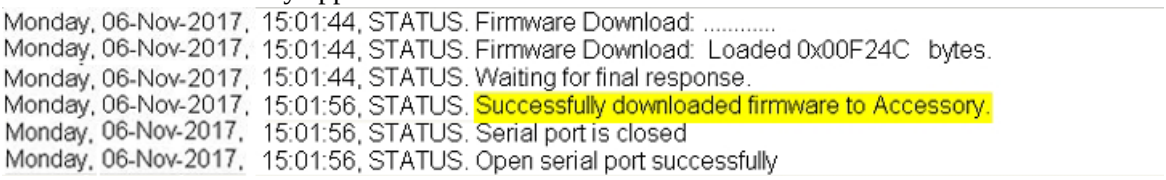


Figure 28 Status message.

11 After receiving the message that the firmware was successfully downloaded to the DMA-RH Accessory, click **Exit** to close the application.

12 As part of the download process, the DMA-RH Accessory automatically reboots.

13 Disconnect the RS-232 communication cable between the controller and UPGRADE port on the rear of the DMA-RH Accessory.

Mapping Temperature on the DMA-RH Accessory

If the RH sensor is replaced, it is necessary to map the new sensor's response to the sample chamber. Additionally, if the measured temperature drifts away from the requested temperature by an unacceptable amount, perform the temperature mapping process as a means to reconcile the values. Follow the procedure below to map the temperature sensor:

1 Attach an RS-232 cable to the serial port on the controller and to the serial port labeled INSTRUMENT on the rear of the DMA-RH Accessory.

2 Navigate to the directory **C:\Program Files (x86)\TA Instruments\TRIOS\Tools\RH**.

3 Double-click on the executable file **DMARH.exe** to open the DMAR-RH Accessory Application.

4 When the application opens, click the **Accessory Setup** tab.

Figure 29 Accessory Setup tab.

5 Click the drop-down menu to the right of **Open Com Port**. Select the RS-232 Com Port that the cable is connected to on the controller. Then click **Open Com Port**.

Figure 30 Select Serial Port.

6 Click **Start** to begin the temperature mapping process. Note that this process will take approximately 8 hours to complete.

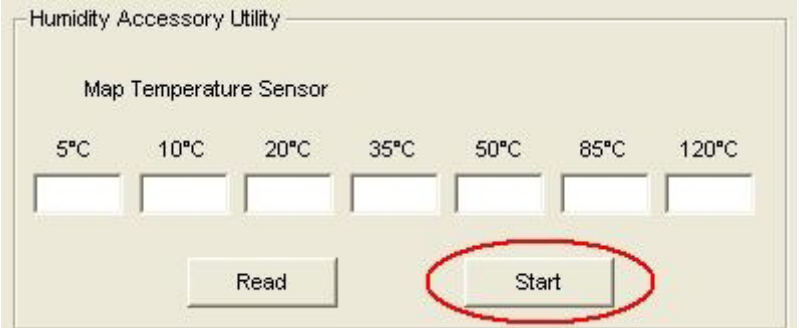


Figure 31 Humidity Accessory Utility.

7 Upon completion of the temperature mapping, the values appear in the boxes, and the DMA-RH Accessory automatically stores the values in flash memory.

Monitoring the Humidity Chamber

The water reservoir within the DMA-RH enclosure will require periodic refills with distilled water. When the reservoir is low, a message will appear in the status line. Follow the instructions on page 16 to fill the chamber again.

NOTE: The “SAT RESERV LOW” indicator initially triggers when approximately 250 mL are left in the reservoir.

The water reservoir in the DMA-RH holds approximately 1 L of water when full. The rate of consumption of that water during experiments is dependent on temperature, %RH requested, and time. The dominant factor, however, is temperature. At 25°C, the rate of consumption is low, even if high humidities are used. At 25°C it takes more than 30 days for the reservoir to be depleted. On the other hand, at extreme conditions (for example, isothermal at 85°C and 85% RH), the rate of water consumption is much higher.

NOTE: It is good practice to always fill the water reservoir prior to starting an experiment. Water can be added in the middle of an experiment with no adverse affects to the data.

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 DMA-RH contains internal fuses that are not user serviceable. If any of the internal fuses blow, a hazard may exist. Call your TA Instruments service representative.

The only fuses that you can replace yourself are the fuses located in the power entry module located at the rear of the accessory. To check or change these fuses:

1 Turn the accessory off and remove the power cord.

2 Remove the fuse drawer from the accessory by using your finger to pry out the edge of the drawer, then removing the entire fuse drawer (see Figure 32).

CAUTION: Do not use a metal tool to remove the fuse drawer from the DMA-RH Accessory, as it could result to damage to the fuse and/or fuse drawer.

MISE EN GARDE: N'utilisez pas un outil métallique pour retirer le tiroir à fusible de l'accessoire DMA-RH, car cela pourrait endommager le fusible et/ou le tiroir à fusibles.

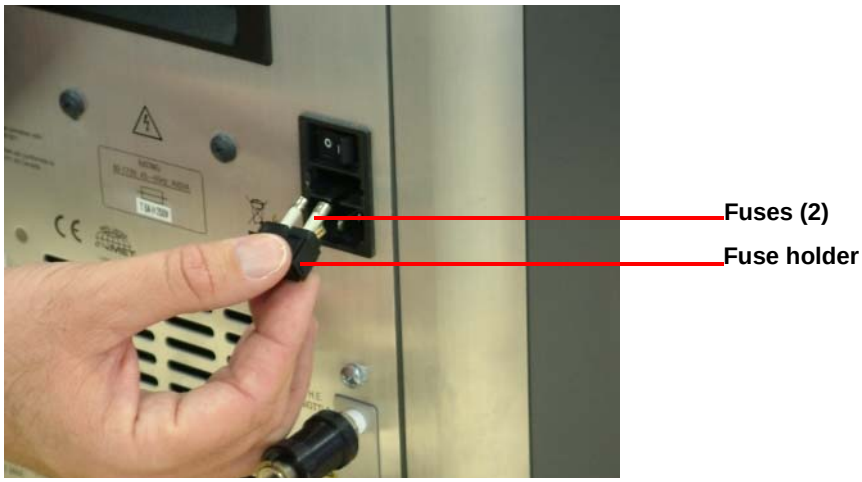


Figure 32 Fuses on DMA-RH Accessory.

3 Remove old fuses and replace the fuses only with the type and rating indicated on the accessory's rear panel.

4 Place fuse holder back into opening and push until it sits securely in the slot.

Replacement Parts

Table 5: Replacement Parts for the DMA-RH Accessory

Part Number	Description
985606.901	Mass flow control assembly
985670.901	DMA RH sensor PC board
985680.901	DMA RH control PC board
985723.901	Post collar assembly
985703.901	Shaft collar assembly