ARES-G2

Electrorheological (ER) Accessory

Getting Started Guide

Revision C **Issued November 2013**

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.

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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
- TA Instruments Patents
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- TA Instruments End-User License Agreement
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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 European Economic Area

(In accordance with Council Directive 2006/95/EC of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.)

EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements + Amendments.

EN 61010-2-010:2003 Particular requirements for laboratory equipment for the heating of materials + Amendments.

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 2004/108/EC of 15 December 2004 on the approximation of the laws of the 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 1 - Basic immunity test requirements.

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 accessory 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 accessoire est prévenu qu'en cas d'utilisation contraire aux indications du manuel, la protection offerte par l'équipement peut être altérée.

WARNING: To avoid potential injury or death, do not attempt to install or operate the ER Accessory until you have read this Getting Started Guide and the accompanying waveform generator and amplifier documentation in their entirety. The documentation includes important information regarding safety and operation.

AVERTISSEMENT: Pour éviter d'éventuelles blessures ou la mort, n'essayez pas d'installer ou d'utiliser l'accessoire ER tant que vous n'avez pas entièrement lu le guide de démarrage et la documentation du générateur à formant et de l'amplificateur assortis. La documentation inclut d'importants renseignements relatifs à la sécurité et à l'utilisation.

The ARES-G2 ER Accessory works in conjunction with a high-voltage amplifier, a function/waveform generator, and the ARES-G2 Rheometer. Refer to the *ARES-G2 Rheometer Getting Started Guide* and the waveform generator and amplifier documentation for important information regarding safety and operation.

High Voltage

WARNING: High voltage is used in the operation of the equipment described herein. Operating personnel must at all times observe all safety regulations governing the installation, operation, and calibration of equipment utilizing high voltage. Death on contact may result if operating personnel fail to observe safety precautions. Learn the area of high voltage connections, and exercise care not to contact these areas when installing, operating, or calibrating this equipment. Do not replace components or cables while power is applied. To avoid injuries or death, always remove power, and discharge and ground an electrical circuit before touching it. Prior to operating this equipment, remove all jewelry. Do not make physical contact with any high voltage connection while power is applied.

AVERTISSEMENT: Des tensions élevées sont utilisées dans le fonctionnement de l'équipement décrit dans le présent document. Le personnel d'exploitation doit toujours respecter toutes les règles de sécurité régissant l'installation, l'utilisation et l'étalonnage de l'équipement utilisant de la haute tension. Si le personnel d'exploitation ne respecte pas les précautions d'utilisation, il peut en résulter la mort au contact de cet instrument. Familiarisez-vous avec la zone des raccordements haute tension et faites preuve de prudence pour ne pas toucher ces zones lors de l'installation, l'utilisation ou l'étalonnage de cet équipement. Ne remplacez pas les composants ou les câbles lorsque l'instrument est sous tension. Pour éviter des blessures ou la mort, coupez toujours l'alimentation, déchargez et mettez le circuit électrique à la terre avant de le toucher. Avant d'utiliser cet équipement, retirez tous vos bijoux. N'établissez pas de contact physique avec un raccordement haute tension lorsque l'équipement est sous tension.

WARNING: The Trek amplifier is available in two configurations: 110V and 220V. Before operating the ER Accessory, refer to the power label on the rear panel of the Trek amplifier to ensure that the amplifier's configuration is correct for your building's line voltage. See page 12 for more information.

AVERTISSEMENT: L'amplificateur Trek est disponible en deux configurations : 110 V et 220 V. Avant d'utiliser l'accessoire ER, consultez l'étiquette des caractéristiques électriques apposée sur le panneau arrière de l'amplificateur TREK pour vous assurer que la configuration de l'amplificateur est appropriée à la tension de la ligne de votre bâtiment. Voir la page 13 pour plus de renseignements.

WARNING: DO NOT insert a digital enable shorting plug (shown on page 11) into the Trek amplifier when operating the ER Accessory. The ER Accessory is not safe to operate if the digital enable shorting plug is installed in the amplifier.

AVERTISSEMENT: N'insérez pas une fiche de court-circuit à activation numérique (illustrée sur la page 12) dans l'amplificateur Trek lors de l'utilisation de l'accessoire ER. L'accessoire ER ne peut pas être utilisé en toute sécurité si la fiche de court-circuit à activation numérique est installée dans l'amplificateur.

WARNING: When using the ER APS system with plate geometries, ALWAYS use stainless steel quick change plate geometries. These geometries are designed with a groove to accommodate the APS ground springs; the ER APS configuration is not safe to operate without this ground connection.

AVERTISSEMENT: Lorsque vous utilisez le système ER APS avec des géométries de plaque, utilisez TOUJOURS des géométries de plaque en acier inoxydable à changement rapide. Ces géométries sont conçues avec une rainure pour adapter les ressorts de terre APS; en effet, la configuration de l'ER APS ne permet pas de l'utiliser en toute sécurité sans cette prise de parc.

WARNING: To ensure a proper ground connection, routinely clean the APS ground springs, the groove in APS cup plate, and the ER APS top grooved plate. If you are unsure about the acceptable cleanliness of the ground spring clips, use the spares provided in the kit.

AVERTISSEMENT: Afin d'assurer une mise à la terre appropriée, nettoyez systématiquement les ressorts de terre APS, la rainure de la plaque à coupelle APS et la plaque rainurée supérieure ER APS. Si vous n'êtes pas certain du niveau de propreté acceptable des attaches à ressort de terre, utilisez les pièces de rechange fournies dans le kit.

WARNING: DO NOT insert a digital enable shorting plug into the TREK amplifier (shown on page 11) when operating the ER Accessory. The ER Accessory is not safe to operate if the digital enable shorting plug is installed in the amplifier.

AVERTISSEMENT: N'insérez pas une fiche de court-circuit à activation numérique (illustrée sur la page 12) dans l'amplificateur Trek lors de l'utilisation de l'accessoire ER. L'accessoire ER ne peut pas être utilisé en toute sécurité si la fiche de court-circuit à activation numérique est installée dans l'amplificateur.

Required Equipment

While operating this accessory, you must wear eye protection that either meets or exceeds ANSI Z87.1 standards. Additionally, wear protective clothing that has been approved for protection against the materials under test and the test temperatures.

Accessory Symbols

The following label is displayed on the ER for your protection:

Symbol	Explanation
	This symbol indicates that you should read this Getting Started Guide in its entirety. This guide contains important warnings and cautions related to the installation, operation, and safety of the accessory. Ce symbole indique que vous devez lire entièrement ce guide de démarrage. Ce guide contient d'importants avertissements et mises en garde relatifs à l'installation, à l'utilisation et à la sécurité de l'accessoire.
	This symbol on the polycarbonate ER shield indicates that extreme care should be taken when operating the ER Accessory; the ER operates using voltages up to 4,000 volts (AC or DC). If you are not trained in electrical procedures, do not remove the instrument 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 apposé à l'écran ER en polycarbonate indique que des précautions extrêmes doivent être prises lors de l'utilisation de l'accessoire ER; l'ER fonctionne à l'aide de tensions de 4 000 volts (CA ou CC) maximum. Si vous n'êtes pas formé aux procédures électriques, ne déposez pas les couvercles de l'instrument 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.

Please heed the warning labels and take the necessary precautions when dealing with these areas. The *ARES-G2 Electrorheological (ER) Accessory Getting Started Guide* contains cautions and warnings that must be followed for your own safety.

Table of Contents

Chapter 1:

Introducing the ARES-G2 ER Accessory

Overview

Electrorheological (ER) fluids are suspensions of extremely fine non-conducting particles in an electrically insulating fluid, which show dramatic and reversible rheological changes when the electric field is applied. These changes in apparent viscosity can be up to five decades in magnitude. For example, a typical ER fluid can go from the consistency of a liquid to that of a solid, and back, with response times on the order of milliseconds. The change in rheological properties depends on the applied electric field, i.e. the potential divided by the distance between the plates. Another way to think of the effect is as an electric field-dependent shear yield stress. When activated, an ER fluid behaves as a Bingham plastic (a type of visco-elastic material), with a yield point that is determined by the electric field strength. After the yield point is reached, the incremental shear stress is proportional to the rate of shear (in a “Newtonian fluid” there is no yield point and stress is directly proportional to shear). Hence, the resistance to motion of the fluid can be controlled by adjusting the applied electric field. ER fluids were discovered around 1940, and today we can see significant improvements in performance and reliability of these materials. Additionally, we see a great deal of interest in characterizing ER fluids, as they have found more potential applications (damping devices, clutches, braking devices, actuators, optical devices, and polishing devices, to name a few).

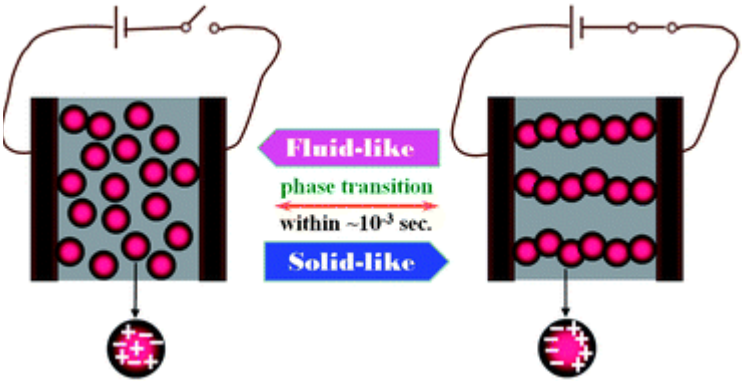


Figure 1 Example diagram of phase transition when voltage is applied.

The ARES-G2 ER Accessory provides the ability to apply up to 4,000 volts during the course of an experiment using either parallel plate or couette geometry. The temperature range of the ER Accessory depends upon the environmental system used (the widest range, –40°C to 180°C, is achieved using a Peltier Plate). The voltage is applied via a Trek Amplifier through a special high-voltage cable into the test station that connects onto an insulator block behind the transducer hub. A special insulator block geometry adapter is placed between the transducer hub and the upper geometry, effectively isolating the transducer from the voltage being applied across the geometry to the sample. The motor is grounded to complete the circuit.Tests are run either at room temperature, with the Peltier Plate system, or the Advanced Peltier System (APS). There are no limitations to the type or rheological experiments that can be run with this accessory.

ER Components

The following section describes the components included with the ARES-G2 ER Accessory.

Agilent Function/Waveform Generator

The Agilent function/waveform generator (shown below) is a 10-Mz synthesized function generator with built-in arbitrary waveform and pulse capabilities. This function/waveform generator is used to generate the AC or DC input signal into the Trek Amplifier via the TRIOS Software.

For more information on this unit, refer to the function/waveform generator user guide.

Figure 2 Function/waveform generator.

Trek Amplifier

The Trek Model 609E-6 generates the high voltage signal to the ARES-G2 upper geometry. The signal can range from 0 to 4000 VDC or 4000 VAC (8000 volts peak to peak).

For more information on this unit, including important safety information, refer to the amplifier user guide.

DO NOT operate the ER Accessory with a digital enable shorting plug installed. For your safety, the shorting plug supplied with the amplifier has been removed.

Figure 3 Trek amplifier.

WARNING: DO NOT insert a digital enable shorting plug into the Trek amplifier when operating the ER Accessory. The ER Accessory is not safe to operate if the digital enable shorting plug is installed in the amplifier.

AVERTISSEMENT: N'insérez pas une fiche de court-circuit à activation numérique dans l'amplificateur Trek lors de l'utilisation de l'accessoire ER. L'accessoire ER ne peut pas être utilisé en toute sécurité si la fiche de court-circuit à activation numérique est installée dans l'amplificateur.

WARNING: The Trek amplifier is available in two configurations: 110V and 220V. Before operating the ER Accessory, refer to the power label on the rear panel of the Trek amplifier to ensure that the amplifier's configuration is correct for your building's line voltage.

AVERTISSEMENT: L'amplificateur Trek est disponible en deux configurations : 110 V et 220 V. Avant d'utiliser l'accessoire ER, consultez l'étiquette des caractéristiques électriques apposée sur le panneau arrière de l'amplificateur TREK pour vous assurer que la configuration de l'amplificateur est appropriée à la tension de la ligne de votre bâtiment.

Figure 4 Power label on the left side of the Trek amplifier rear panel.

Insulation Block and Geometry Adapters

The insulation block (below, left) is mounted on the underside of the transducer stage and is used in conjunction with the upper geometry adapter (below, right).

Note that if you are not using an Advanced Peltier System (APS) or Peltier Plate, it is necessary to install the lower geometry adapter (shown in Figure 21).

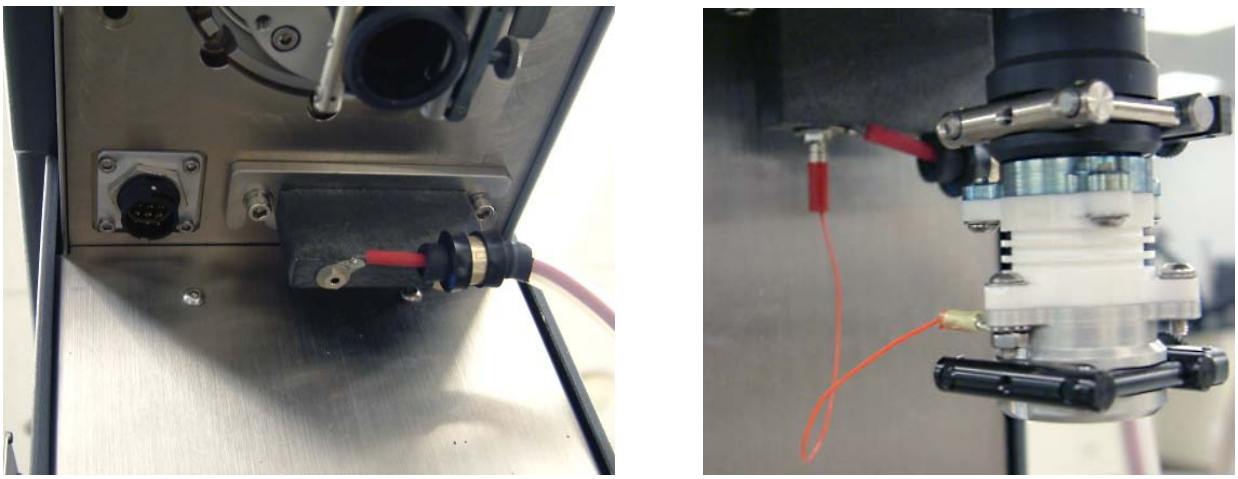


Figure 5 Insulation block (left) and upper geometry adapter.

Polycarbonate ER Shield

The polycarbonate ER shield is a mandatory component of the ER Accessory; as a safety feature, the ER Accessory will not function unless the shield is installed properly.

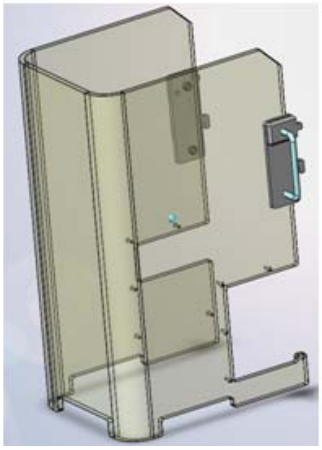


Figure 6 ER shield.

The shield comes with several panels; the panels to use on the shield depend upon your Environmental System configuration. For more information, see "Installing the Polycarbonate ER Shield" on page 30.

ER Accessory Specifications

Table 1: ER Accessory Specifications

Item/Area	Specification
Geometry	Only stainless steel plates and concentric cylinders are compatible with applicable temperature systems
Temperature system compatibility	Peltier Plate and Advance Peltier System (APS)
Temperature range	Depends on environmental system; widest possible range of –40 to 180°C from Peltier Plate
Voltage supply interface	IEEE internal to instrument
High-voltage power amplifier	TREK Model 609E-6
Maximum voltage	0 to 4,000 VDC; 4,000 VAC peak (8,000 peak-peak)
Output current range	0 to ± 20 mA
Function/waveform generator	Agilent Models 33210A
Safety	Polycarbonate ER shield cover with interlock switch

Chapter 2:

Installing the ER Accessory

This chapter briefly describes the installation of the ER Accessory on the ARES-G2 Rheometer.

The ER Accessory is used in conjunction with a Trek amplifier and Agilent function/waveform generator. For safety and other important information related to your amplifier and function generator, refer to the appropriate documentation.

NOTE: Proper installation of the ER Accessory requires a TA Instruments Service Representative to install a communication board into the instrument. Contact TA Instruments for more information.

WARNING: High voltage is used in the operation of the equipment described herein. Operating personnel must at all times observe all safety regulations governing the installation, operation, and calibration of equipment utilizing high voltage. Death on contact may result if operating personnel fail to observe safety precautions. Learn the area of high voltage connections, and exercise care not to contact these areas when installing, operating, or calibrating this equipment. Do not replace components or cables while power is applied. To avoid injuries or death, always remove power, and discharge and ground an electrical circuit before touching it. Prior to operating this equipment, remove all jewelry. Do not make physical contact with any high voltage connection while power is applied.

AVERTISSEMENT: Des tensions élevées sont utilisées dans le fonctionnement de l'équipement décrit dans le présent document. Le personnel d'exploitation doit toujours respecter toutes les règles de sécurité régissant l'installation, l'utilisation et l'étalonnage de l'équipement utilisant de la haute tension. Si le personnel d'exploitation ne respecte pas les précautions d'utilisation, il peut en résulter la mort au contact de cet instrument. Familiarisez-vous avec la zone des raccordements haute tension et faites preuve de prudence pour ne pas toucher ces zones lors de l'installation, l'utilisation ou l'étalonnage de cet équipement. Ne remplacez pas les composants ou les câbles lorsque l'instrument est sous tension. Pour éviter des blessures ou la mort, coupez toujours l'alimentation, déchargez et mettez le circuit électrique à la terre avant de le toucher. Avant d'utiliser cet équipement, retirez tous vos bijoux. N'établissez pas de contact physique avec un raccordement haute tension lorsque l'équipement est sous tension.

NOTE: Refer to TRIOS software Online Help for block diagrams of the various ER configurations.

Preparing the ARES-G2

NOTE: Refer to your instrument documentation for detailed procedures on removing and reassembling components.

1 Raise the stage to maximum height.

2 Remove all upper and lower test geometries as well as upper and lower PRTs (if installed).

3 Thoroughly inspect the geometry mounting surfaces (that is, the transducer anvil and the motor anvil) and clean off any material that may interfere with the mounting of the upper or lower geometry.

Installing the ER Accessory on the ARES-G2

The ER Accessory can be used as a standalone option or in conjunction with the APS or Peltier Plate. This section details the installation for these three configurations.

To install the ER Accessory, follow the instructions below:

1 Using two 10-32 screws (included in the kit), secure the insulation block to the underside of the transducer stage as follows:

a Partially install one screw into the screw hole on the left (shown below).

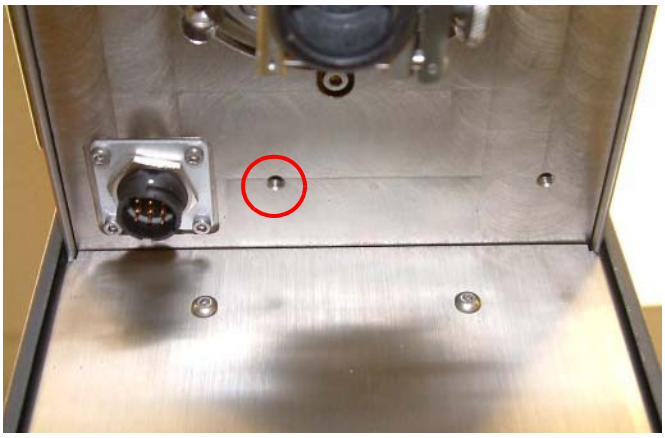


Figure 7 Insulation block screw hole location on transducer stage.

b Position the insulation block under the transducer stage with the high-voltage cable run to the right (while facing the instrument). Slide the notch on the left side of the insulation block over the partially-installed screw.

c Fully install the other 10-32 screw on the right side of the insulation block, and then tighten down the left-side screw to complete insulation block installation. See the figure below.

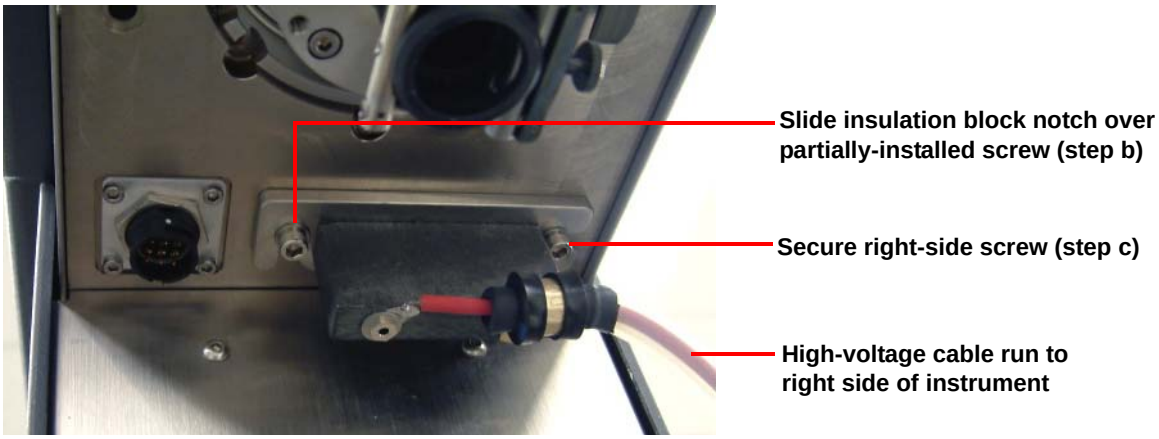


Figure 8 Insulation block installed.

2 Install the upper geometry adapter:

a Remove the large thumbscrew from the transducer anvil and replace it with the smaller thumbscrew included in the ER Accessory kit.

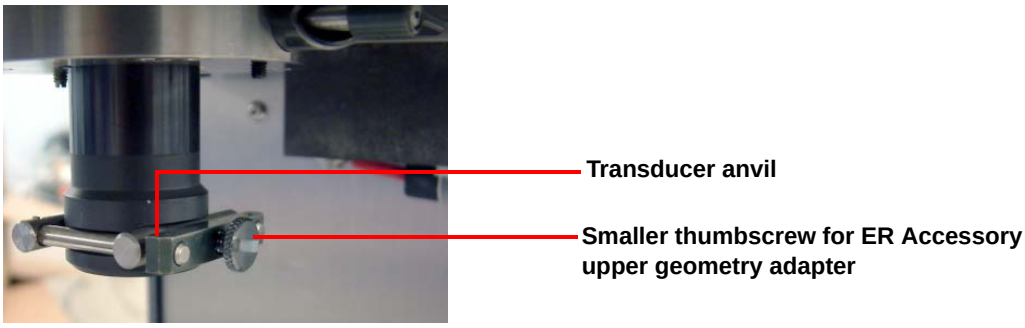


Figure 9 Smaller thumbscrew installed on transducer anvil.

b Install the upper geometry adapter as you would any other ARES-G2 geometry. Plug the upper geometry adapter signal cable into the insulation block, as shown below.

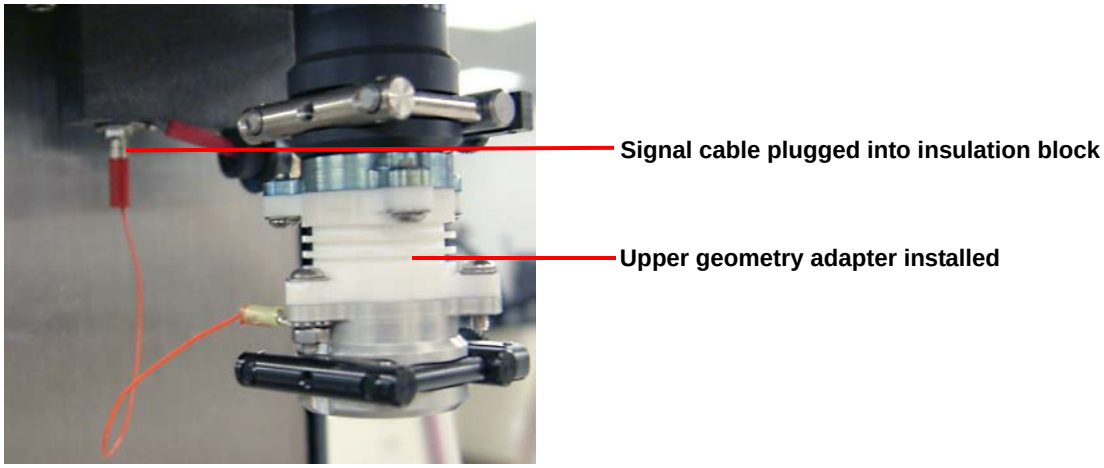


Figure 10 Upper geometry adapter installed.

3 Place the amplifier on a bench or table that is in close proximity to the instrument.

4 Plug the high-voltage cable into the rear of the amplifier and connect the ground cable to the amplifier ground connector.

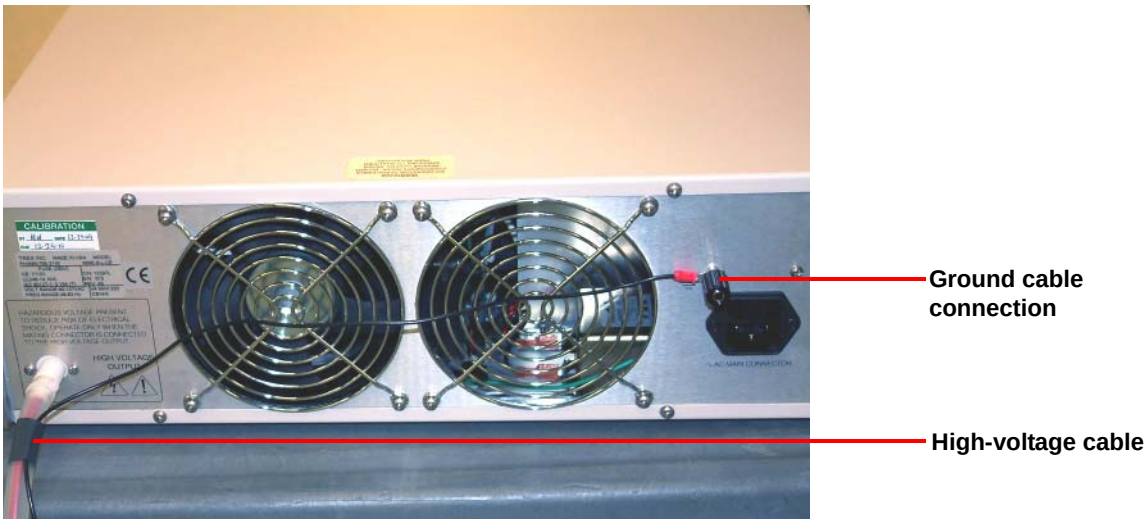


Figure 11 Amplifier high-voltage cable and ground connections.

5 Plug the power cable into the back of the amplifier.

6 Place the function generator on top of the amplifier, and install the power cord into the function generator.

7 Obtain the amplifier input cable. Plug the cable connector labeled **WAVEFORM GENERATOR OUTPUT** into the **Output** connector on the front panel of the function generator. Plug the connector labeled **H.V. AMP. INPUT** into the **INPUT** connector on the amplifier.

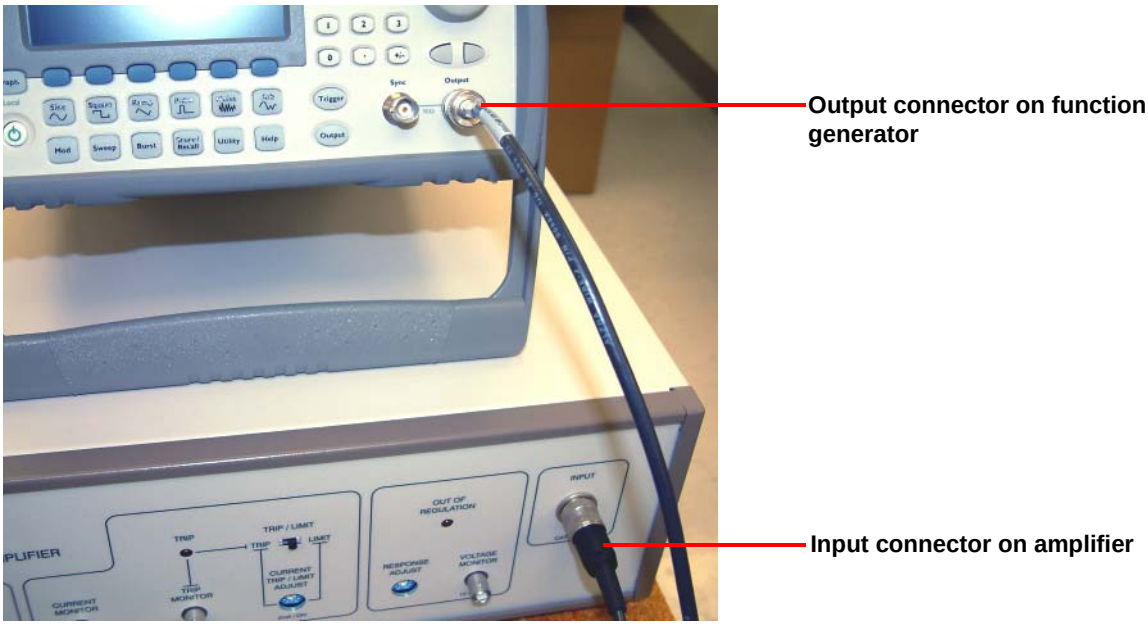


Figure 12 Amplifier input cable connections.

8 Plug one end of the GPIB cable into the GPIB connector on the rear panel of the ARES-G2.

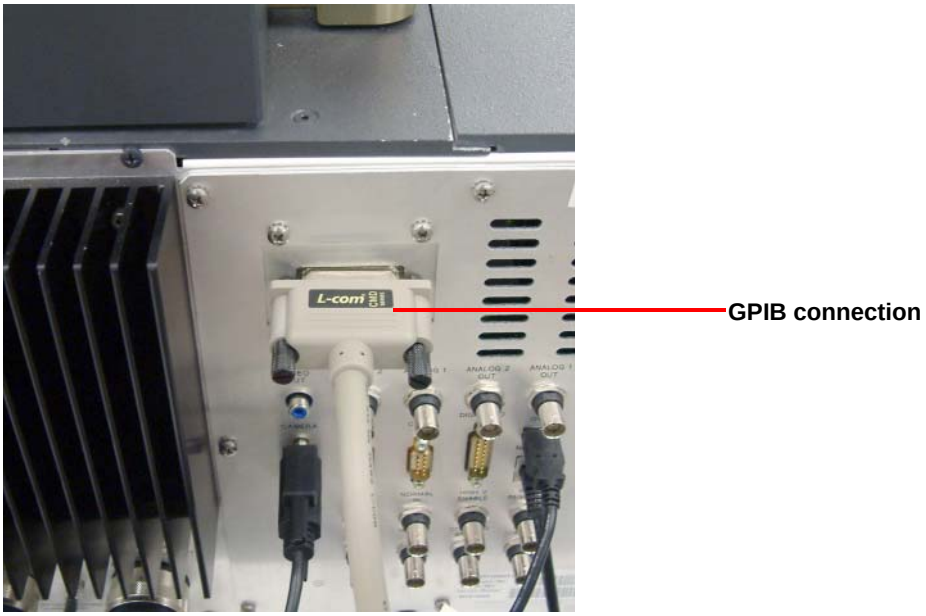


Figure 13 GPIB connection on rear panel of ARES-G2.

9 Plug the other end of the GPIB cable into the **GPIB** connector on the rear panel of the function generator.

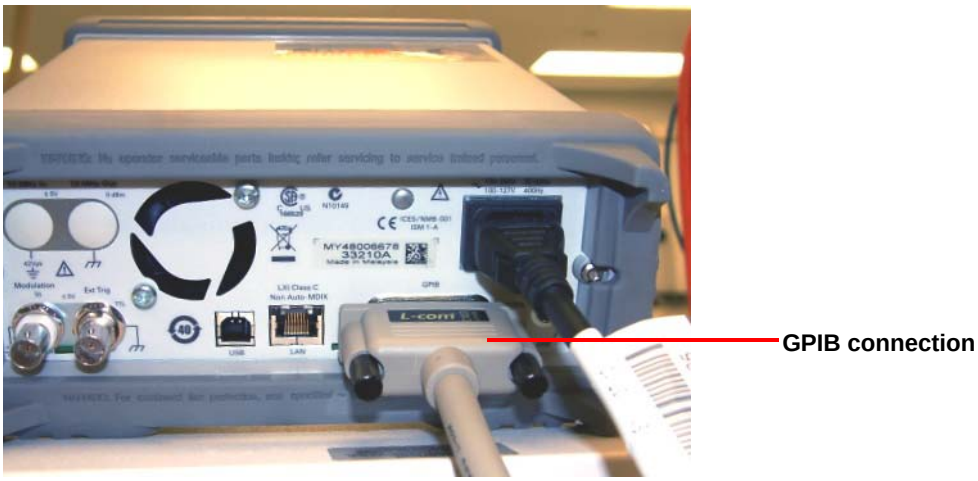


Figure 14 GPIB connection on rear panel of function generator.

10 Connect a BNC cable from the **VOLTAGE MONITOR** connector on the amplifier front panel to the **ANALOG 1 IN** connector on the ARES-G2 rear panel. See Figure 15 (top image).

11 Connect the other BNC cable from the **CURRENT MONITOR** connector on the amplifier front panel to the **ANALOG 2 IN** connector on the ARES-G2 rear panel. See the bottom image in Figure 15.

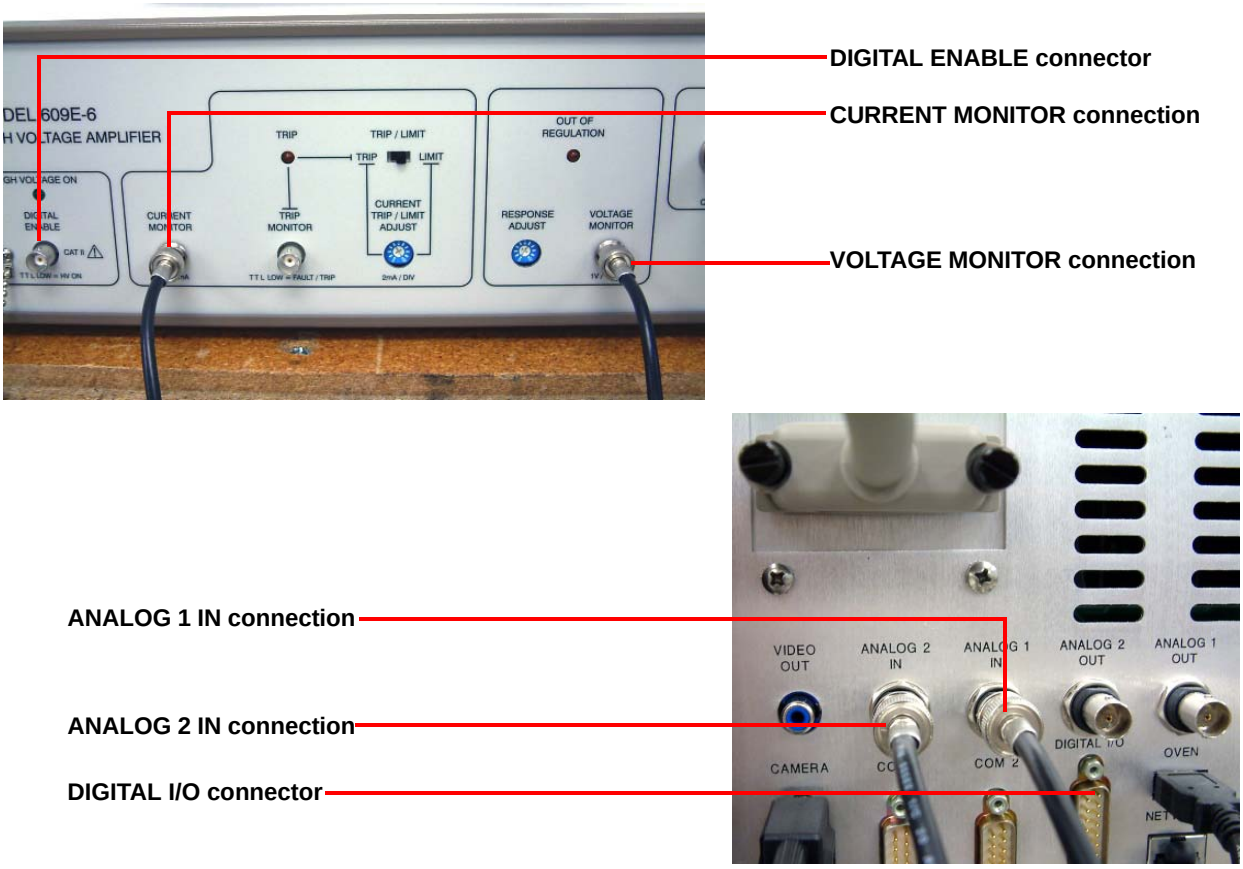


Figure 15 BNC cable connections from amplifier (top image) to ARES-G2 rear panel (bottom image).

12 Install an interlock bracket onto each slide on the ARES-G2. The procedure is identical for both sides of the ARES-G2, but it is important to note the orientation of the interlock bracket for each side.

a Remove the top M4 x 10-mm LG screw and flat washer from the ARES-G2 striker plate, as shown below (right side of instrument shown). Leave the external tooth lock washer on the striker plate.

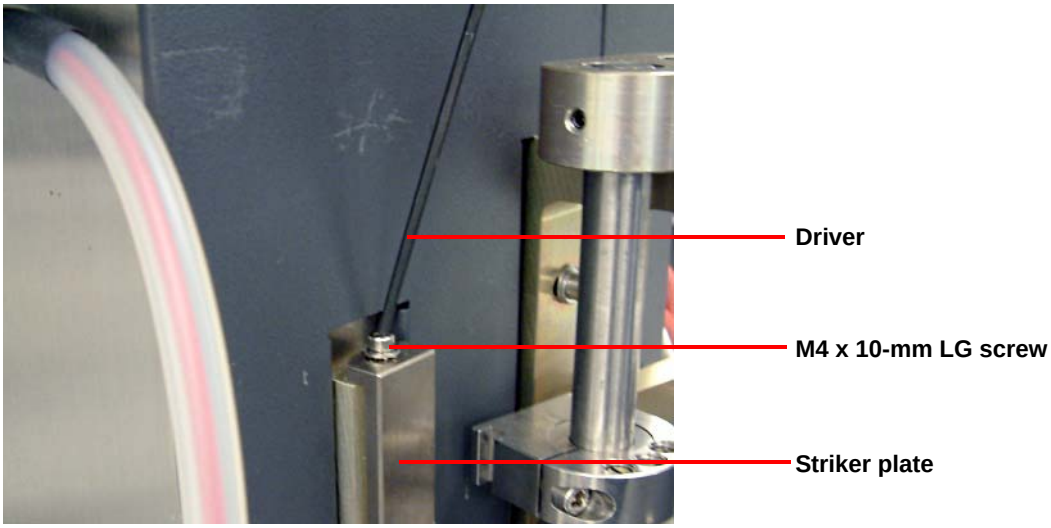


Figure 16 Removing M4 x 10-mm LG screw from ARES-G2 striker plate.

b Place the flat washer first, then the included M4 x 10-mm LG screw onto the interlock bracket notch identified below. The M4 screws and spares for both washers are included in the ER Accessory kit.

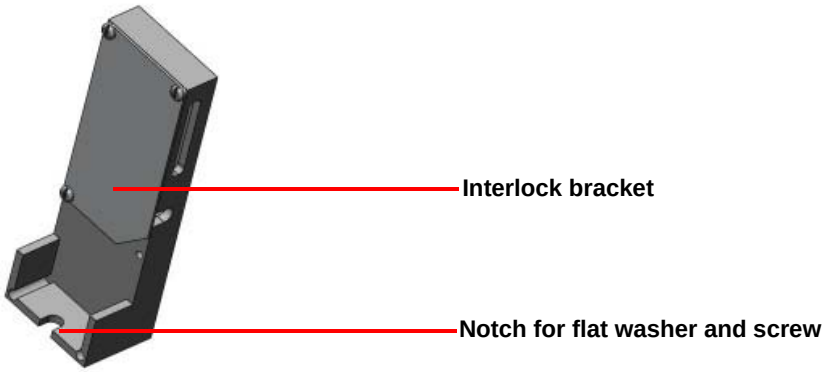


Figure 17 Interlock bracket for right side of ARES-G2 and notch for flat washer and screw.

c Position the interlock bracket on top of the striker plate and lock nut washer, ensuring that the interlock cable is running towards the back of the ARES-G2 and the interlock switch is facing the front of the instrument. Refer to Figure 18 for proper orientation on the right side of the ARES-G2.

NOTE: The lock nut washer should be between the underside of the interlock bracket and the top of the ARES-G2 striker plate.

d Use the supplied long driver to secure the interlock switch to the ARES-G2 striker plate by tightening down the long screw, as shown below.

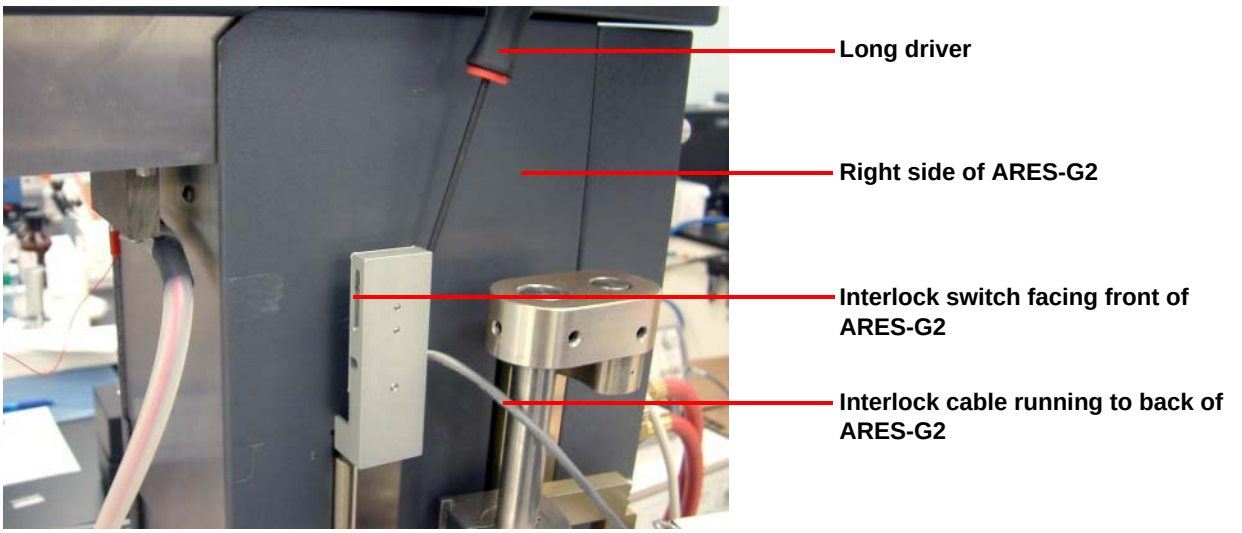


Figure 18 Securing interlock bracket to ARES-G2 striker plate.

e Repeat this procedure for the left side of the ARES-G2, again ensuring that the interlock cable is running to the back of the instrument and the interlock switch is facing the front of the instrument.

f Plug one end of the interlock cable connection into the **DIGITAL I/O** connector on the rear panel of the ARES-G2. Connect the other end of this cable into the **DIGITAL ENABLE** connector on the amplifier. Refer to Figure 15 for connection locations.

13 Proceed with the installation that is applicable to your configuration:

- If you are installing the ER Accessory as a standalone (ambient) option, continue to step 14.
- If you are installing the ER Accessory with the APS, see "Installing the ER Accessory with the APS" on page 24.
- If you are installing the ER Accessory with the Peltier Plate, see "Installing the ER Accessory with the Peltier Plate" on page 28.

14 Obtain the lower housing and knurled nut, and place the knurled nut over the housing as shown below. Note the orientation of the housing pin and housing slot.

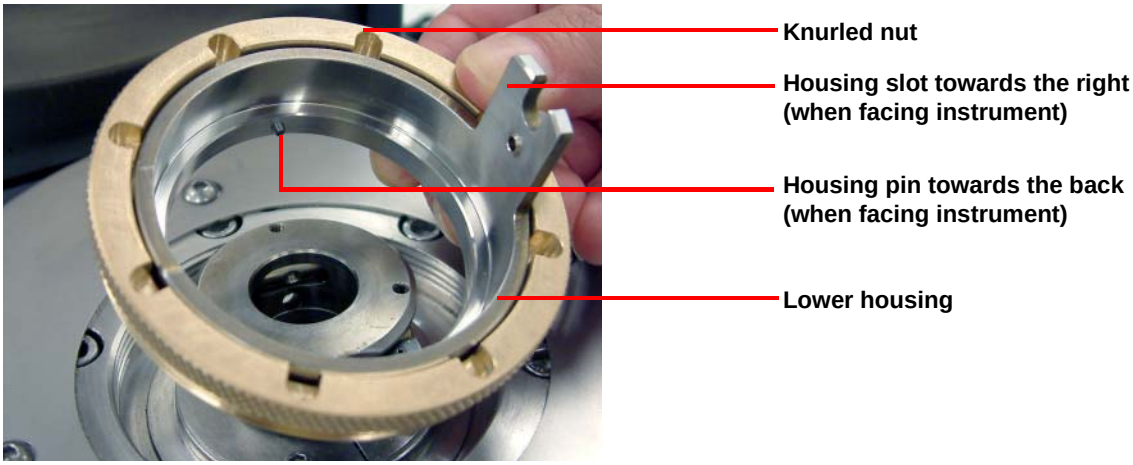


Figure 19 Lower housing and knurled nut assembly.

15 With the motor anvil thumbscrew facing towards the front of the instrument, seat the lower housing alignment pin into the notch in the motor housing (the pin and notch should be located toward the rear of the instrument). It may be necessary to rotate the lower housing and knurled nut assembly back and forth until the pin falls into the notch. Verify that the knurled nut rests in the threaded portion of the motor housing, then tighten the nut using the spanner wrench included in the kit.

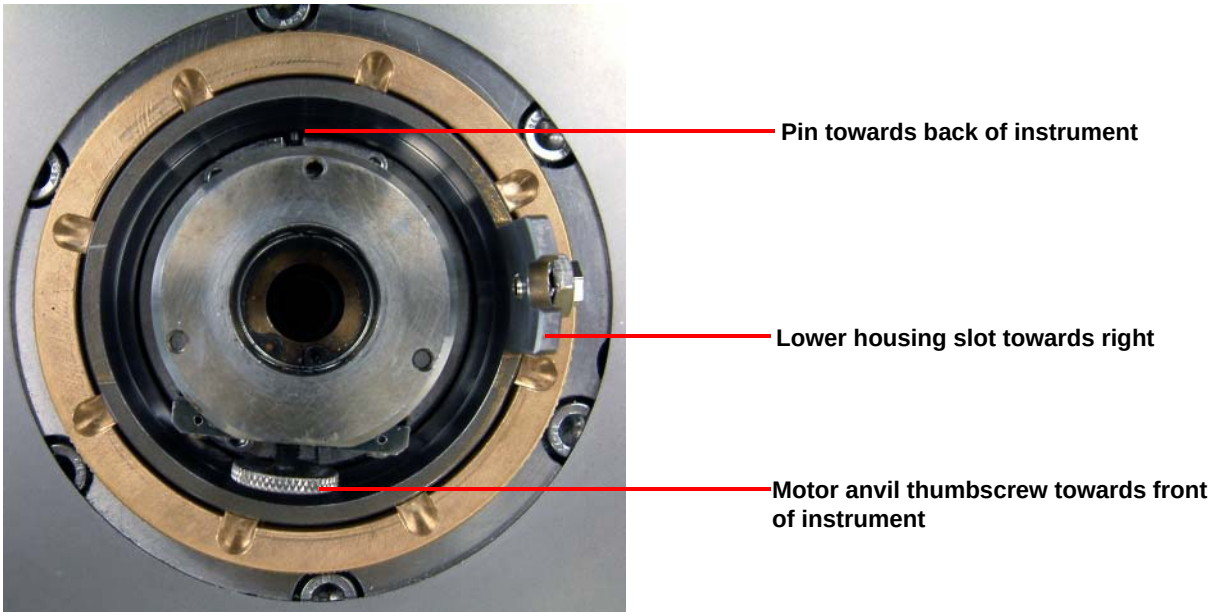


Figure 20 Top-down view of lower housing and knurled nut assembly installed in motor housing.

16 Install the lower geometry adapter as you would any other ARES-G2 geometry. Ensure that the small rubber tube on the lower geometry adapter is resting in the lower housing slot, and ensure that the geometry adapter thumbscrew is aligned with the motor anvil thumbscrew (towards the front of the instrument), as shown below.

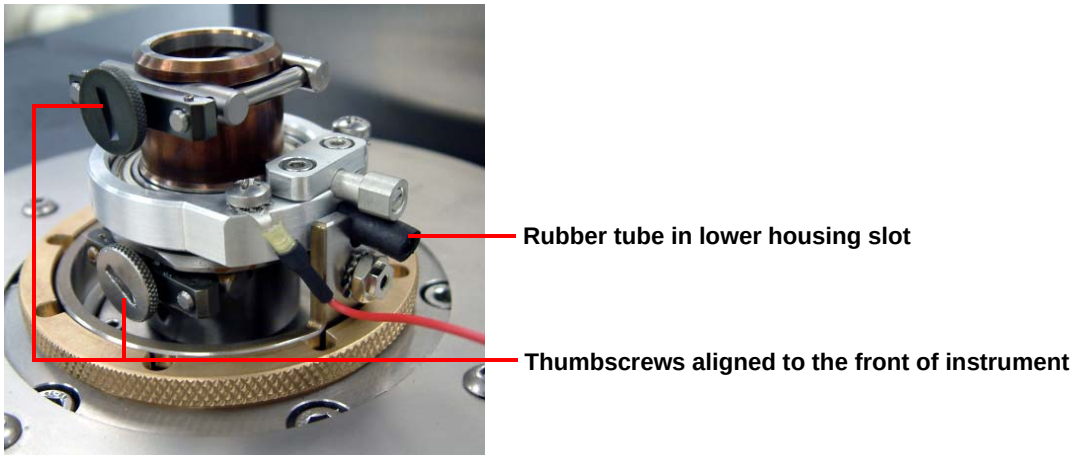


Figure 21 Lower geometry adapter installed.

17 Insert the lower geometry adapter ground wire into the lower housing ground connector. Refer to Figure 22 to see this connection.

18 Remove the lower geometry adapter grounding screw identified below. Obtain the high-voltage cable ground wire and connect it to the lower geometry adapter by re-installing the grounding screw on the grounding cable ring lug.

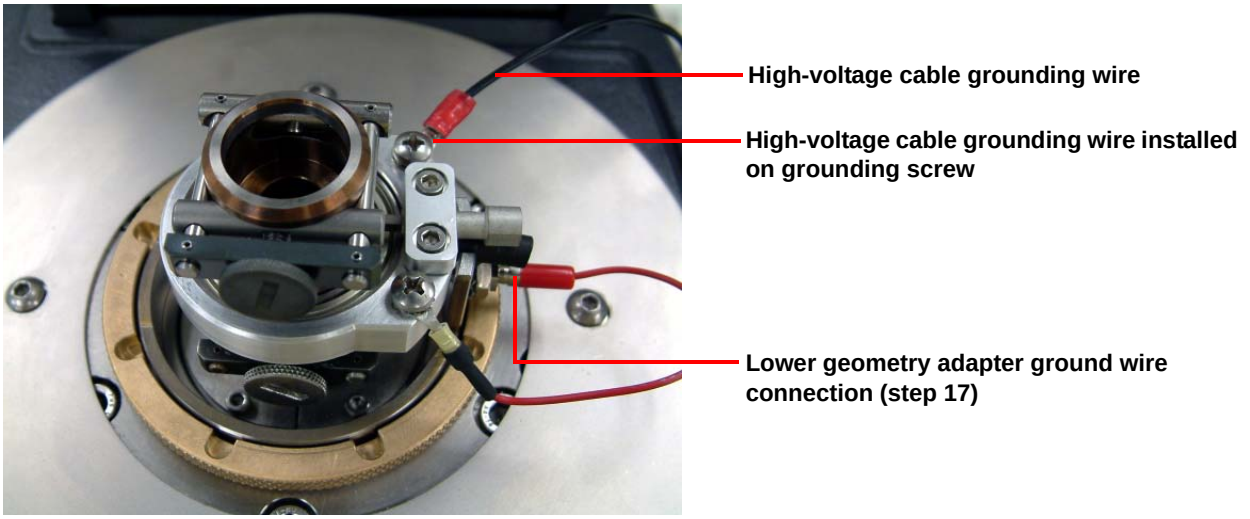


Figure 22 Lower geometry adapter and lower housing ground connections.

19 Install your desired upper and lower geometries.

20 To complete installation, see "Installing the Polycarbonate ER Shield" on page 30.

Installing the ER Accessory with the APS

This section assumes that the procedure in "Installing the ER Accessory on the ARES-G2" is completed up to step 13.

Follow the instructions below to complete the ER Accessory installation for use with an APS:

1 Remove the APS top plate and solvent trap alignment ring by removing the screw shown below.

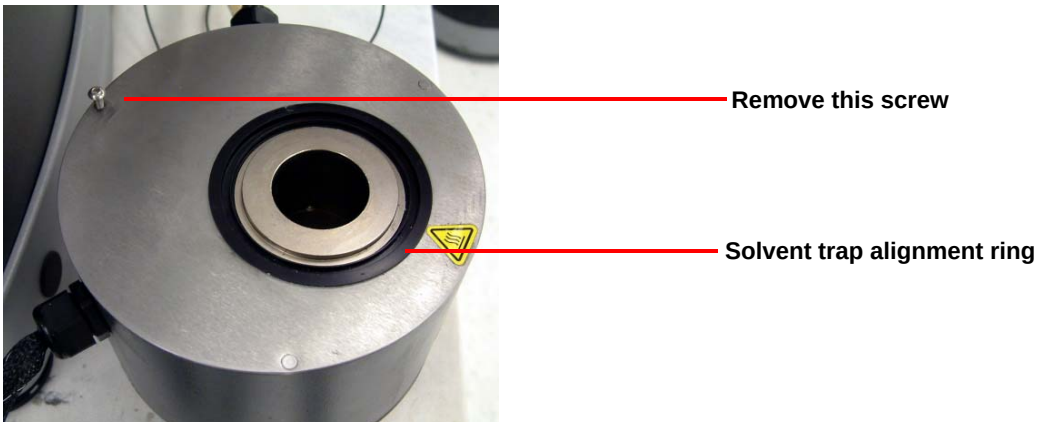


Figure 23 APS top plate screw to remove.

2 The APS requires a special top plate when it is used with the ER Accessory. Therefore, it is necessary to remove the ground wire from within the APS body and install the ground wire to the underside of the new APS top plate.

a From within the APS body, remove the screw indicated below to obtain the APS ground wire. Pull the wire out of the APS body, and reinstall the screw into the APS body to save for future use.

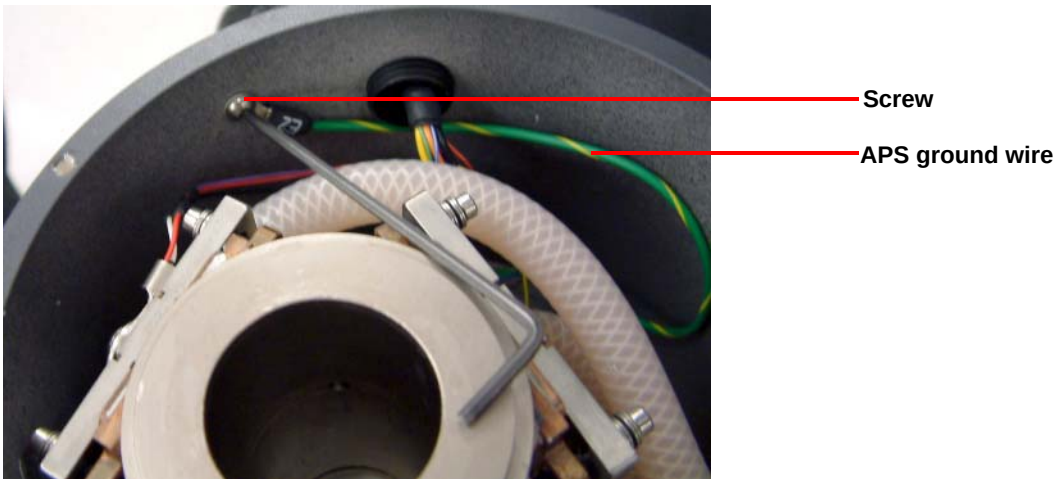


Figure 24 APS ground wire.

b Connect the APS ground wire to the underside of the ER APS top plate, as shown below.

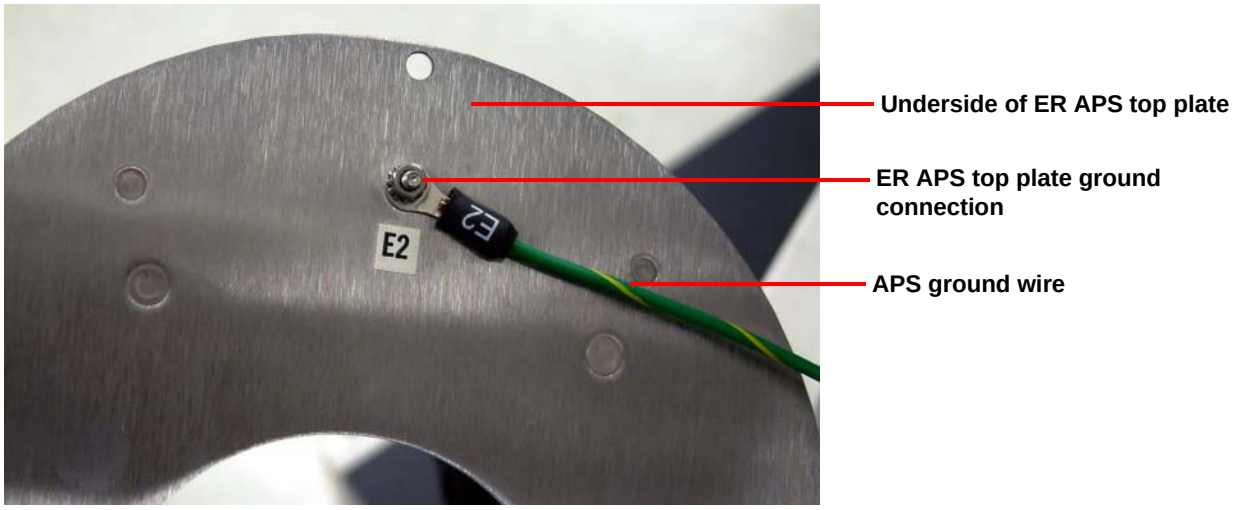


Figure 25 Ground connection on underside of ER APS top plate.

3 Install the ER APS top plate onto the APS body using the top plate screw removed in step 1 above. Then re-install the black solvent trap alignment ring. See Figure 26.

4 Connect the high-voltage cable ground wire to the APS top plate by removing the top plate ground screw, placing the ring lug over the screw hole, and reinstalling the ground screw. Use the supplied wrench to fully tighten the screw. See the figure below.

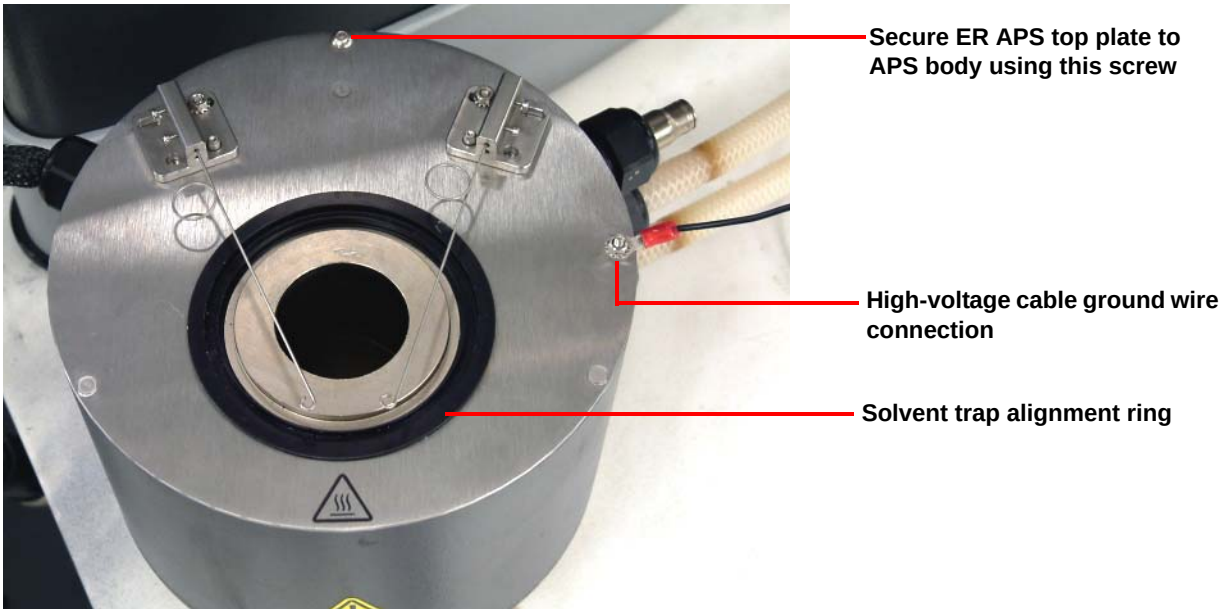


Figure 26 ER APS top plate, solvent trap alignment ring, and ground wire installed.

5 Mount the APS onto the motor housing and plug in the accessory cable. If necessary, refer to the *ARES-G2 Advanced Peltier System (APS) Getting Started Guide* for instructions.

6 Install the lower geometry.

If using the quick-change plates: install the PRT into the motor housing, then install your desired stainless steel quick-change plate. If necessary, refer to the *ARES-G2 Advanced Peltier System (APS) Getting Started Guide* for instructions.

WARNING: When using the ER APS system with plate geometries, ALWAYS use stainless steel quick change plate geometries. These geometries are designed with a groove to accommodate the APS ground springs; the ER APS configuration is not safe to operate without this ground connection.

AVERTISSEMENT: Lorsque vous utilisez le système ER APS avec des géométries de plaque, utilisez TOUJOURS des géométries de plaque en acier inoxydable à changement rapide. Ces géométries sont conçues avec une rainure pour adapter les ressorts de terre APS ; en effet, la configuration de l'ER APS ne permet pas de l'utiliser en toute sécurité sans cette prise de parc.

If installing the ER APS-specific stainless steel cup (with built-in PRT):

a Obtain the ER APS cup shown below.

Figure 27 ER APS cup.

b Install the ER APS cup top grooved plate (included in the ER Accessory kit) using three screws, as shown below. Ensure that the red mark on the top plate is aligned with the mark on the top of the cup.

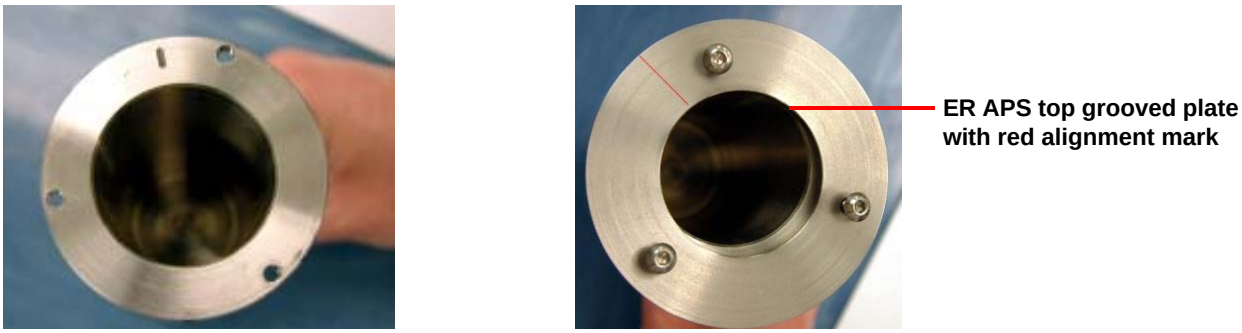


Figure 28 Installing the ER APS cup top grooved plate.

7 If necessary, remove the upper geometry adapter from the transducer anvil.

8 Install the ER APS cup geometry:

a Ensure that the motor anvil thumbscrew is facing towards the front of the instrument.

b With the cup PRT's red dot pointing 90 degrees to the left of the motor thumbscrew, insert the ER APS cup into the motor housing.

c Press the geometry into the bore to compress the spring-loaded PRT, and while holding the geometry in position, tighten the motor anvil thumbscrew to lock the geometry into place using the 5 in-lb APS torque screwdriver.

9 Position the APS top plate pressure contacts so that they both rest in the groove of the ER APS cup (shown below) or in the groove of the quick change plate. See Figure 30 for correct pressure contact orientation.

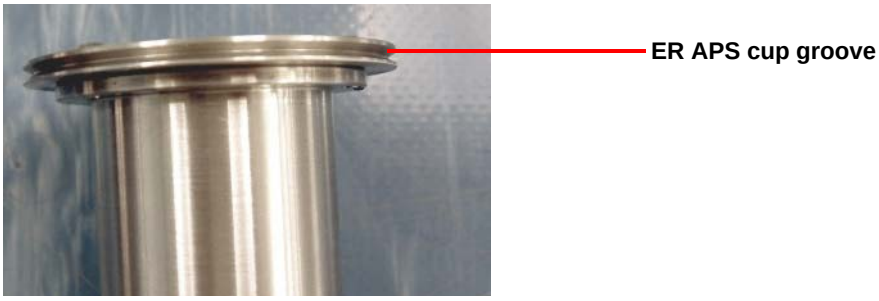


Figure 29 APS lower geometry grooves (cup shown).

10 Re-install the upper geometry adapter onto the transducer anvil.

11 Install your desired upper geometry, ensuring that it is a stainless steel geometry. Note that the upper geometry does **not** use a PRT.

12 Connect the necessary hoses to the APS; refer to the *APS Getting Started Guide* for instructions, if necessary.

13 The figure below shows a typical ER APS cup and bob configuration. To complete installation, see "Installing the Polycarbonate ER Shield" on page 30.

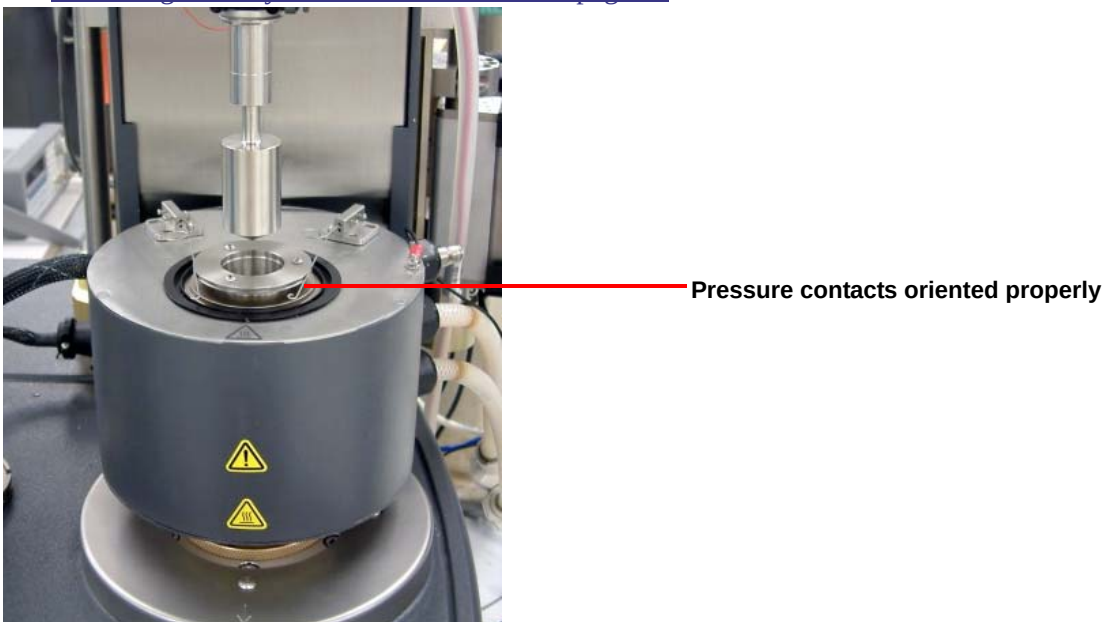


Figure 30 Typical ER APS configuration.

Installing the ER Accessory with the Peltier Plate

This section assumes that the procedure in "Installing the ER Accessory on the ARES-G2" is completed up to step 13.

CAUTION: If the ER Accessory is being installed on an existing system that uses a Peltier Plate, contact TA Service to verify that your Peltier Plate is of a specific design that will enable it to function properly with the ER Accessory. Failure to do so may lead to system damage.

MISE EN GARDE: Si l'accessoire ER est installé sur un système existant qui utilise une plaque Peltier, contactez le service d'entretien de TA pour vous assurer que votre plaque Peltier est issu d'un modèle spécifique qui lui permet de fonctionner correctement avec l'accessoire ER. Le non-respect de cette précaution risque d'endommager le système.

Follow the instructions below to complete the ER Accessory installation for use with a Peltier Plate:

1. Plug in the accessory cable and then mount the Peltier Plate onto the motor housing. If necessary, refer to the *ARES-G2 Peltier Plate Installation Instructions*.
2. Connect the high-voltage cable ground wire to the Peltier Plate top by removing the plate ground screw, placing the ring lug over the screw hole, and reinstalling the ground screw. The ground wire should be positioned so that it allows the gray cover to be raised up.

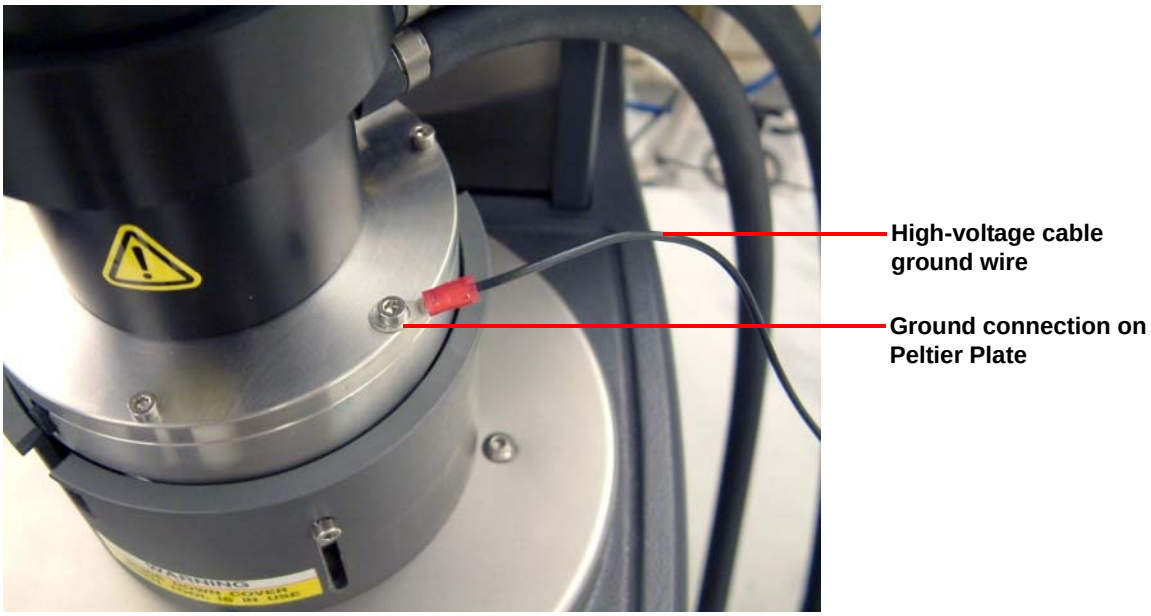


Figure 31 High-voltage cable ground wire connection on Peltier Plate.

3. Install your desired upper geometry.

NOTE: When using the ER Peltier Plate system, you must use ER Peltier Plate-specific 50-mm or 25-mm plate geometries. These plates are shorter in length than standard plates and are necessary for use with the ER Peltier Plate configuration. See "Replacement Parts" on page 36 for plate part numbers.

4. Connect the necessary hoses to the Peltier Plate; refer to the *ARES-G2 Peltier Plate Installation Instructions* for details, if necessary.

5 The figure below shows a typical ER Peltier Plate configuration. Note the short-stemmed top plate geometry. To complete installation, see "Installing the Polycarbonate ER Shield" on page 30.

Figure 32 Typical ER Peltier Plate configuration.

Installing the Polycarbonate ER Shield

The ER shield is a mandatory safety component of the ER Accessory. Without the safety shield interlock, the Trek amplifier will not be enabled.

The shield comes with several panels; the panels to use on the shield depend upon your system configuration. See the instructions below to assemble and install the ER shield.

1 Determine which shield configuration you require based upon the diagrams below. Obtain the necessary parts from the kit.

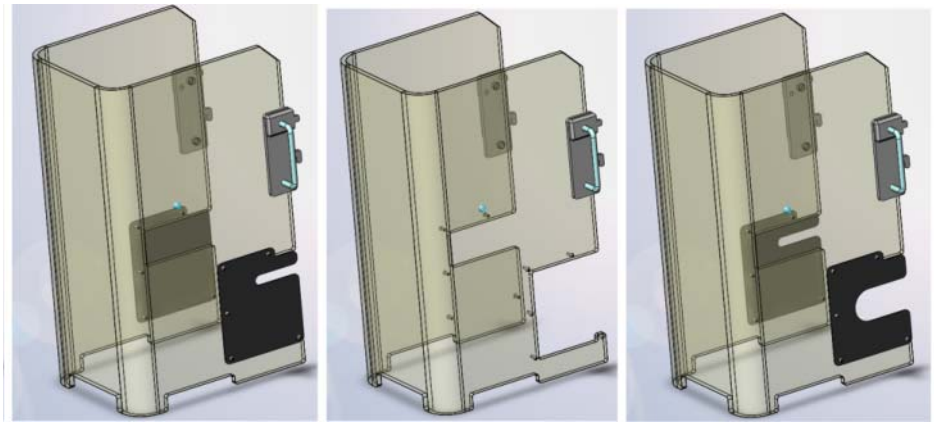


Figure 33 ER shield assembly options.

2 Install the appropriate panels onto the shield using the supplied M3 screws.

3 Using the handles on the shield, place the shield over the ARES-G2 stage. Carefully position the high-voltage cable into a slot on the right side of the ER shield. If using an APS or Peltier Plate, carefully orient the hoses and Smart Swap cable in the appropriate slots.

4 Complete the installation by inserting the shield interlock tabs (identified below) into the interlock brackets located on both sides of the ARES-G2.

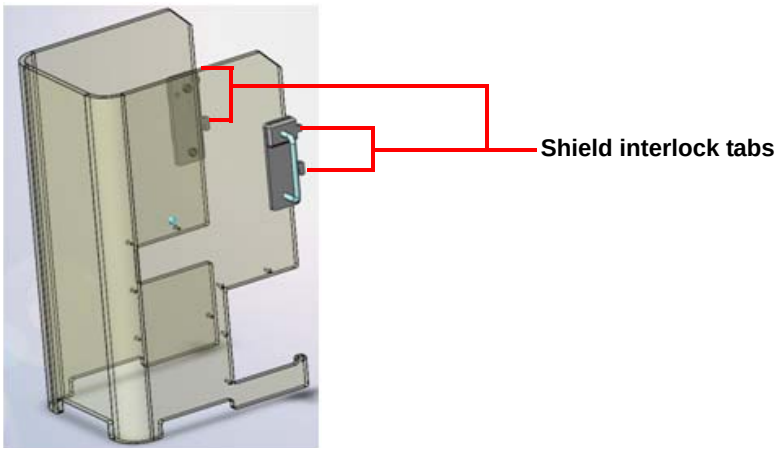


Figure 34 ER shield interlock tabs.

NOTE: The ER Accessory will not function unless these interlock tabs are properly inserted into the interlock brackets.

5 The image below shows a typical ambient ER Accessory setup, complete with parallel plate geometries the ER shield.

Figure 35 ER Accessory ambient configuration.

6 This completes installation of the ER Accessory. Proceed to the next chapter for operational and maintenance information.

Chapter 3:

Operating and Maintaining the ER Accessory

This chapter briefly describes the operation and maintenance of the ARES-G2 ER Accessory.

Establishing Connection with TRIOS

In order to operate the ER Accessory, you must first establish a connection through the instrument control software (TRIOS software).

1 Power on the function generator and amplifier.

2 Connect to the instrument through TRIOS software.

3 Click the TRIOS icon at the top left corner of the application.

4 Select **Options** from the drop-down menu.

5 Select **ARES G2** > **Options** to display a list of hardware configuration options.

6 Click **Accessory** to access the **Hardware Accessories** menu.

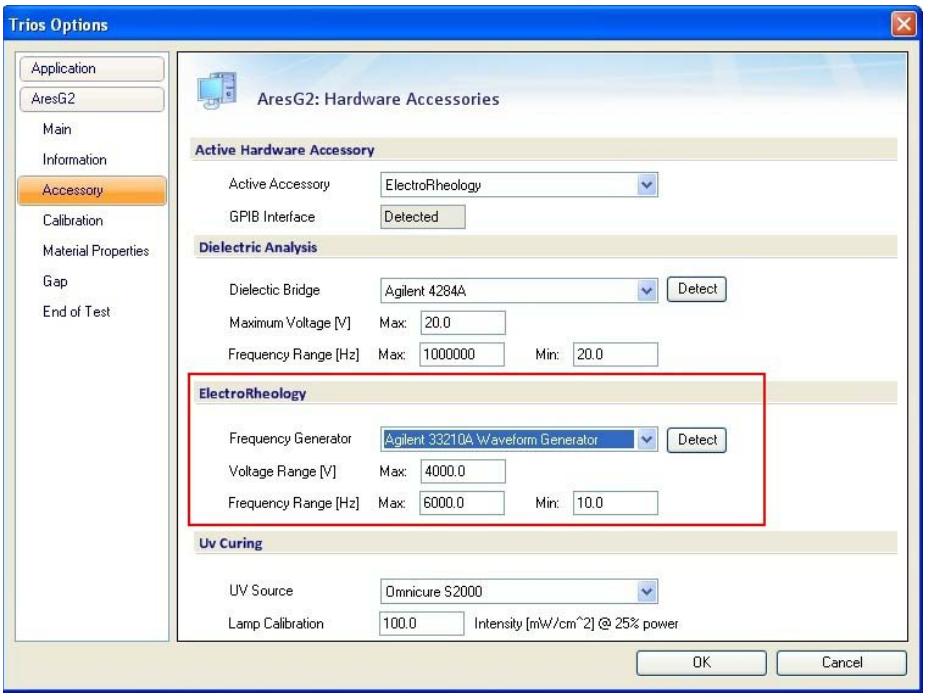
7 Select **ElectroRheology** as the **Active Hardware Option**.

8 From the **ElectroRheology** section:

a Select the **Agilent 33210A Function Generator** from the **Frequency Generator** drop-down list.

b The **Voltage Range** and **Frequency Range** for the **Agilent 33210A Function Generator** are pre-set values and cannot be changed.

9 Click **OK** to save configuration and close TRIOS Options window.



Operating the ER Accessory .

WARNING: DO NOT insert a digital enable shorting plug (shown on page 11) into the Trek amplifier when operating the ER Accessory. The ER Accessory is not safe to operate if the digital enable shorting plug is installed in the amplifier.

AVERTISSEMENT: N'insérez pas une fiche de court-circuit à activation numérique (illustrée sur la page 12) dans l'amplificateur Trek lors de l'utilisation de l'accessoire ER. L'accessoire ER ne peut pas être utilisé en toute sécurité si la fiche de court-circuit à activation numérique est installée dans l'amplificateur.

WARNING: The Trek amplifier is available in two configurations: 110V and 220V. Before operating the ER Accessory, refer to the power label on the rear panel of the Trek amplifier to ensure that the amplifier's configuration is sufficient for your building's power capabilities. See page 12 for more information.

AVERTISSEMENT: L'amplificateur Trek est disponible en deux configurations : 110 V et 220 V. Avant d'utiliser l'accessoire ER, consultez l'étiquette des caractéristiques électriques apposée sur le panneau arrière de l'amplificateur TREK pour vous assurer que la configuration de l'amplificateur est appropriée à la tension de la ligne de votre bâtiment. Voir la page 13 pour plus de renseignements.

WARNING: High voltage is used in the operation of the equipment described herein. Operating personnel must at all times observe all safety regulations governing the installation, operation, and calibration of equipment utilizing high voltage. Death on contact may result if operating personnel fail to observe safety precautions. Learn the area of high voltage connections, and exercise care not to contact these areas when installing, operating, or calibrating this equipment. Do not replace components or cables while power is applied. To avoid injuries or death, always remove power, and discharge and ground an electrical circuit before touching it. Prior to operating this equipment, remove all jewelry. Do not make physical contact with any high voltage connection while power is applied.

AVERTISSEMENT: Des tensions élevées sont utilisées dans le fonctionnement de l'équipement décrit dans le présent document. Le personnel d'exploitation doit toujours respecter toutes les règles de sécurité régissant l'installation, l'utilisation et l'étalonnage de l'équipement utilisant de la haute tension. Si le personnel d'exploitation ne respecte pas les précautions d'utilisation, il peut en résulter la mort au contact de cet instrument. Familiarisez-vous avec la zone des raccordements haute tension et faites preuve de prudence pour ne pas toucher ces zones lors de l'installation, l'utilisation ou l'étalonnage de cet équipement. Ne remplacez pas les composants ou les câbles lorsque l'instrument est sous tension. Pour éviter des blessures ou la mort, coupez toujours l'alimentation, déchargez et mettez le circuit électrique à la terre avant de le toucher. Avant d'utiliser cet équipement, retirez tous vos bijoux. N'établissez pas de contact physique avec un raccordement haute tension lorsque l'équipement est sous tension.

Operating the ER Accessory on the ARES-G2 requires the following steps:

1 Selecting and preparing the sample.

2 Selecting and installing the geometry.

NOTE: When using the ER APS system, ALWAYS use stainless steel quick-change plate geometries.

NOTE: When using the ER Peltier Plate system, you must use ER Peltier Plate-specific 50 mm or 25 mm plate geometries. These plates are shorter in length than standard plates and are necessary for use with the ER Peltier Plate configuration. See “Replacement Parts” on page 36 for geometry part numbers.

3 Setting up your experiment through TRIOS software.

4 Zeroing the gap at the subsequent, initial experimental temperature.

5 Loading and trimming the sample, as required.

6 Starting the test.

For more information on setting up and running ER Accessory experiments in TRIOS software, refer to TRIOS software Help.

Maintaining the ARES-G2 ER Accessory

WARNING: High voltage is used in the operation of the equipment described herein. Operating personnel must at all times observe all safety regulations governing the installation, operation, and calibration of equipment utilizing high voltage. Death on contact may result if operating personnel fail to observe safety precautions. Learn the area of high voltage connections, and exercise care not to contact these areas when installing, operating, or calibrating this equipment. Do not replace components or cables while power is applied. To avoid injuries or death, always remove power, and discharge and ground an electrical circuit before touching it. Prior to operating this equipment, remove all jewelry. Do not make physical contact with any high voltage connection while power is applied.

AVERTISSEMENT: Des tensions élevées sont utilisées dans le fonctionnement de l'équipement décrit dans le présent document. Le personnel d'exploitation doit toujours respecter toutes les règles de sécurité régissant l'installation, l'utilisation et l'étalonnage de l'équipement utilisant de la haute tension. Si le personnel d'exploitation ne respecte pas les précautions d'utilisation, il peut en résulter la mort au contact de cet instrument. Familiarisez-vous avec la zone des raccordements haute tension et faites preuve de prudence pour ne pas toucher ces zones lors de l'installation, l'utilisation ou l'étalonnage de cet équipement. Ne remplacez pas les composants ou les câbles lorsque l'instrument est sous tension. Pour éviter des blessures ou la mort, coupez toujours l'alimentation, déchargez et mettez le circuit électrique à la terre avant de le toucher. Avant d'utiliser cet équipement, retirez tous vos bijoux. N'établissez pas de contact physique avec un raccordement haute tension lorsque l'équipement est sous tension.

The maintenance required for the ARES-G2 ER Accessory consists of the following tasks:

- Routinely check the cabling connections to ensure proper connections and cable integrity. If any of the cables become worn or frayed, DO NOT attempt to operate the system. Contact TA Instruments Service immediately.
- Thoroughly clean the geometries if they become visibly soiled.

WARNING: To ensure a proper ground connection, routinely clean the APS ground springs, the groove in APS cup plate, and the ER APS top grooved plate. If you are unsure about the acceptable cleanliness of the ground spring clips, use the spares provided in the kit.

AVERTISSEMENT: Afin d'assurer une mise à la terre appropriée, nettoyez systématiquement les ressorts de terre APS, la rainure de la plaque à coupelle APS et la plaque rainurée supérieure ER APS. Si vous n'êtes pas certain du niveau de propreté acceptable des attaches à ressort de terre, utilisez les pièces de rechange fournies dans le kit.

- If the polycarbonate shield becomes soiled, wet a cloth with warm, soapy water and wipe the shield clean. DO NOT use acetone to clean the shield.

Replacement Parts

The table below lists the replacement parts available on the ARES-G2 ER Accessory.

Table 2: Replacement Parts for ARES-G2 ER Accessory

Part Number	Description
402752.901	GEOM 50mm PARALLEL PLATE - ER/PELTIER PLATE
402754.901	GEOM 25mm PARALLEL PLATE - ER/PELTIER PLATE
401902.001	TRANSDUCER HUB ISOLATION BLOCK
402437.001	TRANSDUCER HUB THUMBSCREW
402592.001	APS GROUNDING WIRE BRUSH (SPRING)

Index

N

P

S

T

W