Electrical Heating Jacket

User Manual

2I-20730 Issue 11

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CONTENTS

1. Introduction

Thank you for buying a Specac product.

The Electrical Heating Jacket P/N GS20730 has been designed to allow for the study of solid and liquid samples over a temperature range from ambient to circa 250°C, via transmission spectroscopy ranging from the Far UV through to the Far IR. The variation in temperature is achieved by heating the Electrical Heating Jacket from its dedicated 30volt supply 4000 Series™ power controller whilst a particular liquid or solid cell holder is contained within the Electrical Heating Jacket.

The Electrical Heating Jacket has been designed to hold a variety of liquid and solid sample cell holders safely at elevated temperatures. The range of sample cell holders compatible for use with the Water Heating Jacket are seen in Section 3 of this instruction manual. (Note that the Specac solid holder P/N GS20610 will not fit into the Electrical Heating Jacket.)

The Electrical Heating Jacket is supplied with its own 3” x 2” slide mount backplate, which is also water cooled, and is mounted into a spectrometer sample compartment via use of this 3” x 2” slide mount. The water cooling minimizes transfer of heat from the accessory to the spectrometer and also helps for finer temperature control of operation.

A Cr/Al (K-type) thermocouple, as part of the power cable assembly lead, is included with the accessory for accurate temperature control. The tip of the thermocouple is placed into any sample cell holder that will be located in the Electrical Heating Jacket. Power to the Electrical Heating Jacket and measurement of the thermocouple is provided by a single 6 way plug connection to the 4000 Series™ Temperature Controller.

This particular instruction manual for the Electrical Heating Jacket is to be used in conjunction with the separate instruction manual provided for operation of the 4000 Series™ Temperature Controller.

2. Checklist of Contents

Check that the following items have been supplied:

- Electrical Heating Jacket with power lead and thermocouple Assembly and instruction manual.
- The 4000 Series™ Temperature Controller, Power Cable and instruction manual.
- Any sample cell holder ordered.

Unpack the Electrical Heating Jacket/Thermocouple assembly and the 4000 Series™ Temperature Controller.

If a Liquid Cell under the part numbers of P/N's GS20500, GS20510, GS20560, GS20570, GS20580 or GS20590 Series has been ordered, do not unwrap it from its protective packing until ready to use as certain windows that may be used for the liquid cell (e.g. NaCl or KBr) may fog on exposure to the ambient atmosphere.

Safety In Use

Note: *When operating the Electrical Heating Jacket up to its maximum temperature capability (250°C), the body of the Jacket will get* ***very hot.*** *Although there are warning stickers on the Accessory to indicate the hazard, always check the temperature of the Electrical Heating Jacket by reading the operating (actual) temperature of the Jacket and sample cell contained within from the 4000 Series™ temperature controller display before attempting to handle the equipment.*

3. The Sample Cells

A variety of different cell holders for various sample types can be used within the Electrical Heating Jacket. These include:

- Heatable Sealed Liquid Cells P/N GS20500 Series.
- Heatable Demountable Liquid Cells P/N GS20510 Series.
- Heatable Flow Sealed Liquid Cells P/N GS20560 Series.
- Heatable Flow Sealed Liquid Cells P/N GS20570 Series.
- Heatable Flow Demountable Liquid Cells P/N GS20580 Series.
- Heatable Flow Demountable Liquid Cells P/N GS20590 Series.
- High Pressure Heatable Liquid Flow Cells P/N's GS05910, GS05915, GS05920 and GS05925 Series.
- Spectroelectrochemical Cells P/N GS20900 Series.
- Solids Cell Holder P/N GS20600.

The liquid sample cell holders can use a range of window materials, all available from Specac. (A comprehensive list of IR transmitting materials and their properties can be found at the back of Specac's Catalogue). The solids holder P/N GS20600 does not require any window material.

The High Pressure Heatable Liquid Flow Cells P/N's GS05910, GS05915, GS05920 and GS05925 Series, can also be used in the Electrical Heating Jacket. Variations of these cells are manufactured for high pressure applications (up to 5000 psi with Sapphire windows) covering a temperature range of 25°C to 180°C.

Spectroelectrochemical Cells P/N GS20900 Series can also be used in the Electrical Heating Jacket, although because of their application capability, they may be more suited for operation at sub zero °C temperatures offered by Specac's Variable Temperature Cell P/N GS21525.

4. Installation

Fitting Sample Cell Holders into the Electrical Heating Jacket

A separate instruction manual has been written for the operation and use of the various sample cell holders (Liquid Cell Holders P/N's GS20500 and GS20510 Series) and the Solids Holder P/N GS20600 that are used within the Electrical Heating Jacket. This manual should be consulted prior to the use of these sample cells in this accessory.

A specific instruction manual for the High Pressure Heatable Liquid Flow Cells P/N's GS05910, GS05915, GS05920 and GS05925 Series, is also available. Once again, if using any of these liquid cells in the Electrical Heating Jacket this manual should be consulted prior to use.

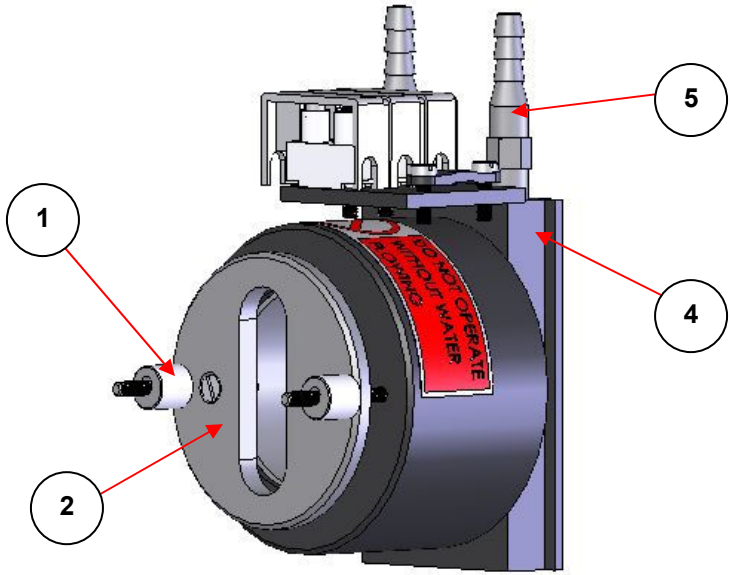


Fig. 1 Electrical Heating Jacket assembly (power cable and thermocouple not shown)

Fitting Static Liquid Cells and the Solids Holder

Please use the following procedure below for the installation of the following Specac sample cell holders into the Electrical Heating Jacket:

P/N's GS20500 and GS20510 Series, **Static** Liquid Cells.
P/N GS20600 Solids Cell Holder.

1. Unscrew the quick-fit nuts (**1**) (see Fig. 1) and remove the sample cell retaining front clamp plate (**2**) of the Electrical Heating Jacket.
2. Lightly smear silicone grease to the inside of the Electrical Heating Jacket (stainless steel part only) and the outside of the sample cell holder. This will ensure good thermal contact. Take care not to contaminate the windows of any Static Liquid Cell holder.
3. Slide the sample cell holder into the Electrical Heating Jacket making sure that the rectangular aperture (long dimension) of the GS20500 and GS20510 Static Liquid Cells is vertical. (See the orientation of both the liquid and solids cell holders from Fig. 2).

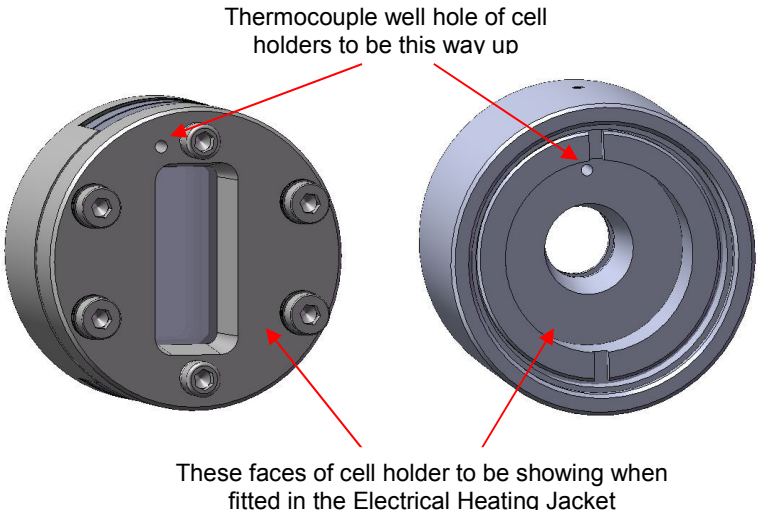


Fig. 2 GS20500 Static Liquid Cell and GS20600 Solids Holder

4. Replace the front clamp plate (**2**) using the quick-fit nuts (**1**) to tighten the assembly. The front clamp plate is put on such that the stand offs (in PEEK material - **3**) are in contact with the face of the sample cell holder protruding from the Electrical heating Jacket. (See Fig. 3).

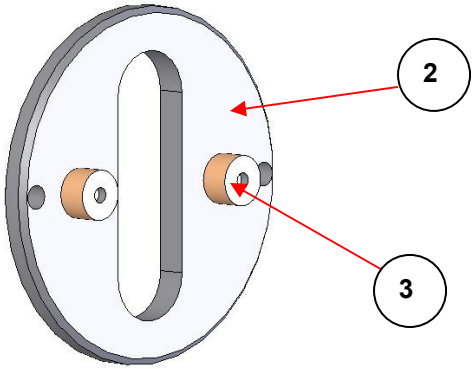


Fig. 3 Cover plate of Electrical Heating Jacket

5. Locate the Electrical Heating Jacket assembly with sample cell holder in the appropriate spectrometer mount using the 3” x 2” slide mount backplate (**4**) on the accessory.
6. Connect cooling water supply tubes securely to the flow tubes (**5**) of the Electrical Heating Jacket. Either flow tube can be the inlet or outlet. A minimum flow of 0.5 liters/min cooling water is required.

A small hole is drilled into each of the sample cell holders to form a thermocouple well. (See Fig. 2 and also please refer to the Static Liquid and Solid Cell holder’s instruction manual to identify the position of the thermocouple well hole). This accommodates the junction end of the stainless steel sheathed Cr/Al (k-type) thermocouple for temperature monitoring using the 4000 Series™ Temperature Controller. The thermocouple is part of the Electrical Heating Jacket’s power cable assembly.

7. Smear a little silicone grease on the junction end of the stainless steel sheathed thermocouple and connect the thermocouple to the sample cell holder’s well hole.

Important: *It is absolutely essential that the thermocouple is properly secured in the thermocouple well hole of the sample cell to enable a feedback to the temperature controller from the accessory. Failure to do this may cause permanent damage to the accessory due to overheating.*

8. Connect the Electrical Heating Jacket to the 4000 Series™ Temperature Controller via its power cable and 6 way connection plug, then follow the instructions for operation from the 4000 Series™ Temperature Controller instruction manual.

Fitting Flow Liquid Cell Holders

There are 4 (four) types of **Flow** Liquid Cell versions of the P/N's GS20510 and GS20500 Series static liquid cells. These are:

GS20560 Series – **Sealed** Flow Cells with 1/16" O.D. stainless steel flow tubes finished with Swagelok union connections.
GS20570 Series – **Sealed** Flow Cells with 1/16" Swagelok union connections direct to the front plate. (There is no flow tubing).
GS20580 Series – **Demountable** Flow Cells with 1/16" Swagelok union connections direct to the front plate. (There is no flow tubing).
GS20590 Series – **Demountable** Flow Cells with 1/16" O.D. stainless steel flow tubes finished with Swagelok union connections.
Further explanation for these flow liquid cells is found from their own instruction manual. For fitting of these types of Flow Liquid Cells into the Electrical Heating Jacket please use the following procedure.

1. Unscrew the quick fit nuts (**1**) (Fig. 1) and remove the cell retaining front clamp plate (**2**) of the Electrical Heating Jacket.
2. Lightly smear silicone grease to the inside of the Heating Jacket (stainless steel part only) and the outside of the Flow Liquid Cell. This will ensure good thermal contact. Take care not to contaminate the windows of the Flow Liquid Cell.
3. Slide the Flow Liquid Cell into the Electrical Heating Jacket, making sure that the rectangular aperture (long dimension) of the Flow Liquid Cell is vertical. (See the orientation of both types of Flow Liquid Cell holders from Fig. 4).

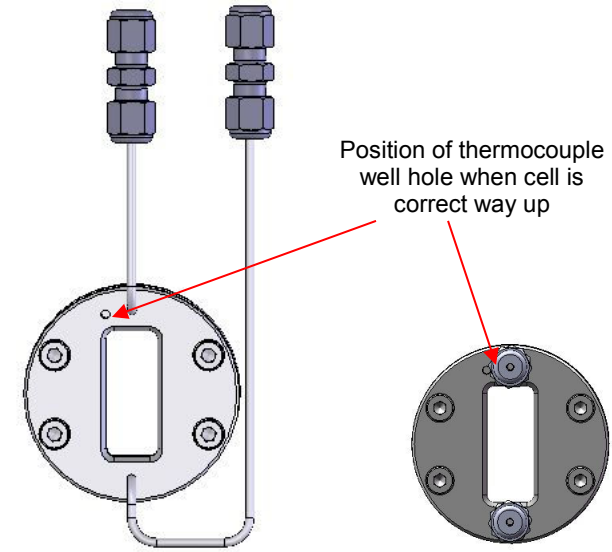


Fig 4. Front view of Flow Liquid Cells when oriented correctly from installation into the Electrical Heating Jacket

4. Replace the front clamp plate (**2**) using the quick fit nuts (**1**) to tighten the assembly. The flow tube from the bottom sampling port of the GS20560 or GS20590 Series Flow Liquid Cells being used will pass between the fixing nut screw stud and the stand off fixing on the underside of the front clamp plate (**2**). The Swagelok unions of the GS20570 and GS20580 Series Flow Liquid Cells will protrude through the vertical aperture of the front clamp plate (2).
5. Locate the Electrical Heating Jacket assembly with Flow Liquid Cell in the appropriate spectrometer mount using the 3” x 2” slide mount backplate (**4**) on the accessory.
6. Connect cooling water supply tubes securely to the flow tubes (**5**) of the Electrical Heating Jacket. Either flow tube can be the inlet or outlet. A minimum flow of 0.5 liters/min cooling water is required.

7. Connect liquid flow tubes from a sample pumping delivery system, to the Swagelok union connections of the flow liquid cell assembly.

A small hole is drilled into each of the Flow Liquid Cell bodies to form a thermocouple well. (See Fig. 4 and also please refer to the Flow Liquid Cell's instruction manual to identify the position of the thermocouple well hole). This accommodates the junction end of the stainless steel sheathed Cr/Al (k-type) thermocouple for temperature monitoring using the 4000 Series™ Temperature Controller. The thermocouple is part of the Electrical Heating Jacket's power cable assembly.

8. Smear a little silicone grease on the junction end of the stainless steel sheathed thermocouple and connect the thermocouple to the Flow Liquid Cell.

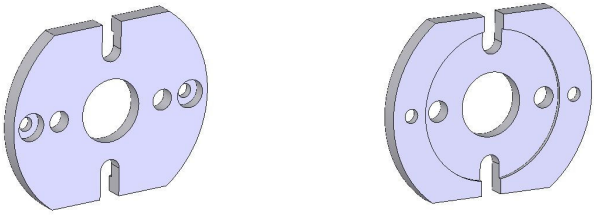
Important: *It is absolutely essential that the thermocouple is properly secured in the thermocouple well of the sample cell to enable a feedback to the temperature controller from the accessory. Failure to do this may cause permanent damage to the accessory due to overheating.*

9. Connect the Electrical Heating Jacket to the 4000 Series™ Temperature Controller via its power cable and 6 way connection plug, then follow the instructions for operation from the 4000 Series™ Temperature Controller instruction manual.

Fitting High Pressure Liquid Cells

There are 4 (four) types of High Pressure Liquid Cells. They are P/N's GS05910, GS05915, GS05920 and GS05925 Series Cells.
Further explanation for the High Pressure Liquid Cell is found from their own instruction manual.

For fitting of the High Pressure Liquid Cells into the Electrical Heating Jacket, the procedure is the same as that for fitting of the Flow Liquid Cells. (See steps 1 to 9 – pages 9 to 11). However, an alternative front cover plate to the one supplied with the Electrical Heating Jacket (**2**) is used to hold the High Pressure Liquid Cells in position. (See Fig. 5 for alternative cover plate).



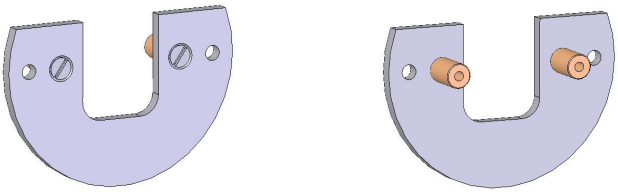
Flat surface side **Recessed surface side**

Fig 5. Alternative front cover plate to be used on the Electrical Heating Jacket when installing High Pressure Liquid Cells

The description of how to fit the alternative cover plate is provided in the instruction manual for the High Pressure Liquid Cells.

Fitting Spectroelectrochemical Cells

The Spectroelectrochemical Cells GS20900 Series can be installed into the Electrical Heating Jacket following the same procedure as that given for the Flow Liquid Cells. (See steps 1 to 9 – pages 9 to 11). However, an alternative front cover plate to the one supplied with the Electrical Heating Jacket (**2**) holds the Spectroelectrochemical Cell in position. (See Fig. 6 for alternative cover plate).



Flat surface side **PEEK standoff surface side**

Fig 6. Alternative front cover plate to be used on the Electrical Heating Jacket when installing Spectroelectrochemical Cells

The description of how to fit the alternative cover plate is provided in the instruction manual for the Spectroelectrochemical Cells.

5. Operating Parameters for the Electrical Heating Jacket

The Electrical Heating Jacket is provided with its own dedicated 4000 Series™ Temperature Controller. A separate manual is supplied for operation of the 4000 Series™ Temperature Controller.

For operation of the Electrical Heating Jacket the parameters of the 4000 Series™ Temperature Controller have been factory set as shown on the following page. Not all of the displayable parameters can be changed but have been listed for reference purposes. If you ever need to change a parameter or autotune the controller for a particular temperature range certain parameter settings will be altered. You can get back to original factory settings by reprogramming the controller with these original values.

Specifications

Accessory Type GS20730

Voltage	230V	110V	100V
Frequency	50HZ	60HZ	50/60HZ
Max Power	150W	150W	150W
Fuse Rating	1.5A	3A	3A
Fuse Type	T	T	T

Insulation rating of external circuits (appropriate for single fault condition) = basic insulation and protective (earth) bonding.

Humidity operation range – 20% to 90% relative humidity non-condensing.

Displayable Parameters For Electrical Heating Jacket GS20730 with WEST 6100+ (4000 Series™) Controllers

Parameter Display (In Green)	Parameter Name	Parameter Factory Set Value
FiLt	Input Filter Time Constant	3.0
OFFS	Process Variable Offset	0
PP␣␣	Primary (Heat) Output Power	0
Pb_P	Primary Output Proportional Band	6.5
ArSt	Automatic Reset (Integral Time Constant)	2.37
rAtE	Rate (Derivative Time Constant)	0.39
biAS	Manual Reset (Bias)	25
SPuL	Setpoint Upper Limit	250
SPLL	Setpoint Lower Limit	0
OPuL	Primary (Heat) Output Upper Power Limit	100
Ct I	Output 1 Cycle Time	4
PhAl	Process High Alarm	250
AHyl	Alarm 1 Hysteresis	1
PLA2	Process Low Alarm	0
AHy2	Alarm 2 Hysteresis	1
APt	Auto Pre-Tune enable/disable	diSA
PoEn	Manual Control select enable/disable	diSA
SPr	Setpoint Ramping enable/disable	EnAb
rP	Setpoint Ramp Rate Value	600
SP	SP Value	1
SLoc	Set-up Lock Code	10

6. Spares for the Electrical Heating Jacket

If a spare/replacement part is required for the Electrical Heating Jacket please contact Specac and have the relevant serial number ready. The serial number is found on the appliance label of the dedicated 4000 Series™ Temperature Controller.

Spare windows for the types of Demountable, Static or Flow Liquid Cells that can be used in the Electrical Heating Jacket are as follows:-

P/N GS20520 Pair of NaCl windows (one drilled, one undrilled).
P/N GS20521 Pair of KBr (one drilled, one undrilled).
P/N GS20522 Pair of CaF2 (one drilled, one undrilled).
P/N GS20523 Pair of BaF2 (one drilled, one undrilled).
P/N GS20596 Pair of ZnSe (one drilled, one undrilled).

7. Specification for the Electrical Heating Jacket

The Electrical Heating Jacket has the following specifications.

Maximum temperature capability: 250°C.
Minimum temperature capability: Ambient.
Thermocouple: K type (NiCr/NiAl).
Voltage for operation: 30 Volts.
Cooling rate: Typically 200°C to ambient in 40 minutes.
Typical water cooling rate requirement: 0.5 liters per minute.
3” x 2” (76mm x 50mm) slide mount backplate.
Overall length (side to side dimension - when installed in spectrometer): 78mm.
Overall width (back to front dimension - when installed in a spectrometer): 68mm.
Jacket bore diameter (to take sample cells): 41.5mm
Jacket bore depth (to take sample cells): 23.0mm

Specifications pertaining to use with dedicated 4000 Series™ temperature controller.

Temperature set steps: 1°C.
Temperature stability: Typically better than + or – 2°C.
Thermocouple accuracy: Typically + or – 1.5°C at 200°C.
Maximum power from controller: 150 Watts.
Maximum heating ramp rate: 10°C per minute.

EC Declaration of Conformity

This is to certify that the:

HEATING JACKET & 4000 Series TEMPERATURE CONTROLLER
20730

Manufactured by:
SPECAC LIMITED

Conforms with the protection requirements of Council directives 2004/108/EC , relating to the EMC DIRECTIVE,

by the application of:

1) Testing to the following standard:
   EN-61326:2006/8 EMC (Emissions/Immunity) requirements for Electrical Equipment for measurement, control and laboratory use.
2) Supported by SPECAC Technical File No. **TF20730**

and also conforms to the general safety requirements of Council Directives 2006/95/EC , relating to the LOW VOLTAGE DIRECTIVE,

by the application of:

1) EN61010-1:2010, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use.
2) Supported by SPECAC Technical File No. **TF20730**

Responsible Person:

Name:	Mr.G.Poulter	**Signature:**	G. Poulter		
Position:	Technical Director	**Of:**	Specac Ltd.	**Date:**	14th Feb 2013
Serial No:		**conforms to the above**			
Name:		**Signature:**			
Position:		**Of:**	Specac Ltd.	**Date:**	

Original to file/1 Copy to Customer: FS. No.: 642-110 Rev. No.: 02

SPECAC LIMITED
RIVER HOUSE,97 CRAY AVENUE,ORPINGTON,KENT,UK BR5 4HE
TEL:01689 873134 FAX:01689 878527 www.specac.com

REGISTERED IN ENGLAND NUMBER 1008689 REGISTERED OFFICE: 765 FINCHLEY ROAD,LONDON NW11 8DS
A SMITHS INDUSTRIES COMPANY

Notes for Use of Electrical Heating Jacket

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Worldwide Distribution

France
Eurolabo - Paris.
Tel.01 42 08 01 28
Fax 01 42 08 13 65
email: contact@eurolabo.fr

Germany
L.O.T. - Oriel GmbH & Co,
KG - Darmstadt
Tel: 06151 88060
Fax: 06151 880689
email:info@LOT-Oriel.de
Website: www.LOT-Oriel.com/de

Japan
Systems Engineering Inc. -Tokyo
Tel: 03 3946 4993
Fax: 03 3946 4983
email:systems-eng@systems-eng.co.jp
Website: www.systems-eng.co.jp

Spain
Teknokroma S.Coop C. Ltda
Barcelona
Tel: 93 674 8800
Fax: 93 675 2405
email: comercial@teknokroma.es

Switzerland
Portmann InstrumentsAG
Biel-Benken
Tel: 061 726 6555
Fax: 061 726 6550
email: info@portmann-instruments.ch
Website:www.portmann-instruments.ch

USA
SPECAC INC.
414 Commerce Drive
Suite 175,
Fort Washington,
PA 19034, USA
Tel: 215 793 4044
Fax: 215 793 4011

United Kingdom
Specac Ltd. - London
River House, 97 Cray Avenue,
Orpington
Kent BR5 4HE
Tel: +44 (0) 1689 873134
Fax: +44 (0) 1689 878527
Registered No. 1008689 England

Brilliant Spectroscopy™

www.specac.com

SPECAC INC.
414 Commerce Drive
Suite 175,
Fort Washington,
PA 19034, USA
Tel: 215 793 4044
Fax: 215 793 4011

SPECAC LTD.
River House, 97 Cray Avenue,
Orpington
Kent BR5 4HE
Tel: +44 (0) 1689 873134
Fax: +44 (0) 1689 878527
Registered No. 1008689 England