Spectrometer User Manual

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Introduction

The Aris spectrometer

The Aris spectrometer is a new generation of compact optical spectrometers . A laboratory-grade instrument that also meets the size, price and reliability requirements for portable and industrial applications. Due to its optimised optical design the Aris delivers significantly better sensitivity and lower stray light than previous models.

The Aris offers an unsurpassed flexibility to adapt the spectrometer to the requirements of a specific application. It is available in five standard wavelength ranges that can be customised using a large choice of available diffraction gratings. The default entrance slit of 20 µm is user-replaceable and can be easily exchanged to obtain better sensitivity. Standard configurations include one of two image sensors with more choices available on request. The powerful microcontroller performs on-board auto exposure, averaging, buffering and spectrum processing. In addition, it enables the implementation of application-specific spectrum evaluation.

With its proven reliability in rough conditions and compact size, the Aris bridges the gap between laboratory and field spectrometers.

The Siena spectrometer

The Siena takes near-infrared spectroscopy to a new level. It combines the performance and flexibility of an array-based spectrometer with the size, price and reliability required for mobile applications and industrial sensors. For the first time it offers wavelength ranges up to 2100 nm with an uncooled InGaAs array sensor.

The Siena uses a new InGaAs line sensor with a built-in dark current compensation. Traditional InGaAs sensors beyond 1700 nm need to be cooled to prevent quick saturation by dark current. The Siena can be operated up to 2100 nm at room temperature without cooling. This eliminates the need for a fan and reduces the overall size and power consumption.

The Siena is available in three standard wavelength ranges that can be customized to increase resolution. Like the Aris, it includes a user-replaceable entrance slit and shares the same electronic and firmware features.

Package Contents

The retail package of the spectrometer includes:

- Spectrometer
- USB cable
- USB flash drive with software and documentation

- Quick start guide
- Calibration and test report

Optional Accessories

For specific applications we offer a range of specialised accessories including:

- Larger entrance slits (user-replaceable)
- Fiber-optical patch cables
- Cosine corrector (for irradiance measurements)
- SMA collimator
- Direct-attach collimator

Software

- Inspective spectroscopy application software for Windows
- Software Development Kit (SDK) with demo code and protocotol documentation

Documentation

- User Manual (this document)
- ZioLink Communication Protocol Manual
- Product datasheet

Setup

Software Installation

The application software Inspective requires Windows 7 or later. Simply run InspectiveSetup.msi to install the software including device drivers on your computer. The software is free of charge and does not require a license.

You can run the program from the Start Menu. Once it's running, you can pin it to the taskbar by right-clicking on its application icon.

Inspective requires the Microsoft ".NET Desktop Runtime" to be installed. It's quite likely that you already have it on your system. However, if you get a message saying that the runtime is missing, please follow the link to download it or alternatively install it from the USB flash drive. Please note that you need the "Desktop" version of the runtime. The ".NET Runtime" (without "Desktop") or the "ASP .NET Core Runtime" are not sufficient.

Electrical connection

Use a USB cable to connect the spectrometer to your PC. Use the supplied cable if you have a traditional USB Type-A port on your computer. For the new USB Type-C port you need a cable with Type-C connectors on both ends (not included).

Upon connecting the device both LEDs should turn on for a brief moment and then the red LED should go off. Otherwise please see the Troubleshooting section below.

Optical connection

The spectrometer has an input port for an optical fiber with a standard SMA connector. Alternatively you can focus the light directly into the spectrometer („free space coupling").

Looking into the SMA connector on the spectrometer, you can see the small entrance slit in its center. Basically, you just need to make sure that the light to be measured enters the spectrometer in the center of this slit at an angle that is not too large. The maximum angle for the incoming light is determined by the numerical aperture of the spectrometer (see datasheet).

For coupling the light into the spectrometer, choose of these options:

- **Use an optical fiber.** We recommend a fiber with a core diameter of 400 or 600 µm. Fibers with a diameter of 600 µm provide a little more sensitivity, but are less flexible and slightly more expensive. Use any fiber with a numerical aperture of 0.22 or more.
- **Focus the light onto the entrance slit** using your own focussing optics. Make sure your optics match the numerical aperture of the spectrometer and at least the center of the entrance slit is illuminated with a height of 600 µm or more.
- **Use the Direct-attach collimator** or any other sampling probe connected directly to the device.
- **Just point the spectrometer at the light source** for simple measurements that don't require precision. For example, for a first test you may simply point the device at a lamp or your computer screen.

Troubleshooting

- **Both LEDs remain off:** The device does not get any electrical power. Please check the USB connection. Try a different cable or a different computer. If you're using a USB hub, try connecting the device directly to the computer.

- **Both LEDs remain on:** The device is not properly recognised by the operating system. Please ensure you have the software installed. Check the driver status in the Windows Device Manager. It may also be a problem with the electrical connection, therefore please also try a different cable or a different computer.
- **Green LED is flashing:** This indicates an internal error. Please contact technical support.
- **Green LED is off and red LED is flashing:** The supply voltage is too low. Please check the USB cable. Try a different cable or a different computer. If you're using a USB hub, try connecting the device directly to the computer.
- **Green LED is on, red LED is off, but the software cannot find the device:** It may take several seconds for the driver to be installed, so please wait and try again. If unsuccessful, please try disconnecting and reconnecting the device. You may use the Device Manager in Windows to check the status of the driver installation.
- **The application software does not start:** This seems to be a bug in the .NET Desktop Runtime version 6.0.0 and 6.0.1. To check which version is installed you can run "dotnet --info" from the command prompt. If you have one of these versions, please install a later version of the runtime (see Software Installation).

For further assistance please contact Technical Support.

Operation

Software Overview

The application software "Inspective" was designed to enable sophisticated spectrum measurements in the lab through a clear and intuitive interface. The current version focusses on the acquisition, display, storing and reloading of spectra. Future versions are going to include more features for spectrum processing, modification and evaluation. To control the spectrometer from your own software, please see the Software Development Kit.

Simple Measurements

Start the application software by choosing "Inspective" from the Start Menu. Once it's running, you can pin it to the taskbar by right-clicking on its application icon. Press F1 for a short description of the main window.

To open the connection to the device, click on the "Open Device" button (showing a plug and a green Plus sign). If no device can be found, a "Simulated Spectrometer" is opened instead, which allows you to try out the software without an actual device. If you have connected the spectrometer to your computer but only the "Simulated Spectrometer" shows up, please check the status LEDs on the device and consult the Troubleshooting section.

When the connection to the device is open, select „Auto" and click on the green triangle button to take a spectrum. Change the „Auto exp. time" value to obtain spectra faster or with less noise. You can also set the exposure parameters manually by selecting „Manual" and then setting the required exposure time and averaging value. Click the "Run Continuously" button for repeated measurements (this is also known as "scope mode" in other programs).

The "Intensity" selection box lets you choose which quantity to display on the y axis of the spectrum:

- **counts** are basically raw ADC values (after offset and nonlinearity correction).
- **counts/ms** are the same values divided by the exposure time. This is very useful to compare spectra taken with different exposure times, especially if Auto Exposure is turned on.
- **Transmittance** is the result of a transmission measurement shown as a percentage (see below).
- **Reflectance** is the result of a reflection measurement shown as a percentage (see below).
- **Absorbance** is the result of an absorption measurement shown as AU (see below).
- **Calibrated** is a spectrum corrected for spectral sensitivity. The result is usually a real physical quantity, like spectral optical power (mW/nm) or irradiance (mW/cm²/nm).

List Of Spectra

When you take a new spectrum, the previous measurement is generally overwritten. If a spectrum looks good and you would like to keep it, click on the "Keep current spectrum" button (showing a pushpin). When you then take another spectrum afterwards, instead of overwriting the previous measurement a new spectrum is added to the list. You can also select "Keep all new spectra" to keep every new measurement.

You can select one or more spectra in the list by clicking on them. If one spectrum is selected, you can see further information about its properties in the panel below.

In the list of spectra there is also a check box next to each spectrum name. By placing a check mark here you can select which spectra should be displayed in the spectrum diagram. If no check mark is placed, the selected spectra are displayed.

When you save the measured data to a file, all spectra in the list are written to a single file. The file format ".spz" is a simple ASCII table that can easily be imported to Excel or any numerical evaluation software.

Inspective features Undo and Redo for all changes to the list of spectra. This also means that if you take a new spectrum and overwrite the previous one, the old spectrum is still available in the Undo buffer. So you can keep on taking and overwriting spectra, and if you then decide that you would like to go back to an earlier measurement, you can simply keep Ctrl-Z pressed to travel back in time.

Diagram Window

Zooming into the displayed spectrum and moving around can be easily done with the mouse. This is similar to using a touch screen, but with the mouse you have only one pointer, therefore a few modifier keys are also required.

- To zoom in on the x axis simply use the mouse wheel.
- To zoom in on both axes press the Shift key and use the mouse wheel.
- To move around, click on a spectrum in the diagram, keep the button down and move the mouse.
- Alternatively, you can also click and drag the axis labels.
- To shift the y axis (instead of scaling it), keep the Shift key pressed while clicking.
- To move out, place a check mark at "Auto scale".

Dark Spectrum Compensation

Every spectrometer measures a certain "dark spectrum" even if operated in total darkness. To obtain a precise result, this dark spectrum needs to be subtracted from the actual measurement. In addition, your measured spectrum might include some unwanted background light like ambient light. Both of these should be compensated by subtracting the dark spectrum.

The Siena spetrometer already has a dark spectrum compensation built into its image sensor. Therefore in most general cases it is not required to subtract a dark spectrum. Only if you use measurement times of several seconds, there may be a small remaining dark spectrum that should be compensated.

Every Aris spectrometer has a dark spectrum stored in the device during manufacturing. But this may change after some time of operation and it also depends significantly on temperature. Therefore it is recommended that you take a new dark spectrum before starting a new series of measurements. The dark spectrum is automatically adjusted to the current exposure time, so it is generally not required to take a new dark spectrum after a change of exposure time. However, if you need to measure as accurately as possible, it is recommended to always take a new dark spectrum immediately before the actual measurement.

To take a new dark spectrum, first close the optical entrance of the spectrometer or turn off you light source. Then simply click on the "Take Dark Spectrum" button (showing a dark light bulb). This can also be done while taking spectra continuously.

To actually use the dark spectrum and subtract it from each measured spectrum, place a check mark in the "Subtract dark" check box.

Sensor Gain

(Siena only)

The image sensor inside your Siena spectrometer offers two different gain settings. You can select one of them in the upper right corner of the main window. Use "low gain" if you have stronger light sources or for general measurements. Select "high gain" to measure weak signals. This settings amplifies the measured signal inside the image sensor by a factor of about 10. The noise also increases, but by much less than 10, which results in a better signal-to-noise ratio. If you select “high gain”, the displayed spectrum is automatically divided by this factor.

If you chose to subtract a dark spectrum from your measurement and you change the gain settings, it is recommended to take a new dark spectrum.

Relative Measurements

In transmission, reflection and absorption spectroscopy you determine properties of a sample by comparing the spectrum of light before and after it interacts with the sample. They always involve (at least) two measurements: one spectrum of the light source $I_0(\lambda)$ and one of the light after it has interacted with the sample $I(\lambda)$.

Transmission Spectroscopy

In transmission spectroscopy you measure how much light is transmitted through a sample. The spectral transmittance $T(\lambda)$ is then simply the ratio:

$$T(\lambda) = \frac{I(\lambda)}{I_0(\lambda)}$$

It is usually given as a percentage.

To measure transmittance with Inspective:

1. For precise measurements it is recommended to take a new dark spectrum first (as described above).
2. Turn on dark spectrum compensation by placing a check mark in the “Subtract dark” check box.
3. Remove the sample from your optical setup.
4. Take a reference spectrum $I_0(\lambda)$ by clicking the “Take Reference Spectrum” button (showing a yellow light bulb).
5. Choose “Transmittance” in the “Intensity” selection box.
6. Place the sample between the light source and the spectrometer.
7. Take a spectrum to make a transmission measurement. Since this is a relative measurement, the resulting spectrum will be shown as a percentage.
8. You can update the dark and reference spectra later anytime, even while taking spectra continuously. For example, if you observe that transmission spectra of the light source without any sample deviate from the 100 % line, you can simply click the “Take Reference Spectrum” button to set it back to 100 %.

Relative measurements frequently have an increased amount of noise towards the left or right end of the spectrum. This is an expected behaviour. The reason may be a lower sensitivity of the spectrometer or less intensity from the light source in these regions. Both contribute to a larger uncertainty, which after calculating the ratio appears as an increased level of noise.

Absorption Spectroscopy

In absorption spectroscopy the measurements are basically the same, but the result is displayed as absorbance instead of transmittance. The spectral absorbance $A(\lambda)$ is defined as:

$$A(\lambda) = -\,log_{10}\,T(\lambda) = log_{10}\frac{I_0(\lambda)}{I(\lambda)}$$

The absorbance is a dimensionless quantity, but for the sake of clarity the unit AU (for Absorbance Units) is usually added. Absorbance is the same as Optical Density (OD). Both are logarithmic units like the decibel.

To measure absorbance, simply follow the procedure above, but choose "Absorbance" instead of "Transmittance" from the "Intensity" selection box.

Reflection spectroscopy

In reflection spectroscopy the reflected light from a surface is measured instead of the transmitted light. This is frequently used, for example to measure color properties of surfaces.

The main difference to transmission spectroscopy is that for obtaining the reference spectrum $I_0(\lambda)$ you measure the reflection from a reflectance standard sample. Since every surface absorbs at least a small amount of light, there is no reference sample with a reflectance of 100%. To obtain precise measurements, it is therefore necessary to correct the spectra with a reflectance spectrum $R_0(\lambda)$ of the actual reflectance standard sample. The Reflectance $R(\lambda)$ is then given by:

$$R(\lambda) = \frac{I(\lambda)}{I_0(\lambda)} R_0(\lambda)$$

To measure reflectance, first open the file containing the reflectance standard spectrum in Inspective. Then choose Device → Write Calibration to Device → Reflectance Standard. This spectrum is then stored in the device and used for all subsequent Reflectance measurements as $R_0(\lambda)$, until you replace or delete it. The procedure for the actual measurement is the same as above, except that you need to choose "Reflectance" from the "Intensity" selection box.

You can delete the reflectance standard spectrum by choosing Device → Delete Calibration to Device → Reflectance Standard. Any subsequent reflectance measurements will then be just the same as if you choose "Transmittance".

Emission Spectroscopy

To measure a precise spectrum of light emitted by a light source, the spectrometer needs to be calibrated for spectral sensitivity. You also need to use a suitable light collection optics, which determines the physical property that is being measured. For example, a "Cosine Corrector" (which is basically a diffusor) can be used to measure irradiance (optical power per area) while a collimator (or lens) measures radiance.

Generally, the spectrometer as well as a the light collection optics have a certain spectral sensitivity. In order to measure spectra in physical units like nW/nm, both need to be corrected by a spectral sensitivity calibration of the whole system.

To calibrate the spectral sensitivity you need a calibrated broadband light source. This is usually a tungsten lamp which is supplied with a precisely measured reference spectrum. Then:

1. Take a spectrum of the calibrated light source.
2. Choose "Calibrate Sensitivity" from the Device menu.
3. Load the file with the reference spectrum.
4. It is recommended to enter the unit of the physical quantity that corresponds to your measurement. For example, for irradiance you may enter "nW/m²/nm". This unit is used to label the spectrum values.
5. Click OK to write the new sensitivity calibration to the device.

If you then choose "Calibrated" from the "Intensity" selection box, all subsequent measurements will be corrected for spectral sensitivity.

Triggering

To show the settings for triggering, please click on the button with the two arrows pointing downwards (if you don't see this button, you may need to update the application software). You can then select the following options:

Trigger Mode

The image sensor inside the device can be operated in one of two trigger modes:

- **Hardware Trigger:** In this case, the spectrometer acts just like a photo camera: you push the button and then it takes a picture. In our case this means: when the device receives a "Start Exposure" command (or an external trigger event, see below), it immediately starts the exposure. This trigger mode is usually used with CMOS sensors like the Hamamatsu S11639. It allows precise triggering.
- **Free-Running:** This mode is more like taking a still image from a live television broadcast: pictures are coming in all the time, and when you push the button, the next available picture is being recorded. This is the default mode for CCD sensors like the Toshiba TCD1304, because they need to be periodically cleared of charges. In Free-Running mode, the spectrometer continuously takes spectra, one after the other. When you send the "Start Exposure" command (or an external trigger event is received), the spectrometer waits until the current exposure period has finished, and then reads out this spectrum. This mode does not allow precise triggering, because the device always needs to wait until the current exposure has finished.

If you have a spectrometer with a CMOS sensor, the default trigger mode is Hardware Trigger. This should be the best option for almost all cases.

If you have a spectrometer with a CCD sensor, the default trigger mode is Free-Running as described above. You can change it to Hardware Trigger, but for most applications this is not recommended, because it may reduce measurement accuracy. Specifically in the case of the Toshiba TCD1304 sensor, Hardware Trigger significantly affects the linearity of the measurements on the vertical axis.

External Triggering

Activate "External Trigger" to synchronise the exposure to an external event. In this case, when you click on one of the "Start Exposure" button, the spectrometer waits for an external trigger event before it actually starts the measurement.

By default pin 6 on the aux connector is used as an input for external trigger signals (see Aux Connector). You can select whether it should trigger on a rising or falling edge of an external pulse. This input does not have an internal pull-up- or pull-down-resistor, so if required, you may need to add an external one.

Trigger Delay

You can also choose to set a Trigger Delay, which is a specific time that the spectrometer waits between receiving the trigger event and starting the exposure.

Device Settings

All device settings can be displayed by choosing "Device Settings" from the Device menu. This window is mostly intended for expert users who need to make specific changes that are not supported by the normal user interface.

There are three types of device settings:

- **Parameters:** Can be changed by the user and are stored persistently in the device (see below).

- **Device Properties:** Are written during device production and usually not changed afterwards.
- **Measured Values:** Reflect the current state of the device.

You can change any parameter by clicking on its value to select it and then clicking again to enter the editing mode. Afterwards, click on "Write To Device" to apply the changes.

You can reset all parameters to their default values with the "Write Defaults" button.

By default all changes of parameters are persistently stored in the device when the connection to the device is properly closed (using the "Close Device" button or by sending the "Stand By" command to the device). This means that when you later disconnect and reconnect the device, all parameters are set to the values most recently used.

You can also choose not to save any parameter changes persistently by setting the parameter "SaveChangesPersistently" to "false". In this case, any parameter changes are not kept when disconnecting the device and all parameters are reset to their previous values.

Long-term measurements

Sometimes you may want to take measurements over an extended period of time (hours, days or even weeks). In principle, you can just select "Keep all new spectra" and start a continuous measurement. To set a time interval between measurements, use the "Trigger Delay" parameter. However, while there is no hard limit to the number of spectra you can keep in the list, if you take thousands of spectra it may slow down your computer considerably. In addition, to improve reliability you may want to save your data frequently to disk and to be able to monitor the progress remotely.

We therefore recommend the following procedure for long-term measurements:

- In Tools → Options → Acquisition select "Only show last spectrum". This ensures that when taking spectra continuously, only the last spectrum is selected for display. Otherwise with hundreds of spectra in the list, drawing the diagram window might become quite slow.
- In the same window, select "Save all spectra automatically" and choose a suitable interval time and target folder. This has several advantages: The spectra are saved to a file in regular intervals, so you wont loose your data even if there is a software or hardware problem. Your computer also won't run out of memory or slow down significantly when collecting several 10 000 spectra. Finally you can sync the data to another computer to continuously monitor the progress remotely.
  Note: we do not recommend using a network drive as a target folder for automatically saving spectra, because network connections may be unreliable. Instead, save it to a local drive and use a file synchronization service (see below).
- Then select „Keep all new spectra" in the main window
- To set a time interval between measurements, use the "Trigger Delay" parameter. You can find it in the main window after clicking on the "double-arrow down" button.
- Start your measurement with "Run Continuously"
- Wait until the first spectra have been saved automatically and open these files to check that everything works fine.

Monitoring the progress of your measurement remotely

To monitor the progress of your measurement from a remote location, we recommend using a file synchronization service like Dropbox, Google Drive, OneDrive or Box. For example, you may set up a free Dropbox account on your measurement PC and your own laptop. If you then choose to save the measured spectra automatically to the Dropbox folder, you can always check the latest measurement files on your own laptop. Obviously, this only works if both computers are connected to the internet. Please also note that the commercial services mentioned above require you to hand over your measurement files to the respective company. If you prefer to keep your data for yourself, you may setup an open-source file synchronization software like rsync or ownCloud on your own file server.

Technical Information

For all technical specifications concerning your spectrometer please see the corresponding product datasheet.

Software Development Kit

The Software Development Kit (SDK) contains documentation, sample code and device drivers to control devices by Avenir Photonics from your own software. It includes:

- **ZioLink Protocol Manual:** The main documentation for the SDK.
- **BasicSpectrometer C#:** A simple demo code showing the basic steps to measure a spectrum. It is a console program for Windows written in C# using .NET 5.0. A compiled binary is included in the 'bin' folder.
- **BasicSpectrometer Python:** The same in Python. Runs under Linux, Mac and Windows. Requires the 'pyusb' package to be installed. Tested with Python 3.8.
- **SimpleSpectrometer C#:** The source code for a simple program for measuring spectra with a WinForms user interface, written in C# using .NET 5.0. A compiled binary is included in the 'bin' folder. The communication with the device is encapsulated in the ZioLinkSpectrometer class, which is more sophisticated and ready to be used in your own software. This class uses the WinUsbInterface class for USB communication. The classes CommunicationInterface and Device are abstract base classes.
- **ProtocolDroid:** This is a simple Windows tool to demonstrate, test and unterstand the command and data structures of the ZioLink protocol. You can use it to compose simple command codes, send them to the device and see the response from the device.
- **Windows device driver:** The driver installation files to install the WinUSB driver for the spectrometer.

Please see the ZioLink Protocol Manual for further details.

Technical Support

If you have any questions or comments, please check our website at:
https://www.avenirphotonics.com/support/

If this does not answer or resolve it, please contact us at:
support@avenirphotonics.com

Software updates are usually released several time per year. You can find the latest download on our website.

We appreciate any comments, bug reports or feature requests, so don’t hesitate to share your experiences and requirements with us.

Changing the entrance slit

The entrance slit of the spectrometer can easily be exchanged by the user. Use a hex key to loose the headless screw below the optical interface. Then carefully remove SMA connector with the entrance slit at its back. When reinserting another SMA connector, make sure that the semi-circle markings on both parts line up. Then fasten the headless screw again. If the screw does not go all the way in, check the position and angle of the SMA connector.

Aux Connector

The 16-pin Auxiliary (Aux) Connector can be used for power supply, analog and digital I/O, trigger in and out and offers several alternative digital interfaces. Not all features are currently supported by the software. Please check the datasheet and contact technical support if you plan to use features on the Aux Connector.

The mechanical connector to be plugged into the Aux Connector is a 20-pin 1.27 mm Female IDC connector. This type of connector can be directly pierced on a 20-wire ribbon cable, eliminating the need to solder individual wires. Please note that you need a high-density ribbon cable with a distance of 1.27 mm between the wires.

Suitable IDC connectors are available from different manufacturers, including:

- Würth 62701623121
- Harwin M50-3300842
- Amphenol 20021444-00016T4LF
- CNC Tech 3230-16-0103-00
- Samtec FFSD-08-01-N

The pin assignment is as follows:

Pin	Primary Function	Alternate Functions	Note
1	GND		
2	Analog Output	Analog Input 2	max. voltage 3.3 V (not 5-V-tolerant)
3	Analog Input	Analog Output 2	max. voltage 3.3 V (not 5-V-tolerant)
4	/Reset		low-active input
5	I²C SDA	GPIO	
6	Trigger In	GPIO	no internal pull-up or pull-down resistor
7	I²C SCK	GPIO, UART RX	
8	Trigger Out	GPIO	
9	SPI NSS	GPIO, UART TX	
10	GND		
11	SPI CLK	GPIO	
12	Supply Voltage Out		+5 V output to power external accessories
13	GND		
14	Supply Voltage In		+ 5 V input to power the spectrometer
15	SPI MOSI	GPIO, UART CTS, USB D+	UART handshake is optional
16	SPI MISO	GPIO, UART RTS, USB D-	UART handshake is optional

Compliance

EU Declaration of Conformity

The manufacturer

Avenir Photonics GmbH & Co. KG
Franz-Mayer-Straße 1, 93053 Regensburg, Germany

declares that the products

Aris spectrometer (part numbers ARIS-xxx-xxx-xx-xxx-xxx)
Siena spectrometer (part numbers SIENA-xxx-xxx-xx-xxx)

comply with the European standards

EN 61326-1
EN 61326-2-3
EN IEC 63000:2018

and therefore conform to the European Directives

2014/30/ EU (Electromagnetic compatibility)
2011/65/EU (Restriction of Hazardous Substances)

FCC Compliance

This declaration applies to the products

Aris spectrometer (part numbers ARIS-xxx-xxx-xx-xxx-xxx)
Siena spectrometer (part numbers SIENA-xxx-xxx-xx-xxx)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.