

VERSION 1.0

COMLINE ELEKTRONIK ELEKTROTECHNIK GMBH

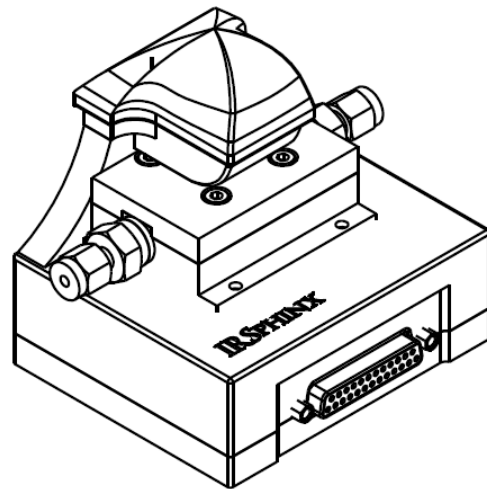
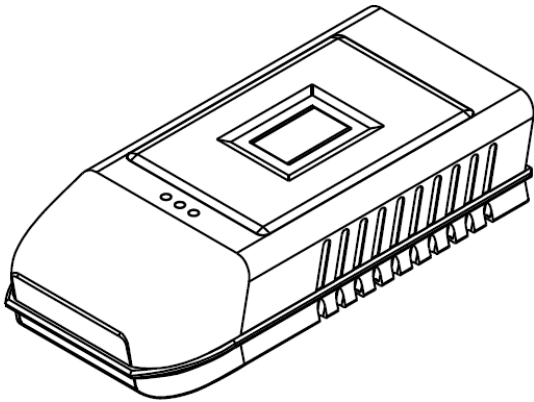
Advanced Wiring Systems and Sensor Systems

IR Sphinx

User Manual

COMLINE ELEKTRONIK ELEKTROTECHNIK GMBH

IRsphinx User Manual



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1 PREFACE

With the new developed IRSphinx MID-IR spectrometer a new chapter of IR spectroscopy is opened in the middle infrared spectral range. Due to the no-moving-parts design, applications even in harsh environmental conditions are made possible. The small size and power consumption stands out clearly from conventional IR spectrometers available on the market.

IR spectroscopy is a powerful technique for measuring the concentration of organic molecules. The physical effect of infrared light absorption by molecules contained in the sample is measured. Each molecule absorbs light of a certain wavelength. The strength of absorption is a measure of the concentration of the particular molecule.

The sensor is based on a spectral apparatus that is constructed with no-moving-parts, which makes it durable and virtually maintenance free. Meaningful parameters are calculated from the recorded spectra by a previously built calibration (chemometric model).

In addition to portable systems for rapid on-site analysis, device models for use in the laboratory are available – as well as rugged field installations for inline operation.

1.1 USING THIS GUIDE

This guide tells you how to install and maintain the IRSphinx system; We recommend that you use it as follows:

1. Reading *Warnings and Safety Information* in Chapter 2.
2. Follow the procedures in *Unpacking and Installation* in Chapter 3.
3. Read *Description of the Spectrometer Units* in Chapter 4, to learn about the spectrometer.
4. Read the first section of the Maintenance Chapter 5 to learn what maintenance is required.

1.2 CONVENTIONS

Two terms, in the following standard formats, are also used to highlight special circumstances and warnings.



We use the term **WARNING** to inform you about situations that could result in **personal injury** to yourself or other persons. Details about these circumstances are in a box like this one.



We use the term **CAUTION** to inform you about situations that could result in **serious damage of the instrument** or other equipment. Details about these circumstances are in a box like this one.

1.3 PRODUCT OVERVIEW

The IRSphinx spectrometers are available in different configurations. In general the spectrometers are classified into the types: Lab, Portable and Industrial. The sample interface can be chosen between Transmission and ATR, the spectral range between 2.5-5 μm (2000-4000 cm^{-1}) and 5.5-11 μm (1800-900 cm^{-1}) and the material of the cuvette windows and the ATR crystal can be chosen between ZnSe (zinc selenide) and ZnS (zinc sulfide). Additional accessories like an ATR flow through plate or a gas-cell is available. All Transmission mode spectrometers feature two additional bandpass sensors which can be changed customer specific.

Article Number	Product Name	LVF	ATR Crystal
IRSphinx ATR mode spectrometers			
919100-00	IRSphinx ATR Lab	2,5-5 μm	ZnSe
919101-00	IRSphinx ATR Lab	2,5-5 μm	ZnS
919200-00	IRSphinx ATR Lab	5,5-11 μm	ZnSe
919201-00	IRSphinx ATR Lab	5,5-11 μm	ZnS
918100-00	IRSphinx ATR Industrial	2,5-5 μm	ZnSe
918101-00	IRSphinx ATR Industrial	2,5-5 μm	ZnS
918200-00	IRSphinx ATR Industrial	5,5-11 μm	ZnSe
918201-00	IRSphinx ATR Industrial	5,5-11 μm	ZnS
917100-00	IRSphinx ATR Portable	2,5-5 μm	ZnSe
917101-00	IRSphinx ATR Portable	2,5-5 μm	ZnS
917200-00	IRSphinx ATR Portable	5,5-11 μm	ZnSe
917201-00	IRSphinx ATR Portable	5,5-11 μm	ZnS

IRSphinx Transmission mode spectrometers			Bandpass config
909100-00	IRSphinx Transmission Lab incl. cuvette ALU	2,5-5 μm	3.09 μm / 4.64 μm
909200-00	IRSphinx Transmission Lab incl. cuvette ALU	5,5-11 μm	3.09 μm / 4.64 μm
908100-00	IRSphinx Transmission Industrial incl. cuvette Stainless	2,5-5 μm	3.09 μm / 4.64 μm
908200-00	IRSphinx Transmission Industrial incl. cuvette Stainless	5,5-11 μm	3.09 μm / 4.64 μm

906100-00	IRSphinx Transmission Fieldkit incl. cuvette Stainless	2,5-5µm	3.09µm / 4.64µm
906200-00	IRSphinx Transmission Fieldkit incl. cuvette Stainless	5,5-11µm	3.09µm / 4.64µm
907100-00	IRSphinx Transmission Portable incl. cuvette ALU	2,5-5µm	3.09µm / 4.64µm
907200-00	IRSphinx Transmission Portable incl. cuvette ALU	5,5-11µm	3.09µm / 4.64µm

IRSphinx Accessoire

90901-00	Cuvette Alu	ZnSe
90902-00	Cuvette Stainless Steel	ZnSe+fluid channels

SphinxSuite Software

941100-00	SphinxSuite Basic (additional license)
941100-01	SphinxSuite Option A (modulation frequency)
941100-02	SphinxSuite Automation
941100-03	SphinxSuite Chemometrics
941100-04	SphinxSuite Predicition
941100-05	SphinxSuite Standalone

2 WARNINGS AND SAFETY INFORMATION

2.1 GENERAL SAFETY

The IRSphinx Spectrometers has been designed and tested in accordance with the safety requirements of the International Electrotechnical Commissions (IEC). The spectrometer conforms to IEC publication 61010-1 (Safety requirements for electrical equipment for measurement, control, and laboratory use).

If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired. Only use the IRSphinx under following conditions:

Temperature: 0°C to 50°C

Humidity: 75% maximum (non-condensing)

Whenever it is likely that the IRSphinx is unsafe make it inoperative. The IRSphinx may be unsafe if it:

- Shows visible damage
- Fails to perform the intended measurement
- Has been subjected to prolonged storage in unfavorable conditions
- Has been subjected to severe transport stresses



If the equipment is used in a manner not specified herein the protection provided by the equipment may be impaired



The IRSphinx contains a pulsed hot source and contact with flammable vapors may cause an explosion. When working with flammable solvents or samples make sure that no flammable vapor is entering the system. If there is any possibility that they have entered the interior (by coming into contact with the gasket of the ATR sample stage for example) the the instrument must be switched off immediately and disconnected from the power supply and battery.



Flammable solvents or samples should not be stored on or near the instrument. Handling of such materials during preparation should be performed in a safe area away from the instrument such as a fume cabinet.



Some chemicals used with this instrument may be hazardous or may become hazardous after completion of an analysis. The responsible body (for example, the Laboratory Manager) must take the necessary precautions to make sure that the surrounding workplace is safe and that the instrument operators are not exposed to hazardous levels of toxic substances (chemical or biological) . Venting for fumes and disposal of waste must be in accordance with all national, state and local health and safety regulations and laws.

2.2 WARNING LABELS

Warning signs on the instrument



Caution (refer to accompanying documents)

2.3 EMC COMPLIANCE

The IRSphinx system has been designed and tested to meet the requirements of the EC Directive 89/336/EEC. The IRSphinx complies with the EMC standard EN61326-1:2013 (EMC standard for electrical equipment for measurement, control and laboratory use), EN 301 489-01; V1.9.2 (portable version) and EN 61000-3-3:2013 (industrial version).

2.4 ZnSe (ZINC SELENIDE) WINDOW



During routine use of the IRSphinx the ZnSe windows in the flowcell or ATR unit present no hazard, but:

- DO wear protective gloves when handling the windows.
- DO NOT use acids to wash the windows because they react to emit H₂Se, which is very toxic and irritating.
- Avoid contact of the windows with oxidizers.
- ZnSe is highly toxic by ingestion

2.4.1 Cleaning the ZnSe Crystal

Avoid a contact of the window with oxidizers or acids. ZnSe can be cleaned in pure dry acetone or methanol using a soft, lint-free cloth and drying in a current of warm air so that there is no possibility of condensation forming on the window. Other suitable solvents are petroleum ether and hexane. The windows may also be cleaned in some commercial laboratory detergents, but they must be neutral. Alkaline solutions will slightly etch the surface, and acids will severely attack the material. A final rinse in distilled water and drying in a current of warm air is recommended.

Hazard Class	6.1
UN Number	2811
CAS Number	1315-09-9

2.4.2 Physical Data

Description	Yellow crystal
Melting point	1525°C
Boiling point	Not applicable
Specific gravity	Not applicable
Solubility in water	Immiscible or insoluble
Vapor pressure	Not applicable
Vapor density	Not applicable

2.4.3 Fire and Explosion Hazard

May evolve toxic fumes in a fire

Flash point	Not applicable
Explosive limits	Not applicable
Auto-ignition temperature	Not applicable
Fire-fighting measures	Use extinguisher suitable for surrounding fire

2.4.4 Health Hazard

In contact with gastric juices, very toxic and irritating H₂Se is evolved. Chronic effects: can cause dermatistic and digestive disturbances. Garlic odor of breath is a common symptom. May cause pallor, nervousness and depression.

Toxicity data	TLV (soluble compounds) 0.2 mg/m ³ as for selenium compounds; LD ₅₀ unknown
Carcinogenicity	No evidence of carcinogenic properties
Mutagenicity/ Teratogenicity	No evidence of mutagenic or teratogenic effects
Exposure limits OES, mg/m ³	0.2 Se (Long-term, 8 hour TWA).

2.4.5 First Aid

Affected Area	Effect of acute exposure	Emergency First Aid
Eyes	Harmfull	Irrigate thoroughly with water for at least 10 minutes; OBTAIN MEDICAL ATTENTION if discomfort persists
Lungs	Irritates	Remove from exposure, rest and keep warm; OBTAIN MEDICAL ATTENTION in severe cases
Skin	Irritates	Wash thoroughly with soap and water; OBTAIN MEDICAL ATTENTION if discomfort persists
		If ZnSe is swallowed or ingested, wash out mouth thoroughly with water; OBTAIN MEDICAL ATTENTION

2.4.6 Reactive Hazards

Stability	Stable
Reaction with water	May emit hydrogen selenide (H ₂ Se)
Decomposition products	Highly toxic fumes. Decomposition results from extreme heat temperatures greater than 400°C especially in a oxidizing atmosphere
Other known hazards	Reacts with acids to give highly toxic hydrogen selenide (H ₂ Se)
Avoid contact with	<ul style="list-style-type: none">• Water (no)• Acids (yes)• Bases (no)• Oxidizers (yes)• Combustibles (no)

2.4.7 Storage and Handling

Special requirements	Wear protective gloves when handling the crystal
----------------------	--

2.5 LIPO ACCUMULATOR

Lithium-Polymer (abbreviation: LiPo) batteries require particularly careful handling. This applies to charging and discharging techniques, and also to storage and other aspects of general handling. Special measures must be observed, and these are outlined below.

Mishandling these batteries may lead to explosions, fire, smoke and a risk of poisoning. In addition to these hazards ignoring our instructions and warnings will result in loss of battery performance and other problems. The capacity of a LiPo battery declines every time you charge or discharge it. Storing these batteries at excessively high or low temperatures may also cause a gradual reduction in capacity.

2.6 SPECIAL NOTES REGARDING THE USE OF THE LIPO BATTERY

2.6.1 General warning notes



LiPo batteries must not be thrown in a fire or incinerated.



LiPo cells must not be allowed to come into contact with fluids such as water, salt water or drinks, even for a very short period. Avoid all contact with liquids of any type.



Batteries must not be placed in a microwave oven or subjected to pressure. This may result in smoke and fire or even worse.



Never dismantle a LiPo battery. Dismantling a pack may cause internal short-circuits, with the possible results of gassing, fire, explosion and other problems.



LiPo batteries contain toxic electrolytes and electrolyte vapours which are damaging to health. Take great care to avoid direct contact with electrolyte. If electrolyte contacts your skin, eyes or any other body part, immediately wash it off using plenty of clean water, then consult a doctor.



Never short-circuit these batteries. Shorting the terminals allows a very high current to flow, and this heats up the cell. This in turn may lead to a loss of electrolyte, gassing (venting of gas) or even an explosion. When handling the LiPo battery keep them well away from conductive objects and surfaces to avoid the danger of a short-circuit.



The permissible range of temperature during the charging and storing of LiPo batteries is from 0 – 50° C. Storing: LiPo cells should be stored with a charged capacity of 10 – 20 %. Do absolutely avoid short-circuits. Permanent short-circuits cause a destruction of the battery, high temperatures and self-inflammation may be the consequence.

2.6.2 Mechanical shock:

LiPo batteries are not as mechanically robust as metal-cased cells, and for this reason you must avoid subjecting them to mechanical shocks such as dropping, hitting, bending, cutting, scoring, deforming or drilling into the laminate film. Never bend or twist the LiPo battery, and do not exert pressure on the battery or its connections.

2.6.3 Charging the LiPo battery pack

Charging of the LiPo battery pack is only allowed in the system with its appropriate Battery management unit. Any manipulation of the charger or of the charging lead may cause serious damages. The battery must be placed on a non-flammable, heat resistant and non-conductive surface directly inside the battery compartment of the system. Keep inflammable and volatile materials well away from the charging area. Batteries must not be left on charge unsupervised.

2.6.4 Mechanical strength of the case film:

The aluminum laminate film which encloses the cells is easily damaged by sharp objects such as pins, knives, nails or similar: If the film is damaged, the battery is useless and has to be removed from the system immediately. If the pack were to be short-circuited, it could burst into flames. Temperatures above 70°C may also damage the case and cause leaks; this will result in loss of electrolyte, the battery gets useless and must be disposed of.

2.6.5 Handling the battery terminals:

The terminals of LiPo cells are not as robust as those of other batteries; this applies in particular to the aluminum + terminal. Please note that the terminals can easily break off. Due to the heat transfer it is not possible to solder to the aluminum terminals. The terminals are fitted in the battery compartment without applying strain to them.

2.6.6 Replacing LiPo battery pack:

The LiPo battery pack of the IRSphinx spectrometer may only be replaced by original spare parts from the manufacturer or a certified distributor.

2.6.7 Re-using damaged cells:

Damaged cells must never be re-used. Indications of damage include broken housings, distortion of battery cells, escaping electrolyte or a smell of electrolyte. If your LiPo battery exhibits any of these problems it must not be used again. Damaged or exhausted cells constitute toxic waste and must be disposed of in the appropriate manner.

3 UNPACKING AND INSTALLATION

This user guide describes how physically set up and connect to your IRSphinx spectrometer and its standard sampling procedure. For details of how to use the software *SphinxSuite* please refer to SphinxSuite User Manual.

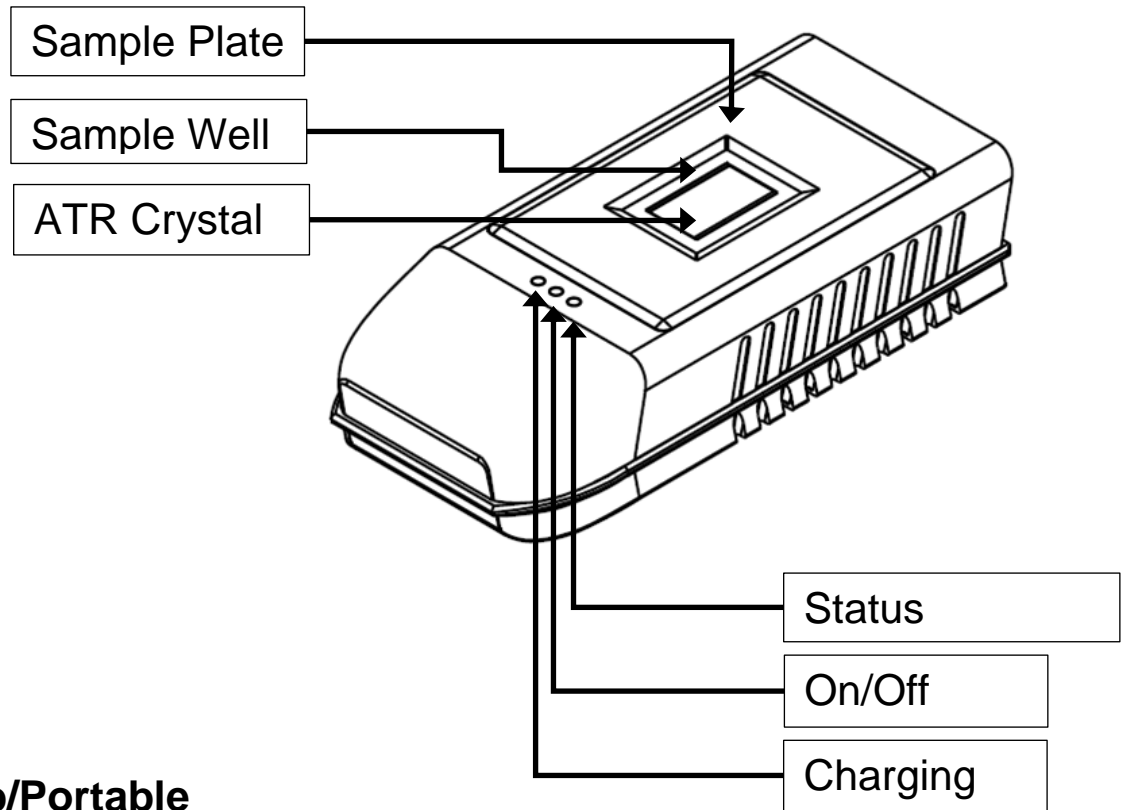
3.1 PACKAGE CONTENTS IRSPHINX

The IRSphinx spectrometer is shipped with the following components.

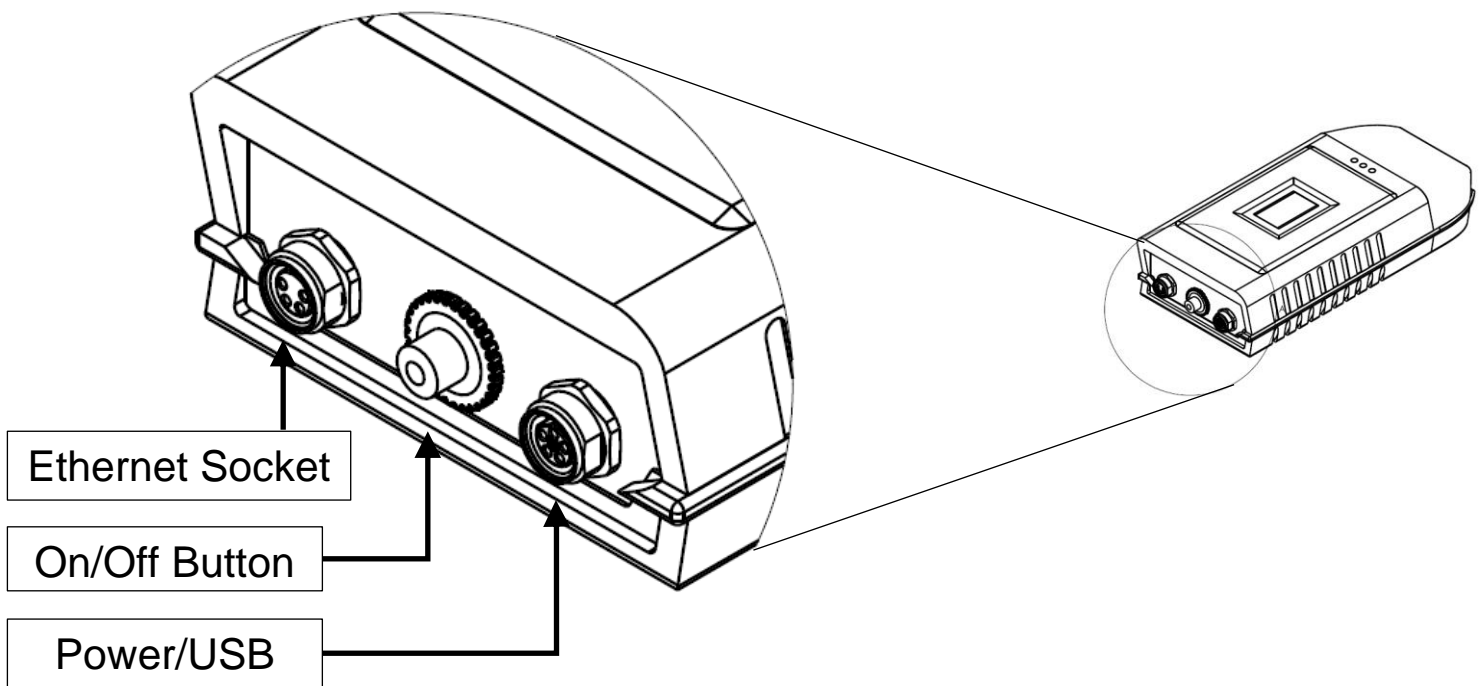
- IRSphinx spectrometer with LiPo Battery (1)
- Power adapter (2)
- Ethernet Cable (3)
- USB/Power interface cable (4)
- USB A/B cable (5)
- License, User Manuals and Safety Documentation

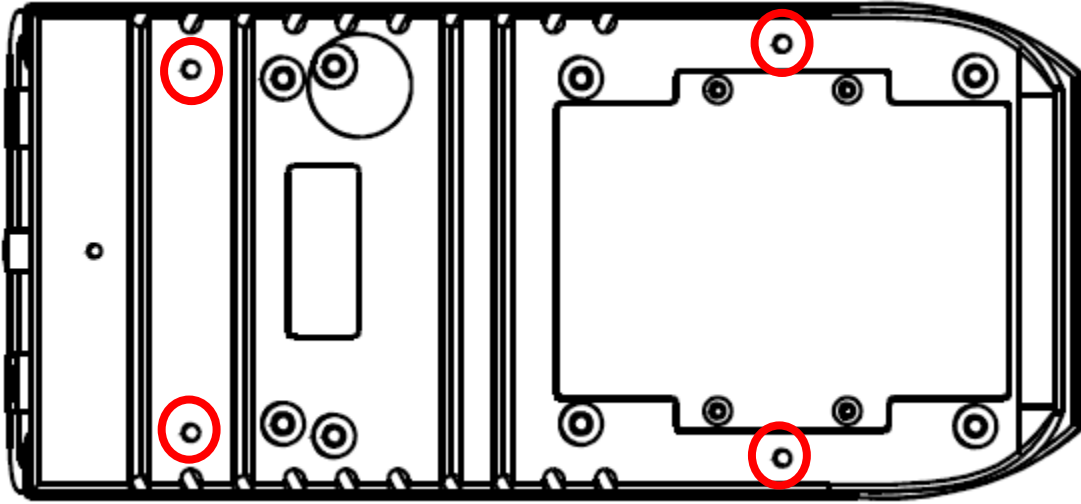


3.2 OVERVIEW IRSPHINX ATR



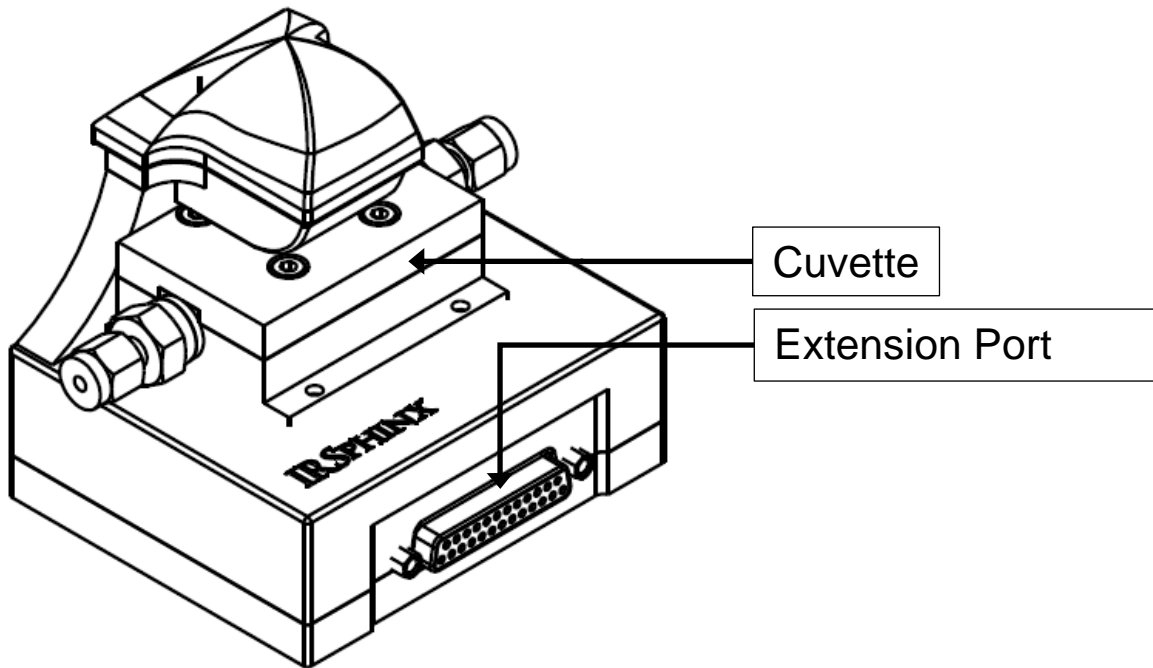
IRSphinx Lab/Portable

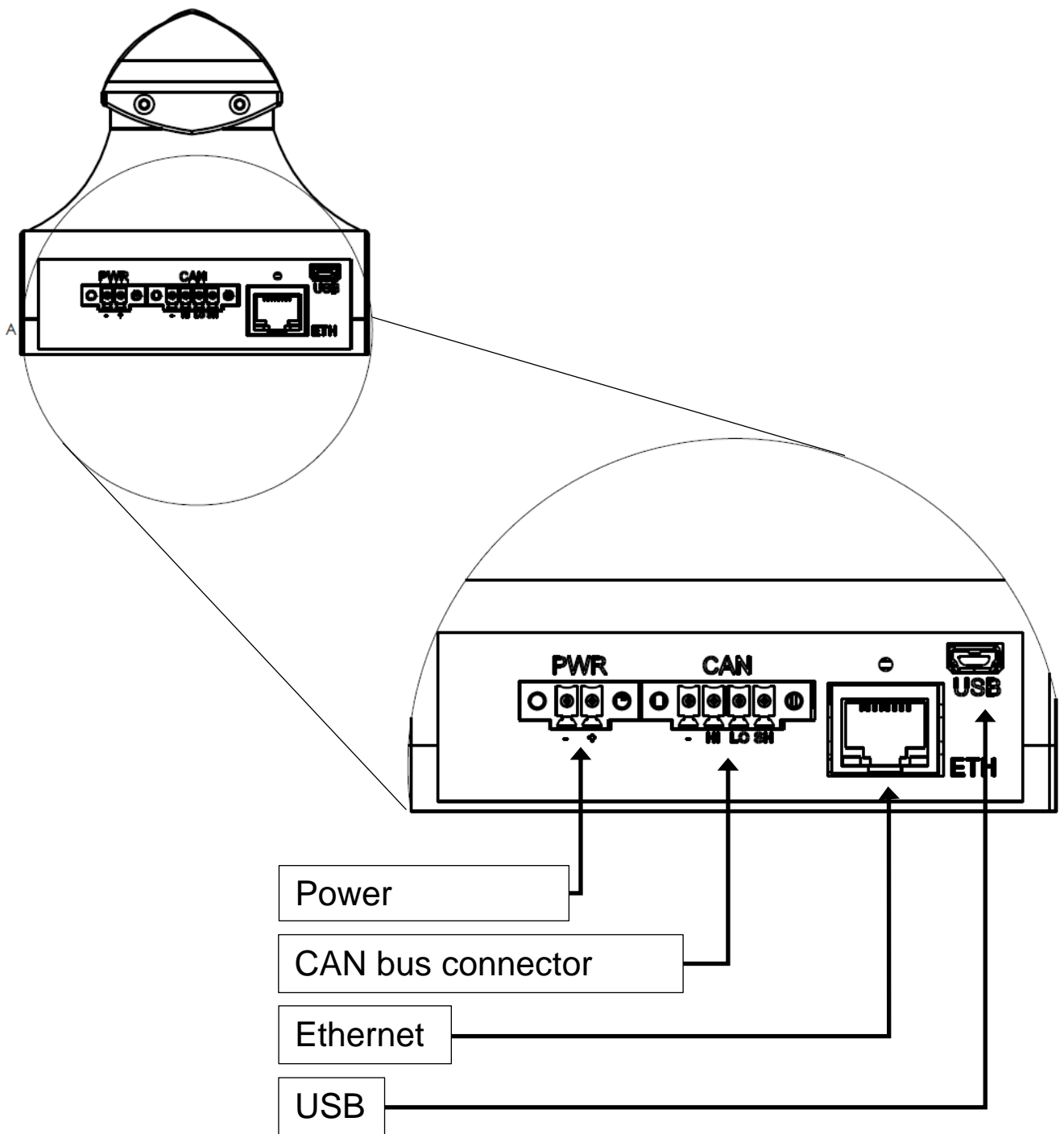




 M3 Thread for permanent installation

3.3 OVERVIEW IRSPHINX TRANSMISSION





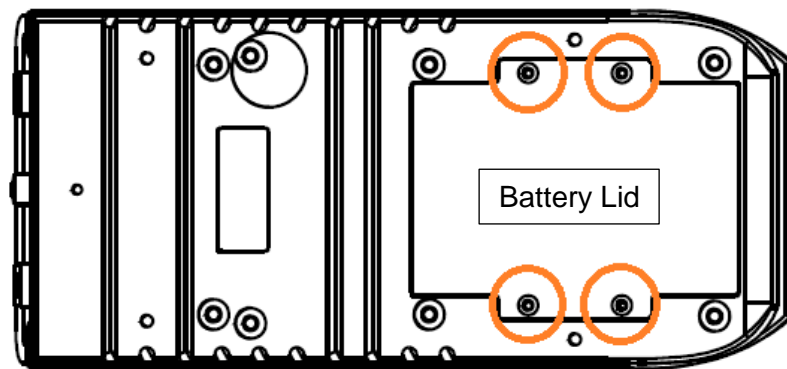
3.4 INSERTING THE IRSPHINX SPECTROMETER BATTERY



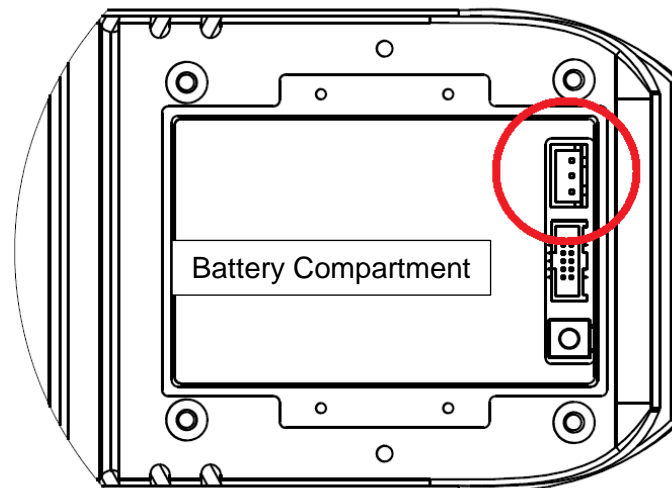
Due to shipping regulations the LiPo battery comes within the battery compartment and is unconnected. Never ship the spectrometer with connected LiPo battery.

Prior to using your spectrometer you must ensure that its battery is connected:

1. Remove the 4 screws highlighted orange and remove the battery lid



2. Place your battery in the battery compartment and insert its connector into the port highlighted in red.

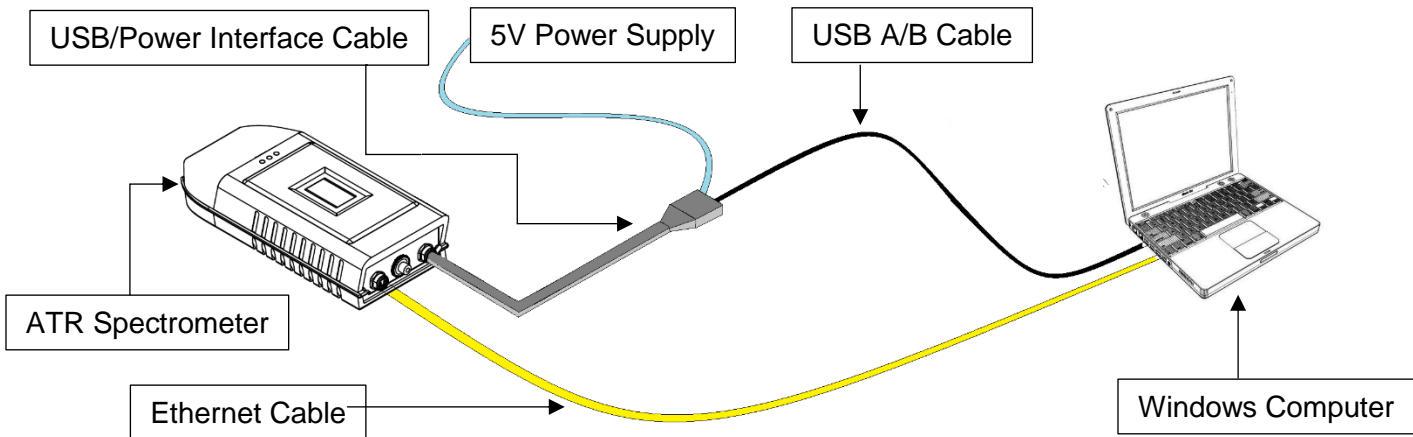


3. Replace the battery lid and all screws that were removed.

3.5 CONNECTING UP THE IRSPHINX ATR

You can connect to your IR Sphinx spectrometer over USB, Ethernet (Lab, Industrial) and with the portable versions over Bluetooth.

The following diagram shows how to connect your spectrometer to a power supply, USB and Ethernet. Please note the diagram is merely illustrative and there is no need to connect to USB and Ethernet simultaneously. Provided the battery is charged, there is no requirement to use wires when using Bluetooth. The spectrometer can be used over a standard TCP/IP network. For details please refer to the SphinxSuite Manual.



When you run a wired connection please make sure that you connect the spectrometer as follows:

1. Connect the 5V power supply
2. Turn it on
3. Then connect the USB cable to your PC

When your spectrometer is connected to USB/5V power, the battery status indicator will glow orange when the battery is charging or green if it's fully charged.

3.6 SWITCHING ON YOUR IRSPHINX ATR SPECTROMETER

Press the On/Off press button to turn your spectrometer on or off. When the spectrometer is on the On/Off indicator on the front of the system will flash blue, otherwise it will remain unlit.

The status indicator will change colour depending on the operation state of the spectrometer. While disconnected from SphinxSuite it will glow solid green, otherwise it will glow solid amber. Whilst in the process of recording a spectrum, it will alternately flash green and orange. Please refer to the SphinxSuite manual for details of how to connect to your spectrometer.

3.7 CONNECTING UP THE IRSPHINX TRANSMISSION

You can connect to your IRSphinx Transmission spectrometer over USB and Ethernet. When your spectrometer is connected to the 12V power supply it starts automatically. You can then connect over USB or Ethernet to the device. Please refer to the SphinxSuite manual for details of how to connect to your spectrometer.

3.8 SAMPLING PROCEDURES FOR LIQUIDS AND SOLIDS

Sampling an Infrared spectrum contains always of the following steps and changes slightly between Transmission and ATR mode readings.

3.8.1 IRSphinx Transmission modes spectrometers:

1. Turn on the spectrometer and start “Live View” to bring the spectrometer into operation temperature. The more stable the temperature of the better the taken spectra.
2. The background measurement always is taken without cuvette in the optical path.
3. Make sure that the optical windows over the light sources and the dispersive element are cleaned with a lint free tissue and take care not to scratch it.
4. Adjust the scan count for the Background to 400 or higher to achieve a noise minimized Background reading. The more time you invest here the better the results get.
5. When the spectrometer reached its operation temperature take a Background measurement.
6. Adjust the cuvette spacer thickness to your sample requirements (see Chapter 5.2)
7. Then place the cuvette into the optical path and fit it with both screws. To gain optimal repeatability make sure that the cuvette windows are cleaned with a lint free tissue and take care not to scratch it. The cuvette needs to be always in the same position so take care that it is screwed in exactly.
8. Fill the cuvette with the liquid sample and take care that no particles are flushed into the cuvette and no air bubbles stay in the optical path.
9. Take a sample reading. Here again, the higher the scan count the better the results at the end.
10. Flush the cuvette with an appropriate solvent
11. Take a new Background reading as often as the ambient temperature change requires this.

3.8.2 IRSphinx ATR modes spectrometers:

1. Turn on the spectrometer and start “Live View” to bring the spectrometer into operation temperature. The more stable the temperature of the better the taken spectra.
2. The Background measurement always is taken without a sample on the ATR crystal.
3. Make sure that the ATR crystal is cleaned with a lint free tissue and take care not to scratch it.
4. Adjust the scan count for the Background to 400 or higher to achieve a noise minimized Background reading. The more time you invest here the better the results get.
5. When the spectrometer reached its operation temperature take a Background measurement.
6. Place a sample on the ATR crystal and be careful to cover the full crystal and to be free of air bubbles.
7. Take a sample reading. Here again, the higher the scan count the better the results at the end.
8. Clean the ATR with an appropriate solvent and a lint free tissue.
9. Take a new Background reading as often as the ambient temperature change requires this.

3.9 INSTALLING SPHINXSUITE

3.9.1 PC Hardware Requirements

We recommend a hardware configuration with the following minimum requirements:

- Windows XP or Windows 7 (32 or 64bit)
- Processor: Intel Atom Z530 or higher
- 200 MB RAM
- At least 300 MB of Hard Disk Space (Run-Time included)
- RJ45 port for communication over Ethernet
- USB 2.0 port or higher for communication over USB (full and low speed)
- Bluetooth Adapter for communication over Bluetooth (for availability refer to the technical specification of your device)

3.9.2 Software Installation

Please refer to the included SphinxSuite software manual.

4 DESCRIPTION OF THE SPECTROMETER UNITS

4.1 IRSPHINX ATR

Type	Lab				Portable				Industrial			
Spectral range	2.5-5 μ m		5.5-11 μ m		2.5-5 μ m		5.5-11 μ m		2.5-5 μ m		5.5-11 μ m	
ATR Crystal Material	ZnS	ZnSe	ZnS	ZnSe	ZnS	ZnSe	ZnS	ZnSe	ZnS	ZnSe	ZnS	ZnSe
ATR Frame Material	Grade 1.4401 stainless steel											
Spectrometer Housing Material	Anodised aluminium											
ATR Surface area	17 x 27 mm											
Number of Sample Reflections	9											
Illumination Source	Electrically modulated MEMS emitter											
Source Lifetime	>5000 Hrs of continuous measurement											
Dispersing Element	Linear variable filter (LVF)											
Detector	128-pixel uncooled pyroelectric array											
Pixel Size/Pitch	60 x 500 μ m/ 100 μ m											
Pixel to pixel wavelength interval	43.3 nm											
Spectral Bandwidth (FWHM)	<2% of centre wavelength											
Analogue to Digital Converter	16-bit											
Dynamic Range (max)	5600:1											
Signal to noise ratio	~425:1 (2σ) using a 1 minute integration time											
Measurement time (typical)	~30 seconds (N=200)											
Operating Environment	0 - 50°C non-condensing											
Storage environment	0 - 60°C non-condensing											
Dimensions	L x W x H / 165 x 74 x 35 mm											
Battery	Lithium polymer (LiPo) – 4.8 Wh											
Power Requirement	5 Volt DC, 4W				5 Volt DC, 4W				5 Volt DC, 6W			
Standalone operation	No				No				Yes			
Thermal Stabilisation	No				No				Yes			
Interface	USB, Ethernet				USB, Ethernet, Bluetooth				USB, Ethernet, CANopen			
Weight	700g				710g				750g			

4.2 IRSPHINX TRANSMISSION

Type	Lab		Portable		Industrial	
Spectral range	2.5-5 μ m	5.5-11 μ m	2.5-5 μ m	5.5-11 μ m	2.5-5 μ m	5.5-11 μ m
Cuvette	aluminum		aluminum		Stainless steel + fluid channels	
Spectrometer Housing Material	Anodised aluminium					
ATR Surface area	17 x 27 mm					
Number of Sample Reflections	9					
Illumination Source	Electrically modulated MEMS emitter					
Source Lifetime	>5000 Hrs of continuous measurement					
Dispersing Element	Linear variable filter (LVF)					
Detector	128-pixel uncooled pyroelectric array					
Pixel Size/Pitch	60 x 500 μ m/ 100 μ m					
Pixel to pixel wavelength interval	43.3 nm					
Spectral Bandwidth (FWHM)	<2% of centre wavelength					
Analogue to Digital Converter	16-bit					
Dynamic Range (max)	5600:1					
Signal to noise ratio	~425:1 (2σ) using a 1 minute integration time					
Measurement time (typical)	~30 seconds (N=200)					
Operating Environment	0 - 50°C non-condensing					
Storage environment	0 - 60°C non-condensing					
Dimensions	L x W x H / 165 x 74 x 35 mm					
Battery	No		LiPo accu		No	
Power Requirement	12 Volt DC, 4W		5 Volt DC, 4W		12 Volt DC, 6W	
Standalone operation	No		No		Yes	
Thermal Stabilisation	No		No		Yes	
Interface	USB, Ethernet		USB, Ethernet, Bluetooth		USB, Ethernet, CANopen	
Weight	430g		460g		460g	

4.3 IRSPHINX ACCESSORIES - CUVETTES

Type	Cuvette Alu
Article number	90901-00
Application	Demountable standard cell for easy cleaning, for use in IRSphinx Transmission spectrometers
Dimensions	H x W x D / 20 x 60 x 50 mm + fitting
Open aperture	W x D / 19 x 11 mm
Mounting holes	M3
Weight	185g
Pressure	max. 5bar
Housing	Aluminum – anodized
Windows	ZnSe – Zincselenide
Gasket	Viton
Spacer	PTFE, 100 µm (typical) / 25 µm (on request)
Fitting	G1/8", 4mm quick fitting coupling
Spare parts	Window kit, gasket kit, spacer kit

Type	Cuvette Stainless steel
Article number	90902-00
Application	Demountable heavy duty cell for easy cleaning, for use in IRSphinx Transmission spectrometers
Dimensions	H x W x D / 20 x 60 x 50 mm + fitting
Open aperture	W x D / 19 x 11 mm
Mounting holes	M3
Weight	385g
Pressure	max. 15bar
Housing	Stainless steel – 1.4301 / AISI 304
Windows	ZnSe – Zincselenide with milled in fluid channels
Gasket	Viton
Spacer	PTFE, 100 µm (typical) / 25 µm (on request)
Fitting	G1/8", 6mm SwageLok
Spare parts	Window kit, gasket kit, spacer kit

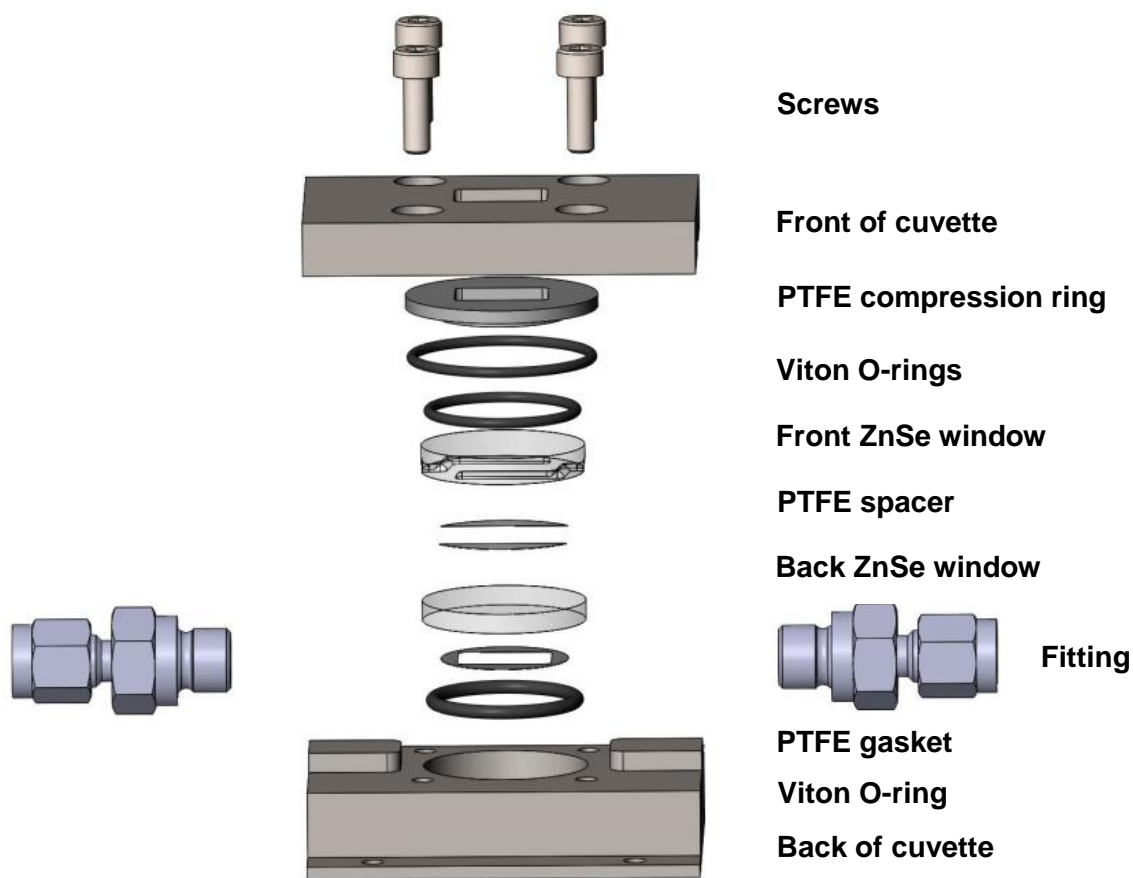
5 ROUTINE MAINTENANCE AND SERVICE

5.1 IRSPHINX MAINTENANCE PROCEDURES

The IRSphinx was designed to be largely maintenance-free. However, some modules are subject to normal wear like the lightsource, the cuvette windows or ATR crystal. These modules can be serviced by sending it back to the manufacturer or by a service technician on site.

5.2 MAINTENANCE OF THE CUVETTE

In normal use of the IRSphinx Transmission ensure that the cuvette is routinely kept clean and free of contaminants. Additionally we recommend that you regularly flush the system with a solvent to avoid the build up of contaminants. The cuvette can be fully disassembled to clean it or to adjust the spacer thickness.



Handling instructions:

- Tighten crosswise symmetrically in low steps to avoid breaking the windows. Upper and lower housing will be separated about 200µm!
- Use a torque screwdriver that covers the range from 10-30cNm.
- Clean windows with soft lint tissue to avoid scratches
- Make sure the sealings are in right position before tighten the cuvette
- Make sure the spacers and PTFE gaskets are in right position and don't block the lightpath
- The pathlength of the cuvette has to be recalculated after dismantling the cell. Failing to carry out this procedure will affect the results of the obtained spectra due to the Beer-Lambert's Law.



Do not use acid to clean the windows, as toxic fumes will be given off.



Wear gloves when dismantling the cuvette as the ZnSe windows are toxic.



Handle the windows carefully in order not to break them. The windows are brittle and easily broken. Be careful that you do not tighten the screws holding the cuvette together too tightly. An unsymmetrical tightening of the windows will lead to a breaking. We recommend that you use a torque screwdriver to tighten the screws.



When cleaning the windows use a lint free tissue and take care not to scratch it.



A strong force applied on the ATR crystal may lead to breaking.



Strong thermal gradients may lead to a breaking of the ATR or cuvette crystal. When storing it under cold climate conditions bring it slowly into operation conditions before starting it.

5.3 WARRANTY EXCLUSIONS AND LIMITATIONS

The following consumable items are excluded from the warranty agreement.

- ATR crystal
- Cuvette windows
- Light sources
- LiPo battery



Any attempts to perform installation or maintenance operations that are not detailed in this manual are at the user's own risk.

If a user-attempted service results in a visit by a Comline Service Engineer, the visit will not be covered by the instrument warranty. Warranty is excluded when the seal on the bottom of the instrument is damaged.

Damage caused by the following is not covered by warranty:

- Failure to flush or clean the system adequately after use.
- Failure to observe the precautions described in this manual.
- Failure which resulted after flooding liquids into the system.
- Failure which resulted after a drop of the system.

5.4 TROUBLESHOOTING

Problem	Possible cause	Corrective action
The system shows significant lower SNR than usual	<p>The battery isn't plugged to the system</p> <p>The battery shows a low charging status</p> <p>One or more light emitters yielded</p> <p>The ATR or cuvette window is scratched heavily</p> <p>The ATR or cuvette window is broken</p> <p>Strong soot contamination has permanently incorporated into the crystal structure and weakens the IR</p>	<p>Plug the battery</p> <p>Charge the battery</p> <p>Contact the service to replace the light emitters</p> <p>Contact the service to replace the ATR or to order new cuvette windows</p> <p>Contact the service to replace the ATR or to order new cuvette windows</p> <p>Contact the service to replace the ATR or to order new cuvette windows</p>
Air bubbles in the sample	<p>Connections of the cuvette are loose or leaking</p> <p>The screws in the cuvette are loose</p> <p>Bubbles adhere to the ATR crystal</p>	<p>Check all the connections and tighten them</p> <p>Tighten the screws to correct torque</p> <p>Release the air bubbles from the crystal by gently stir with a spatula. Make sure that no air is left on the crystal</p>
Spectrometer shuts off after 6 hours	You wired a power limited USB port before plugging the spectrometer to the grid.	First plug the spectrometer to the grid then plug it to the USB port.

5.5 SERVICE

To service the instrument please contact the manufacturer:

Comline Elektronik Elektrotechnik GmbH
Karl-Rapp-Str. 1
92442 Wackersdorf, Germany
Phone +49 (0) 9431 7565-0
Fax: +49 (0) 9431 7565-25
Website: www.comline-elektronik.de
Email: infrared@comline-elektronik.de

6 APPENDICES

Other documents that are delivered with the device:

1. Software Manual SphinxSuite
2. License certificate SphinxSuite
3. Safety Datasheet LiPo battery
4. Safety Datasheet ZnSe
5. Test datasheet