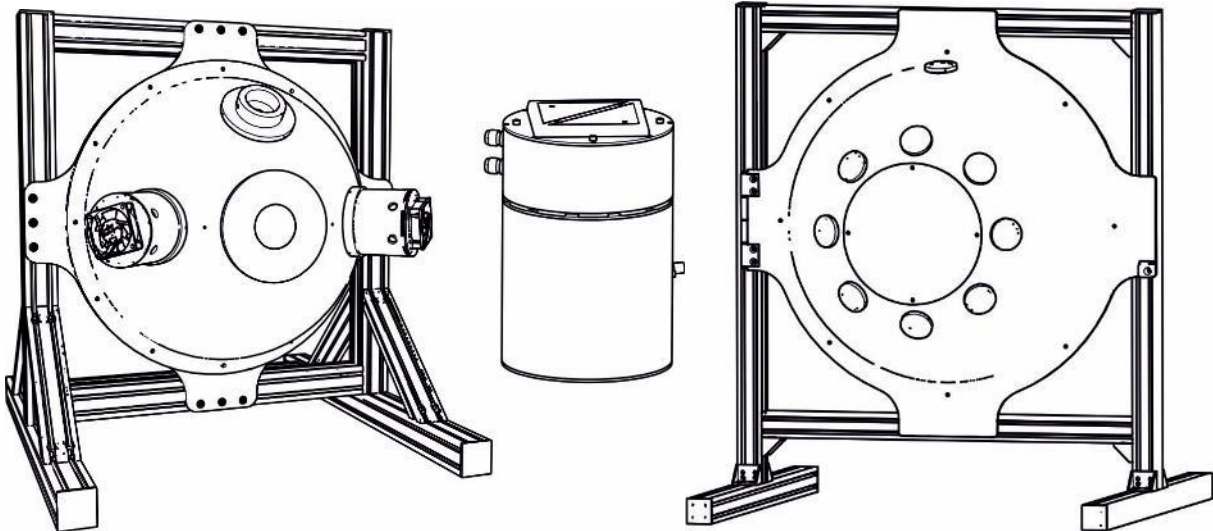


Integrating sphere

Instruction



(images similar)
Version 1.1.2

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2 Foreword

Dear customer!

Thank you for choosing a product from us!

Please take some time to read this manual carefully. Please pay special attention to the safety instructions.

This is the condition for safe handling and operation of the system and its components.

If you have any questions that are not answered in this manual, please feel free to call us. We will be glad if we can help you. We are also always happy to receive suggestions or ideas.

Our products are subject to constant development; therefore, there may be slight differences between your system and the illustrations in this operating manual.

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3 Guidelines and standards



The system is a machine according to Annex II A of the Machinery Directive and is therefore supplied with a declaration of conformity and a CE marking (in accordance with the Machinery Directive).

Guidelines	
EU directives	06/42/EC (machinery) (partly applicable) 2014/30/EC (EMC) 2014/35/EC (low voltage)
Harmonised standards	
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 61000-6-2:2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4:2007+ A1:2011	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission requirements for industrial environments

4 Identification

1.1 Manufacturer

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1.2 Change history



We reserve the right to make changes to the content. Opsytec Dr. Gröbel GmbH is not liable for any errors in this documentation. No liability is accepted for indirect damage arising from the supply or use of this documentation, to the extent permitted by law.

Version	Editor	Date	Change
1.1.0	Paravia	09.12.2019	Editorial changes
1.1.1	Paravia	01.07.2020	Editorial changes PTFE / BASO4
1.1.2	Paravia	25.10.2021	Editorial changes Auxiliary lamp

1.3 Copyright



Opsytec Dr. Gröbel GmbH shall retain the copyright for this operating manual. The operating manual is intended for the owner/operator and his personnel.

Copyright in accordance with DIN ISO 16016:

Reproduction and copying of this document, use and disclosure of the contents herein are strictly prohibited unless expressly authorized. Failure to comply may result in a claim for damages. All rights in the case of a patent application, utility model or design are reserved. Infringements may be subject to prosecution.



1.4 Device identifier

Information for internal use:

Description:	Opsytec integrating sphere, diameter =
Year of manufacture:
equipment no.
Project no.

1.5 Purpose

- The system is intended for industrial use only. It is prohibited to use the devices in potentially explosive atmospheres or for general lighting purposes
- Installation, commissioning, operation, maintenance and service work may only be carried out by trained and qualified personnel who comply with all safety guidelines and standards.
- The device is intended for use in clean, dry rooms.
- Do not operate the device if the air has a particularly high dust or moisture content, in potentially explosive atmospheres or if it is exposed to aggressive chemicals.
- Responsibility: Damage resulting from unintentional or unauthorized tampering terminates any right to assert warranty or liability claims against the manufacturer.
- Warranty Disclaimer: The use of any non-original parts will void the warranty.
- Environmental protection: Defective parts and packaging parts containing environmentally harmful substances must be disposed of accordingly.
- During operation, high-energy visible and invisible radiation can be generated if the integrating sphere is equipped with radiation sources or if these are measured in the integrating sphere.
- Operation is only permitted in a dry environment. The installation is horizontal.
- Only suitable for operation in closed rooms.
- Before opening, the system must be disconnected from the voltage and it must be checked that no voltage is present.
- Wear gloves when servicing, cleaning, and operating the integrating sphere.
- Do not clean the system when it is in operation.
- Any use other than that mentioned above will result in damage to the product. Furthermore, this is related to dangers such as short circuits, fire and electric shock. The entire device must not be changed and/or modified! The safety instructions must be observed at all times.

 CAUTION	
	<p>The system may fall down! Damage to the device and personal injury are possible</p> <ul style="list-style-type: none">• Always carry the system with two people. This is not only for personal protection but also for the stability & reproducibility of the integrating sphere.

1.6 Foreseeable misuse

The following is deemed to be foreseeable misuse:

- Operation of the device without safety devices and safety equipment.
- Activities of untrained personnel on the device.
- Failure to follow the owner/operator's operating instructions.
- Ignoring the operating manual.
- Any use outside the specified purpose.

1.7 Legal information

1.7.1 Limitation of liability

All information in this manual has been compiled taking into account the currently applicable standards and regulations, the technical standard and our many years of knowledge and experience.

The manufacturer is not liable for damages in the event that:

- This manual was ignored,
- the device has been used improperly,
- untrained personnel were used,
- untrained personnel used the integrating sphere incorrectly,
- unauthorised modifications have been made,
- technical changes have been made
- unauthorised spare parts have been used.

We are not liable for common faults of the device caused by a power failure or a failure of the control system.

The actual scope of delivery may differ from the explanations and pictures in this manual in the case of special versions, when additional options are ordered, or due to the latest technical changes.

The obligations agreed upon in the delivery contract as well as the delivery conditions of the manufacturer and the legal regulations valid at the time of the conclusion of the contract shall apply.

1.7.2 Declaration of Conformity

The declaration of conformity can be found in the appendix or can be requested from the manufacturer.

1.7.3 Warranty conditions

The warranty conditions are subject to the CivilCode (BGB) of the Federal Republic of Germany. The warranty period is 1 year, unless otherwise agreed in the purchase documents.

5 General

1.8 Information about this manual

This manual is intended to make the handling of this system and its components safe and efficient. This manual is part of the system and must be kept in its immediate environment where it is accessible to personnel at all times.

This documentation contains the necessary information for the intended use of the system described. It is intended for technically qualified personnel who have been specially trained for operation, quality assurance, laboratory, maintenance and repair.

The personnel must have read this manual carefully and understood its contents before starting any work. The basic condition for safe working is the observance of all mentioned safety instructions and operating instructions in this manual.

Knowledge and technically correct implementation of the instructions, safety requirements and warnings are a condition for safety during operation, maintenance and repair. Only qualified personnel have the necessary expertise to apply the safety instructions, safety requirements and warnings mentioned in this operating manual in a general way in a specific situation.

In addition, the local accident prevention regulations and the general safety regulations for the area of application of the system apply.

Illustrations in this manual are for general understanding; they may differ from the actual version.

Apart from this manual, the instructions for the installed components contained in the appendix apply.

This operating manual cannot cover every possible maintenance case. If you require further information or if special problems arise that are not covered comprehensively enough in this manual, please request the necessary information from the manufacturer.



For ease of description, the above components are collectively referred to as a system.


1.9 Information about the symbols


1.9.1 Safety instructions


In this manual, safety instructions are represented by symbols. The safety instructions are preceded by signal words indicating the extent of the danger.

To avoid accidents and damage to persons or property, always follow the information and act prudently.

Throughout the text you will find the following pictograms with the following meanings:

	⚠ DANGER
	<p>Imminent danger Possible consequences: Death or serious injury.</p> <ul style="list-style-type: none"> • Prevention

	⚠ WARNING
	<p>Dangerous situation Possible consequences: Death or serious injury.</p> <ul style="list-style-type: none"> • Prevention

	⚠ CAUTION
	<p>Possible situation Possible consequences: Minor or slight injury. Sometimes also used as a warning of material damage.</p> <ul style="list-style-type: none"> • Prevention



Note

Information on the application or useful, important information

Prohibition signs



General "prohibition sign"

Warning signs



Warning against optical radiation
(such as UV, IR or visible radiation)



Warning against hot surfaces!



Warning of electricity!

Attention



Wear eye protection!



Opaque eye protection must be worn!



Disconnect the mains plug from the socket!



Disconnect before performing maintenance or repair!



Wear hand protection!



Wear foot protection!



Refer to the instructions!

Fire protection sign



Extinguishing hose



Fire extinguisher

Rescue sign



Emergency exit: All emergency exits are marked with this symbol

Optional function

- * Optional function,
not available
for every system.

1.10 Owner/operator information

The system is used in the commercial environment. The owner/operator of the system is therefore subject to legal obligations with regard to occupational safety.

In addition to the safety information in this manual, the general regulations applicable to the system's field of application with regard to safety, accident prevention and environmental protection must be observed and complied with.

The following applies in particular:

The owner/operator must acquire information about the valid occupational health and safety regulations and determine in a risk assessment additional hazards that have arisen due to the special operating conditions at the place of use of the system. He must implement these in the form of the operating instructions for the operation of the system and specifically for the individual workstations.

The owner/operator has an obligation throughout the life of the system to verify that the operating instructions he has developed are in compliance with the current regulatory status and must update them as necessary.

The owner/operator shall clearly assign and define responsibilities for installation/operation, troubleshooting, service and cleaning.

The owner/operator must ensure that all personnel involved with the system have read and understood this manual. Furthermore, he is obliged to offer personnel training at regular intervals and to provide information about the risks and dangers.


The owner/operator must provide the necessary personal protection equipment for his personnel. Furthermore, the owner/operator is responsible for ensuring that the system is always in a faultless technical condition. To ensure this, the service intervals specified in this manual and in the technical documents for the individual system must be observed and all safety installations must be regularly checked for function and completeness.


The owner/operator must regularly check all safety devices for function and completeness.

The owner/operator must ensure that the operating personnel have knowledge of first aid measures and the local rescue equipment.

1.11 Personnel requirements

1.11.1 Qualifications

	⚠ WARNING
	<p>Risk of injury if the personnel is insufficiently qualified!</p> <p>If unqualified personnel carry out work on the system or are in the danger zone of the system, risks arise that can cause serious injuries and serious material damage.</p> <ul style="list-style-type: none"> • Have all measures carried out only by personnel who are qualified for this measure. • Keep unqualified personnel out of the danger zone.

	⚠ WARNING
	<p>Danger of injury if live parts or hot surfaces are touched.</p> <p>In general, low voltage equipment such as this system may have hazardous live parts and hot surfaces. All transport, installation, commissioning, start-up and maintenance work must be carried out by appropriately trained and responsible personnel (in accordance with EN 50110-1 (VDE 0105-100); IEC 60364). Inappropriate behaviour can lead to serious injury or damage.</p>

The manual lists below the staff qualifications for the different areas of activity:

1.11.1.1 Qualified electrician

Based on their training, competence, experience and knowledge of the relevant standards and regulations, qualified electricians carry out work on electrical systems and identify and avoid risks independently.

Qualified electricians are specially trained for the working environment in which they work and they know the relevant standards and regulations. Qualified electricians must meet the requirements of the applicable legal regulations for accident prevention.

1.11.1.2 Qualified specialist

Qualified specialists are or can be trained by Opsytec Dr. Gröbel GmbH in the advanced operation and parameterisation of the system, as well as in the performance of preventive service work.

In addition to their technical training, competence and experience, as well as their knowledge of the relevant standards and regulations, they are able to carry out the work assigned to them and to identify and avoid potential hazards independently.

1.11.1.3 Operator

Operators use and operate the system within the scope of its intended use. They are trained by the owner/operator in the work assigned to them and informed about possible dangers.

1.11.2 Training and qualification of personnel

In regular instructions and training courses, the operating personnel must be informed about the specific risks and dangers involved in working with and handling the system.

The instruction and training should have the following content:

- Dangers when working with the system in normal operation.

- Hazards associated with service, repair and cleaning activities.

- Behavior to minimize accident consequences.

- Behaviour in case of accidents.

- Rescue of injured persons.

- Working without personal protective equipment can cause damage to health. The company supervisor is instructed to ensure that the personnel wears personal protective equipment.

- Special hazards when working on electrical equipment.

The instructions and training must be carried out at regular intervals by the owner/operator. For better tracking, the implementation of the instruction and training should be recorded.

1.11.3 Personal protective equipment

The purpose of personal protective equipment is to protect personnel from hazards that could affect their safety or health at work.

When carrying out various activities on and with the system, the personnel must wear personal protective equipment. This is repeatedly referred to in the individual chapters of this manual. Personal protective equipment is explained below:

1.11.3.1 Protective gloves

Protective gloves are used to protect hands from visible and/or invisible radiation, friction, abrasions, stings and deep injuries.

1.11.3.2 Safety goggles

Safety glasses are used to protect the eyes from visible and/or invisible.

1.11.3.3 Safety shoes


Safety shoes are worn as protection from heavy parts that could fall and from slipping on slippery surfaces.


6 Safety instructions and residual risk


1.12 General

The system is state of the art and has been built in accordance with recognized safety regulations. Nevertheless, its use may present risks to the life and extremities of operating and repair personnel (service personnel) or third parties, or impairments to the integrating sphere. Operate the system only when its safety devices are in perfect working order. Malfunctions that impair their safety must be rectified immediately.

The following safety information must be strictly observed to avoid damage to the integrating sphere and personal injury!


	⚠ WARNING
	<p>Risk of injury if personnel do not read the operating manual!</p> <p>Before commissioning and operation, read the operating manual completely. Read all safety precautions and instructions. Carelessness with regard to the safety information and instructions may result in electric shock and/or serious injury.</p>

	⚠ WARNING
	<p>Risk of injury, risk of crushing</p> <p>There is a risk of crushing with openable integrating spheres and removable parts.</p>




	⚠ CAUTION
	<p>Possible damage</p> <p>Avoid touching the sensitive optical coating with bare hands, tools or other objects. If the optical coating is damaged or soiled, the measuring accuracy may be impaired.</p> <ul style="list-style-type: none"> • Wear gloves. • Do not touch the sensitive optical coating. • Hold components such as port lids only at the edge at the non-coated areas. • Hold parts such as port covers, etc. when loosening so that they do not fall into the integrating sphere. • Keep parts such as port covers clean and protected at all times.

	⚠ CAUTION
---	------------------

	<p>Possible damage to glass fibres</p> <p>Avoid touching the sensitive optical coating with bare hands, tools or other objects. If the optical coating is damaged or soiled, the measuring accuracy may be impaired.</p> <ul style="list-style-type: none">• Handle glass fibers with care.• Observe bending radius of 200 mm!
--	--

	<p>⚠ CAUTION</p>
	<p>Risk of damage</p> <p>The system heats up during operation.</p> <ul style="list-style-type: none">• Make sure that there is sufficient air circulation at the installation site.• Fans and access openings must not be covered.

1.13 Safety instructions relating to normal operation

	<div style="background-color: red; color: white; text-align: center; padding: 5px;">⚠ DANGER</div> <p>Life threatened</p> <p>Danger to life occurs if the system is operated with defective or missing safety devices.</p> <ul style="list-style-type: none"> The system should only be operated when all safety devices and safety-related installations are present and in working order. The operator of the integrating sphere is obliged to check the safety devices regularly, before production is started, to ensure that they are functioning properly.
	<div style="background-color: red; color: white; text-align: center; padding: 5px;">⚠ DANGER</div> <p>Danger to life - Electrical voltage</p> <p>Certain parts are live when the device is switched on. Contact with live parts can lead to death or life-threatening injuries.</p> <ul style="list-style-type: none"> Disconnect the device from the mains during maintenance and repair work and during cleaning.
	<div style="background-color: red; color: white; text-align: center; padding: 5px;">⚠ DANGER</div> <p>Risk of poisoning</p> <p>When using ozone-generating lamps, the exhaust air may be enriched with ozone. Ozone is harmful to health if it is absorbed through the lungs for a longer period of time and in higher concentrations. Therefore, always avoid inhaling ozone.</p> <ul style="list-style-type: none"> Suitable discharge and treatment of the exhaust air must be ensured so that the permissible ozone workplace concentration (MAK value) is not exceeded.



Only instructed operating personnel are permitted to operate the integrating sphere.

Use extreme caution around high-power radiation sources. Never look directly into light guides, lamps, spotlights, or light outputs. Wear personal protective equipment if necessary.

Removal or deactivation of protective devices is not permitted while the system is in operation.

Should a protective device or equipment fail or become faulty, this must be reported immediately to the works supervisor. The latter will then decide on the further procedure.


1.14 Radiation safety

	 WARNING
	<p>Risk of skin and eye injuries</p> <p>There is a risk of photochemical or thermal damage to the eye, retinal damage, burns and / or erythema. Visible (blue) light may cause photochemical damage to the eye. Use appropriate protective eyewear when operating the equipment, if necessary. Provide appropriate training to operating personnel. UV radiation can cause burns and erythema.</p> <p>Recommended Protective Equipment:</p> <ul style="list-style-type: none"> - Gloves - tinted safety goggles, no transmission below 500 nm <p>The devices were classified in risk group 3 according to DIN EN 62471:2009-03 "Photobiological safety of lamps and lamp systems".</p> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="border: 2px solid black; background-color: yellow; padding: 5px; width: 60%;"> <p>DIN EN 62471:2009-03 Risk group 3:</p> <p>Luminaires pose a hazard even for fleeting or brief irradiation. Use in general lighting is not permitted</p> </div> <div style="border: 2px solid black; background-color: yellow; padding: 5px; width: 30%;"> <p>Caution dangerous ultraviolet radiation</p> </div> </div> <div style="border: 2px solid black; background-color: yellow; padding: 5px; width: 30%; margin-top: 10px;"> <p>Caution bright, visible light</p> </div>


The risk assessment for the workplace is the responsibility of the customer. This requires measurements / assessments according to DIN EN 14255-1:2005-06 "Measurement and assessment of personal exposure to incoherent optical radiation - Part 1: Ultraviolet radiation emitted by artificial sources at the workplace".


DIN 14255-1 itself does not contain any limit values. These are given in Directive "2006/25/EC of the European Parliament and of the Council on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (artificial optical radiation)".


1.15 Safety instructions regarding service and repair work


	⚠ CAUTION
	<p>The system may fall down! Damage to the device and personal injury are possible</p> <ul style="list-style-type: none"> • Always carry the system with two people. This is not only for personal protection but also for the stability & reproducibility of the integrating sphere.


	⚠ WARNING
	<p>Risk of injury when touching live parts</p> <p>Before opening the system, disconnect all components from the supply voltage and check that no voltage is present.</p>


	⚠ WARNING
	<p>Risk of injury!</p> <p>The maximum lamp temperature can reach > 60 °C. There is a risk of skin burns on contact. Allow the lamps to cool down (> 30 min) before removing them.</p>


	⚠ CAUTION
	<p>Risk of damage</p> <ul style="list-style-type: none"> • Switch off the system before connecting / disconnecting accessories, sensors or similar. Due to the operating voltage of the system, the accessories may be damaged. • Unplugging & plugging in signal cables during operation is strictly prohibited!



	⚠ CAUTION
	<p>Risk of damage</p> <ul style="list-style-type: none"> • Skin grease and dirt are absorbent in the UV and visible spectral range. • Avoid fingerprints on the optically active sensor surface. If necessary, clean the components carefully with isopropanol.

	⚠ WARNING
	<p>Risk of injury!</p> <p>The maximum lamp temperature can reach $> 60\text{ °C}$. There is a risk of skin burns on contact. Allow the lamps to cool down ($> 30\text{ min}$) before removing them.</p>

	⚠ WARNING
	<p>Risk of injury, risk of crushing</p> <p>There is a risk of crushing with openable integrating spheres and removable parts.</p>

	⚠ CAUTION
	<p>Possible damage</p> <p>Avoid touching the sensitive optical coating with bare hands, tools or other objects. If the optical coating is damaged or soiled, the measuring accuracy may be impaired.</p> <ul style="list-style-type: none"> • Wear gloves. • Do not touch the sensitive optical coating. • Hold components such as port lids only at the edge at the non-coated areas. • Hold parts such as port covers, etc. when loosening so that they do not fall into the integrating sphere. • Keep parts such as port covers clean and protected at all times.

	⚠ CAUTION
	<p>Possible damage to glass fibres</p> <p>Avoid touching the sensitive optical coating with bare hands, tools or other objects. If the optical coating is damaged or soiled, the measuring accuracy may be impaired.</p> <ul style="list-style-type: none"> • Handle glass fibres with care. • Observe bending radius of 200 mm!

 CAUTION	
	<p>Risk of damage</p> <p>The system heats up during operation.</p> <ul style="list-style-type: none">• Make sure that there is sufficient air circulation at the installation site.• Fans and access openings must not be covered.

Service, repair and cleaning work may only be carried out by authorised and specially trained personnel. The system must be de-energized and secured before any major work (including cleaning) is carried out).

Carry out the prescribed adjustment, service and inspection work in accordance with the instructions. If you require further information in this regard or if special problems arise that are not covered comprehensively enough in this manual, please request the necessary information from the manufacturer.

Only qualified electricians may carry out work on the electrical system.

Safety devices may only be removed during service and repairs if the system has previously been switched off and brought into a safe condition.

During service and maintenance work, important safety installations may no longer function. Work of this type therefore requires special caution.

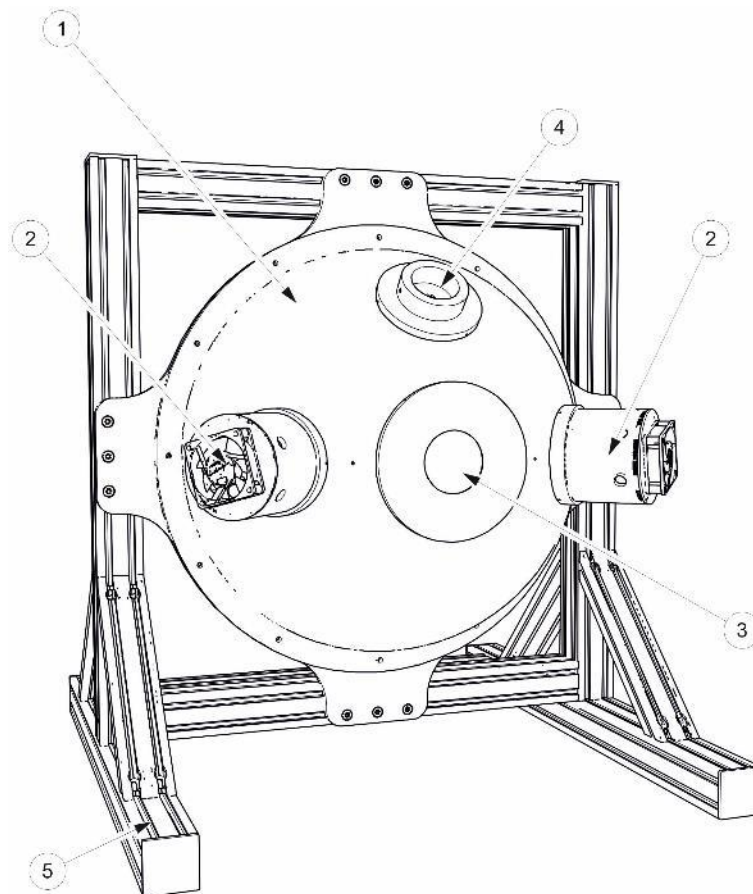
7 Description of the system and function overview

The integrating sphere is based on the optical multiple reflection and integration of light and radiation. The integrating sphere was named after the engineer Richard Ulbricht. It is used for light measurement and generation, especially for determining the radiant power or luminous flux of light sources.

Integrating spheres usually consist of a reflecting hollow sphere whose inner surface is coated with PTFE, BASO4 or gold and reflects diffusely. Depending on the geometry, the radiation is coupled from the outside or centrally and measured at the detector port.

The integrating sphere is a measuring instrument designed exclusively for measuring photometric quantities / radiation quantities or for generating such quantities. Any other use is considered improper.

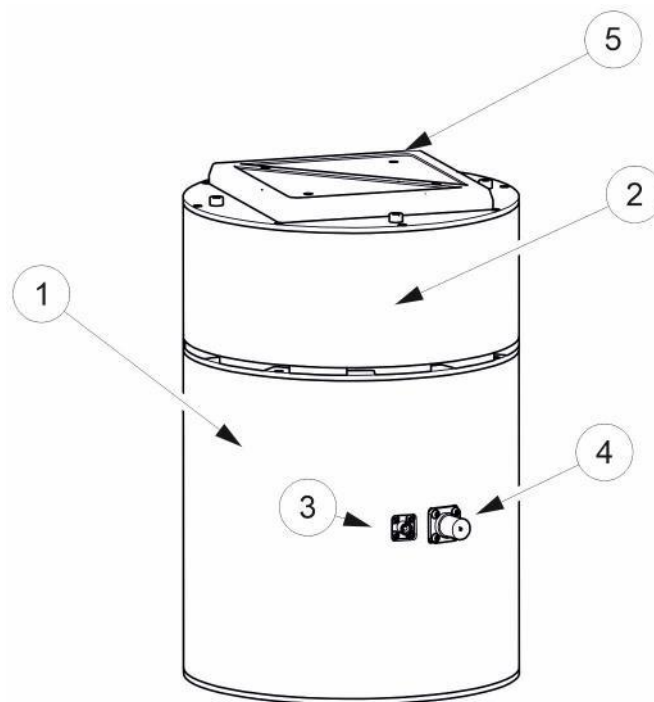
The integrating sphere is shown below as an example of a BASO4-coated integrating sphere:



(Illustration exemplary)

Pos.	Designation	Pos.	Designation
1	Integrating sphere	2	Auxiliary light source / light source
3	Input port / Output port	4	Radiometer port / Sensor port
5	Frame		

The integrating sphere is shown below as an example of a PTFE integrating sphere:

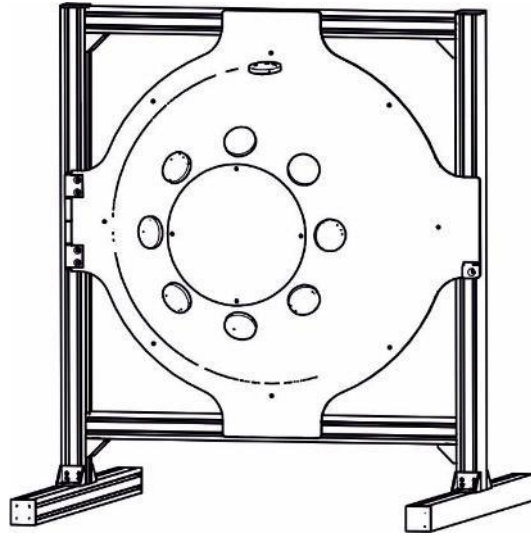


(Illustration exemplary)

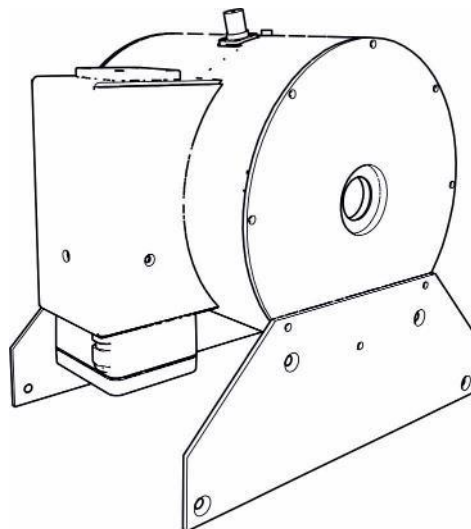
Pos.	Designation	Pos.	Designation
1	Integrating sphere	2	Mounting with pelitic cooler for LED
3	SMA port for spectrometer	4	SIC diodes Port BNC
5	Fan		

Typical configurations include:

BASO4 Straightening sphere for radiance calibration with lamp ports around the central output port:



PTFE integrating sphere for radiance calibration with deuterium lamp:



Also shown is an SMA-905 port for a fiber optic / spectrometer and a BNC connector with SiC photodiode inside.

1.16 General Product Description:

The integrating sphere is built in the following versions:



- Coating: BASO4, PTFE, GOLD
- Ball closed / open
- With frame / without frame
- With / without sensor port
- With additional ports
- With built-in photodiode
- if necessary interem baffle
- if applicable, built-in radiation sources
- if necessary with auxiliary light source with halogen lamp



For ease of description, the above components are collectively referred to as a system.



8 Commissioning



- Unpack all components and remove packing materials.
- Remove all transport locks and protective foils.
- Check for completeness and whether any damage has been caused to the device during transport.
- If necessary, install the source / auxiliary light source to be measured according to the technical data and customer-specific design drawings. For this purpose e.g.:
 - Insert the auxiliary light source into the base. Attach the auxiliary light source to the integrating sphere with the outer locking screws and fix it in place (optional).
 - insert the source into the cooled socket (optional).
 - Connect the mains cable of the Peltier cooler to the mains voltage (optional).
 - Connect the mains cable of the deuterium lamp to the mains voltage (optional).
- If necessary, install the sensor according to the technical data. To do this, insert the sensor into the radiometer port. Attach the sensor to the integrating sphere with the outer locking screws and fix it in place.
-
- The integrating sphere is now ready for operation. Switch off the source and the Peltier cooler after use by disconnecting the mains plugs.

 WARNING	
	<p>Risk of damage</p> <p>To prevent thermal overheating, sufficient ventilation must be ensured at all times.</p> <p>Take special care that the ventilation openings are not covered during operation and that sufficient cooling is ensured.</p>

2 Lamps / LED replacement, cleaning and maintenance

Please observe the following instructions for cleaning and maintenance:

 DANGER	
	<p>Danger to life - Electrical voltage</p> <p>Certain parts are live when the device is switched on. Contact with live parts can lead to death or life-threatening injuries.</p> <ul style="list-style-type: none">• Disconnect the device from the mains during maintenance and repair work and during cleaning.



 CAUTION	
	<p>Possible damage</p> <p>Avoid touching the sensitive optical coating with bare hands, tools or other objects. If the optical coating is damaged or soiled, the measuring accuracy may be impaired.</p> <ul style="list-style-type: none">• Wear gloves.• Do not touch the sensitive optical coating.• Hold components such as port lids only at the edge at the non-coated areas.• Hold parts such as port covers, etc. when loosening so that they do not fall into the integrating sphere.• Keep parts such as port covers clean and protected at all times.

Clean the outside of the integrating sphere only with a dry or slightly damp cloth using pure water or a slightly soapy detergent.

Dirt on the BaSO₄ coating should only be carefully blown away with dry cleaned air.

Dirt on the PTFEs should only be carefully blown away with dry cleaned air.

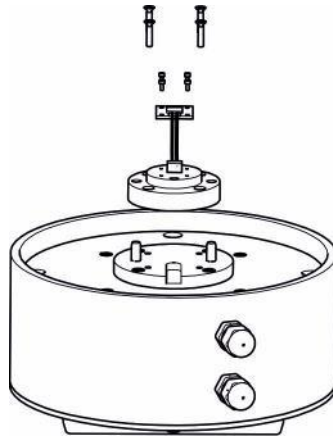
2.1 Inserting & changing the LEDs (example)

	 DANGER
	<p>Danger to life - Electrical voltage</p> <p>Certain parts are live when the device is switched on. Contact with live parts can lead to death or life-threatening injuries.</p> <ul style="list-style-type: none"> • Disconnect the device from the mains during maintenance and repair work and during cleaning.

Loosen the 4 screws at the top of the integrating sphere.



Then carefully remove the upper part of the integrating sphere with the Peltier cooler.

The Leds can be changed carefully - with fitting aluminium core board - after removing the upper unit, see sketch:



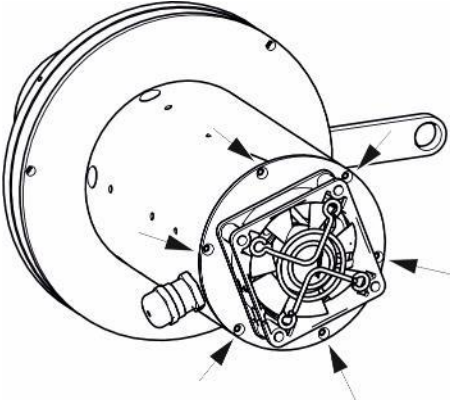
Contact the manufacturer for replacement orders and service needs.

2.2 Inserting & changing the auxiliary lamps (exemplary)

	 DANGER
	<p>Danger to life - Electrical voltage</p> <p>Certain parts are live when the device is switched on. Contact with live parts can lead to death or life-threatening injuries.</p> <ul style="list-style-type: none"> • Disconnect the device from the mains during maintenance and repair work and during cleaning.

Auxiliary lamps can be changed from the outside if necessary. To do this, remove the rear cover and loosen the PG screw connection.


Then insert the auxiliary lamp, mount the rear cover and retighten the PG gland.



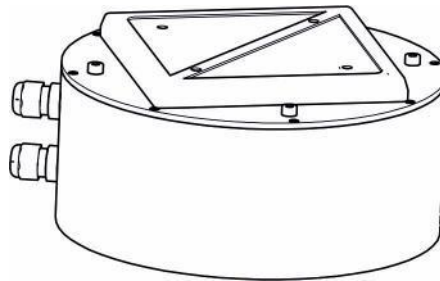
Alternatively, you can also carefully change the auxiliary lamp with tweezers from the front side.

Contact the manufacturer for spare parts.

2.3 Inserting & changing the air filter (exemplary)

	⚠ DANGER
	<p>Danger to life - Electrical voltage</p> <p>Certain parts are live when the device is switched on. Contact with live parts can lead to death or life-threatening injuries.</p> <ul style="list-style-type: none">• Disconnect the device from the mains during maintenance and repair work and during cleaning.

Air filters can be changed from the top of the ventilation grille if necessary. Contact the manufacturer if spare parts are required.



2.4 Setting the cooling (exemplary)

Set the temperature according to the enclosed instructions for the temperature controller.

We recommend a test temperature of 20 °C. Too low temperatures can cause condensation of water and damage the integrating sphere.

9 Spare partsand further service



Contact for replacement orders and service needs:

Opsytec Dr. Gröbel GmbH

Am Hardtwald 6-8

76275 Ettlingen

Germany

Phone +49 - 7243 - 94 783 - 50

Fax +49 - 7243 - 94 783 - 65

Visit us on the Internet: www.opsytec.de

10 Technical data

General data	
Ambient temperature	+5 to 35 °C
Storage temperature, approx.	-10 to +60 °C
Humidity	0% to 80% rel. humidity Info: BASO4 is hygroscopic!
Dimensions, approx.	See attachment "Technical Drawing to these operating instructions
Weight approx.	See attachment "Technical Drawing to these operating instructions
Maximum housing temperature	< 60 °C
Cooling	Air cooling
Noise emission	Lpa < 70 dB at the workplace in normal operation according to DIN 45635 T. 19

Mounting position, minimum distances	
Mounting position	horizontal
Minimum distances, top	4 cm
Minimum distances, lateral	4 cm

Connections	
Operating voltage and frequency	See nameplate
Input current	See nameplate
Maximum input power	See nameplate

Connections (optional)	
BNC	1 piece with integrated SIC photodiode
SMA	1 piece type 905

11 Declaration of Conformity



Manufacturer :	Company name: Opsytec Dr. Gröbel GmbH Street: Am Hardtwald 6-8 Place: 76275 Ettlingen Country: Germany
Authorized person for the compilation of the technical documentation:	Company name: Opsytec Dr. Gröbel GmbH Street: Am Hardtwald 6-8 Place: 76275 Ettlingen Country: Germany
Product:	Integrating sphere
Type designation:	Integrating sphere
Type number:	850 1XX XXXX 850 2XX XXXX 850 3XX XXXX 760 001 XXXX760 004 000X 760 003 0001

The manufacturer hereby declares that we have developed, designed and produced the above-mentioned product(s) under our sole responsibility and that the product complies with the following standard(s) or directive(s) in this declaration:

2014/35/EU

"Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available of electrical equipment".

Equipment for use within certain voltage limits on the market (Low Voltage Directive)".

2006/42/EC

"Directive of the European Parliament and of the Council on machinery and amending Directive 95/16/EC (Machinery Directive)".

2014/30/EU

"Directive of the European Parliament and of the Council on Electromagnetic Compatibility (EMC Directive, recast)".

The conformity of the designated product with the provisions of the Directive is demonstrated by full compliance with the following standards:

DIN EN 60204-1: Safety of machinery - Electrical equipment of machines - Part 1:
Safety of machines
Part 1: General requirements (IEC 60204-1:2005, modified)

Ettlingen, 09.12.2019
gez. Dr. Mark Paravia