

iSR900

industrial spectrometer for LED measurements



Instruction manual

Version 1.0.5

Opsytec Dr. Gröbel GmbH
Am Hardtwald 6-8
D-76275 Ettlingen

Phone: +49(0)7243 / 9 47 83-50
Fax: +49(0)7243/ 9 47 83-
65info@opsytec.de

1 Table of contents

1	Table of contents	2
2	Foreword	4
3	Quick guide spectroradiometric measurement	5
4	Guidelines and standards	6
5	Identification	7
5.1	Manufacturer.....	7
5.2	Change history.....	7
5.3	Copyright	7
5.4	Device identifier	7
5.5	Intended use	8
5.6	Foreseeable misuse	8
5.7	Legal information	9
5.7.1	Limitation of liability	9
5.7.2	Declaration of Conformity.....	9
5.7.3	Warranty condition en	9
6	General	10
6.1	Information about this manual	10
6.2	Information about the symbols	11
6.2.1	Safety instructions	11
6.2.2	Prohibition signs	11
6.2.3	Warning signs.....	12
6.2.4	Attention	12
6.2.5	Optional function	12
6.3	Owner/operator information.....	13
6.4	Personnel requirements.....	14
6.4.1	Qualifications.....	14
6.4.2	Training and qualification of personnel	14
6.4.3	Personal protective equipment.....	15
7	Safety instructions and residual risk	16
7.1	General	16
7.2	Safety instructions relating to normal operation	16
7.3	Radiation safety	17
7.4	Safety instructions regarding service and repair work.....	18
8	Description of the system and function overview	20
8.1	General Product Description:	21
8.2	The following components are supplied:	21
9	Commissioning	22
10	Operation & Installation	23
10.1	Trigger , Trigger input	23

10.2	Installing the software*	23
10.3	Remove iSR900	24
10.4	Installing device drivers under Windows 8	24
11	Technical data	27
12	Control	30
13	Requests/commands of the iSR900	33
14	Error codes	41
15	Maintenance	42
16	Spare parts , calibration and maintenance	43
17	Error / malfunction	44
18	Declaration of Conformity	45

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 further development; therefore, there may be minor deviations between your system and the illustrations in this operating manual.

© 2019

Opsytec Dr. Gröbel GmbH

Am Hardtwald 6-8

D - 76275 Ettlingen

Tel.: +49(0)7243 / 9 47 83-50

Fax: +49(0)7243 / 9 47 83-65

info@opsytec.de

All rights reserved. Reprinting, including excerpts, is only permitted with the written consent of Opsytec Dr. Gröbel GmbH.

3 Quick guide spectroradiometric measurement

The short instructions are intended to demonstrate the function of the spectrometer by means of an operating sequence. The detailed instructions can be found starting on page 22. Please observe the safety instructions in these instructions.

The goal of the Quick Start Guide is that you end up with a measured spectrum on your screen.

1. Open the interface to the iSR900
2. Hold the diffuser in the direction of the light source
3. Test the best integration time for the desired measurement and, if possible, set the integration time so that the level is about 50-90%.
4. Cover the diffuser or turn off the light source.
5. Perform a dark measurement.
6. Perform the measurement.

We recommend averaging over 5 to 10 measurements for absolute irradiance measurements.

4 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)
Harmonized standards	
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1: 2006+A1: 2009+AC:2010	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
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

5 Identification

5.1 Manufacturer

Opsytec Dr. Gröbel GmbH
 Am Hardtwald 6-8
 D - 76275 Ettlingen
 Tel.: +49(0)7243 / 9 47 83-50
 Fax: +49(0)7243 / 9 47 83-65
 info@opsytec.de
 www.opsytec.de

5.2 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	Processor	Date	Change
1.0.0	Paravia	16.04.2018	Creation
1.0.3	Paravia	08.07.2019	Editorial changes, iSR
1.0.4	Rough	29.04.2020	Customization commands
1.0.5	Rough	14.05.2020	Adaptation interface assignment

5.3 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 in this document 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.

Infringement may be subject to prosecution.

5.4 Device identifier

Data for internal use:

Description of the machine:	iSR900
Year of manufacture:
Machine no.
Project no.

5.5 Intended use

The system is intended for industrial use only. It is forbidden to use the devices in explosive environments or for general illumination

- 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.
- 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 containing substances harmful to the environment must be disposed of accordingly.
- Operation is only permitted in a dry environment. The installation is horizontal.
- Only suitable for indoor operation.
- Before opening, the system must be disconnected from the voltage and it must be checked that there is no voltage.
- Wear gloves for servicing, cleaning and replacing the light guides and optical components.
- Do not clean the system when it is in operation.
- The housing must not be opened by the user. The optically active surface must not be touched.
- Gloves must be worn for cleaning the optically active surface.
- The iSR900 is a highly sensitive optical measuring instrument. It must not be subjected to shocks.
- When using the system, light and UV radiation may be reflected and scattered by the measuring head. If necessary, suitable protective measures must be used to protect against radiation.
- 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.

5.6 Foreseeable misuse

The following is considered a foreseeable misuse:

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

5.7 Legal information

5.7.1 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 have used the machine incorrectly,
- inadmissible modifications have been made,
- technical changes have been made
- unauthorized 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 in the delivery contract, as well as the manufacturer's delivery conditions and the legal regulations valid at the time of the conclusion of the contract shall apply.

5.7.2 Declaration of Conformity

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

5.7.3 Warranty condition en

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.

6 General

6.1 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 notes 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 occur which 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 the system.


6.2 Information about the symbols


6.2.1 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 most severe injuries.</p> <ul style="list-style-type: none"> • Prevention

	⚠ WARNING
	<p>Dangerous situation Possible consequences: Death or most severe injuries.</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 about the application or useful, important information

6.2.2 Prohibition signs



General "prohibition sign"

6.2.3 Warning signs



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



Warning against electricity!

6.2.4 Attention



Wear eye protection!



Disconnect the mains plug from the socket!



Disconnect before performing maintenance or repair!



Wear hand protection!



Refer to the instructions!

6.2.5 Optional function

* Optional function,
not available
for every system.

6.3 Owner/operator information

The system is used on the commercial environment. The owner/operator of the system is therefore subject to the legal obligations regarding occupational safety.

In addition to the safety information in this manual, the generally applicable regulations valid for the area of application of the system with regard to safety, prevention of accidents and protection of the environment 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 is required throughout the life of the system to verify that the operating instructions it has developed are in compliance with the current regulatory status and must update them as necessary.

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

The owner/operator must ensure that all personnel dealing 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 hazards.

The owner/operator must provide the required 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.

6.4 Personnel requirements

6.4.1 Qualifications

Below, the manual lists the personnel qualifications for the various areas of activity:

6.4.1.1 Qualified electrician

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

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.

6.4.1.2 Qualified specialist

Qualified specialists are or can be trained by Opsytec Dr. Gröbel GmbH in the advanced operation and parameterization 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 independently recognize and avoid possible hazards.

6.4.1.3 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 hazards.

6.4.2 Training and qualification of personnel

In regular instructions and training, the operating personnel must be informed about the special risks and dangers when 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.

- Behavior 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 wear 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.

6.4.3 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 performing 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. The personal protective equipment is explained below:

6.4.3.1 Protective gloves

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


6.4.3.2 Safety goggles

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

Safety glasses and storage boxes can be ordered from Opsytec Dr. Gröbel GmbH, Am Hardtwald 6-8, 76275 Ettlingen or UVEX AREITSSSCHUTZ GMBH, Würzburger Str. 181 - 189, 90766 Fürth, Germany:

Protective eyewear part number: 9169065

Storage box part number: 9957502

	⚠ CAUTION
	Use eye protection when working with the light source in the hazardous area.

	⚠ CAUTION
	Keep the safety goggles protected at the application site when not in use.

6.4.3.3 Safety shoes

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


7 Safety instructions and residual risk


7.1 General


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


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


7.2 Safety instructions relating to normal operation

	⚠ CAUTION
	<p>Risk of damage</p> <ul style="list-style-type: none"> • The iSR900 is calibrated. Do not expose the device to shock. • CAUTION: Opening the housing will result in loss of calibration.

	⚠ 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.


	⚠ CAUTION
	<p>Risk of damage</p> <p>Special guidelines must be followed when using an optical fiber. Avoid:</p> <ul style="list-style-type: none"> • Touching the end faces with the fingers • Storage on dusty surfaces • Bumping against hard surfaces • Immersion in e.g. contaminated liquids. • small bending radii (200mm)

	⚠ CAUTION
	<p>Risk of damage</p> <ul style="list-style-type: none"> • Hand-tighten the knurled screws of the SMA-905 light guides.

	⚠ WARNING
	<p>Fire hazard!</p> <p>A high irradiance, which can ignite combustible materials in case of continuous irradiation, is achieved at the output of the <u>light guide of optional flash lamps</u>. Remove all combustible materials and observe the irradiation time and material temperature.</p>

The wearing of personal protective equipment (e.g. safety goggles and hand protection) is mandatory when working on the system.


7.3 Radiation safety


	⚠ WARNING
	<p>Risk of eye injury</p> <p>The iSR900 can optionally be equipped with xenon flash lamps. There is then a risk of photochemical or thermal damage to the eye, retinal damage and burns. Visible (blue) light can cause photochemical damage to the eye. If necessary, use suitable protective goggles when operating the unit. The operating personnel must be trained appropriately.</p> <p>Recommended protective equipment:</p> <ul style="list-style-type: none"> - Gloves - Safety glasses, no transmission below 400 nm <p>Do not look into the light source and do not expose skin to radiation! Avoid reflections of the radiation into the eye!</p> <p>The installation should be designed in such a way as to prevent a direct view into the light guide receptacles and the light guides.</p> <p>The devices were classified in risk group 3 according to DIN EN 62471:2009-03 "Photobiological safety of lamps and lamp systems".</p>


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)".


7.4 Safety instructions regarding service and repair work

	⚠ 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>

	⚠ CAUTION
	<p>Risk of damage</p> <ul style="list-style-type: none"> • The iSR900 is calibrated. Do not expose the device to shock. • CAUTION: Opening the housing will result in loss of calibration.

	⚠ 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.

	⚠ CAUTION
	<p>Risk of damage</p> <p>Special guidelines must be followed when using an optical fiber.</p> <p>Avoid:</p> <ul style="list-style-type: none"> • Touching the end faces with the fingers • Storage on dusty surfaces • Bumping against hard surfaces • Immersion in e.g. contaminated liquids. • small bending radii (200mm)

	⚠ CAUTION
	<p>Risk of damage</p> <ul style="list-style-type: none"> • Hand-tighten the knurled screws of the SMA-905 light guides.

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

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

The housing must not be opened by the user. The optically active surface must not be touched.

Gloves must be worn for cleaning the optically active surface.

The iSR900 is a highly sensitive optical measuring instrument. It must not be subjected to shocks.

8 Description of the system and function overview

The compact spectroradiometer iSR900 is a high-resolution measuring system for fast and precise measurements in the UV, visible spectral range and IR. The measuring range is typically from 200 nm to 1100 nm. Special versions can also be equipped with a spectral range of 350 - 500 nm.

The spectroradiometer consists of an array spectrometer with no moving parts and a silicon array with 2048 pixels.

The iSR900 is combined with an SMA-905 quartz optical fiber and our radiometric probes for irradiance and illuminance measurements. With trigger input and output, the iSR900 is also suitable for automated measurements.

The iSR900 measures e.g. irradiances and peak wavelengths and outputs them via RS485. The iSR900 is designed for automatic data acquisition in triggered mode. The measurements are performed spectroradiometrically with the integrated, calibrated spectrometer.

The iSR900 is traceable to the PTB factory calibrated. DAKKS testing in our accredited laboratory is optionally available. The iSR900 thus allows accurate spectroradiometric measurements for the evaluation of irradiances and illuminances, biological efficacy and color measurements. Due to the low stray light design, a high sensitivity in the UV range is achieved.

The iSR900 is designed for operation in non-accessible installations. Individual functions are shown on the display.



Sensor head with fiber optics
(illustration exemplary)



iSR900

8.1 General Product Description:

- Spectral range typically 200-1100 nm
- Low stray light grating
- Order filtering
- Integrated evaluation for color measurement, radiometric and effect-related measurements
- Simple validation
- Extensive range of accessories

8.2 The following components are supplied:

- iSR900 Spectrometer
- Sensor head
- Light guide 1.5 m
- this documentation
- rear connector plug
- Power cable
- optional: integrating sphere reflection attachment




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

The following components are required by the customer:

- PC with Windows 7 / 10 or SPS
- RS485 connection cable

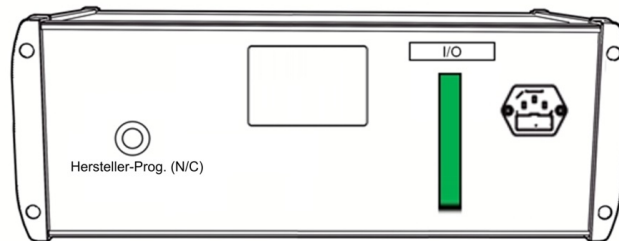
9 Commissioning

- Unpack all components and remove the packing materials.
- Connect the fiber optics with sensor head to the front SMA connector and hand-tighten the knurled nuts.

	⚠ WARNING
	<p>Risk of damage</p> <p>The light conductors are very sensitive and must not be bent or severely bent.</p> <p>A minimum bending radius of 200 mm must be observed.</p>

- Connect the iSR900 to the USB/RS232/RS485 communication and to the supply voltage.

-



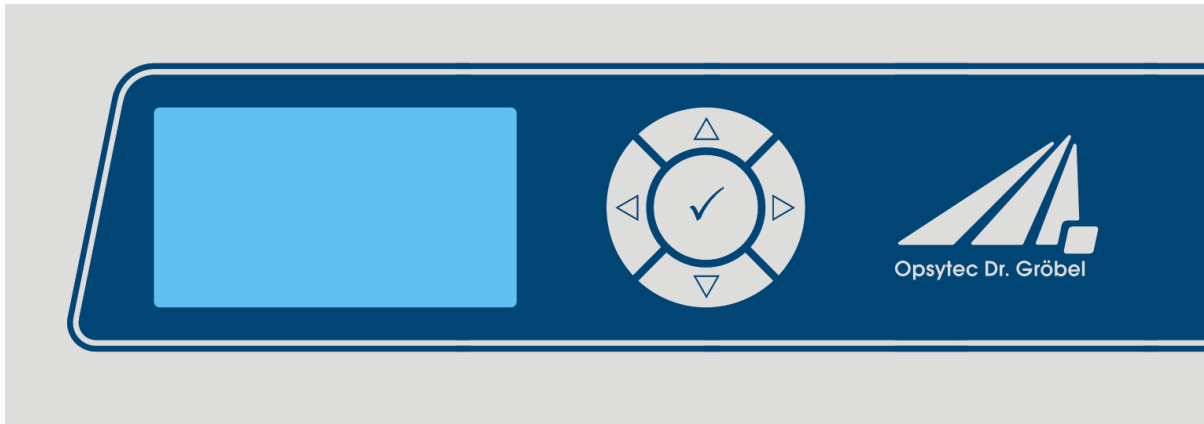
- Connect the trigger inputs (measurement & dark measurement), according to the technical data (see interface assignment).



- Optionally connect the trigger outputs.

10 Operation & Installation

The iSR900 is operated via five keys. These are located on the front panel to the right of the display. The keys and their function assignment are shown below:



Key	Function
	Up / Increase integration time
	Down / Decrease integration time
◀	To the left / Decrease averages
▶	To the right / Increase averages
	Switch backlight on / off

After starting the device, the logo first appears on the display. After that, the device is in standby. The operation on the iSR900 can be locked.

10.1 Trigger , Trigger input

The measurement can be started via an external trigger. To do this, connect a potential-free contact according to the technical data.

10.2 Installing the software*

To install the optional software, proceed as follows:

- 1.) If necessary, disconnect the iSR900 from the PC.
- 2.) Connect the USB stick or CD to the PC and double-click Setup.exe.
- 3.) Follow the instructions of the installation program.



The driver installation is done as a standalone application. For RS485 / RS232 no driver installation of Opsytec software is necessary.



The sample software iSRControl requires the Microsoft .NET Framework in version 4.0 or higher. This can be found on the installation CD or free of charge at www.microsoft.de.

- 4.) After the installation is complete, connect the iSR900 to the PC.
- 5.) Turn on the iSR900 at the switch on the back.
- 6.) The iSR900 is integrated as a virtual serial interface if you have connected a USB port*. If necessary, install the drivers of the customer RS232/RS485 interface. The driver installation is usually done automatically under Windows 7 / 10.

10.3 Remove iSR900

If necessary, you can remove iSR900 from your computer.

The following options are available for this purpose:

- Click on "Start" in the Windows Start menu and select "Programs > SRpro > Remove SRpro".
- Select "Settings > Control Panel" in the Windows "Start" menu. Double-click
- click on "Software" in the Control Panel. Select "SRpro " in the dialog box
- "Software Properties" on the "Install/Uninstall" tab and click the "Add/Remove" button.

10.4 Installing device drivers under Windows 8

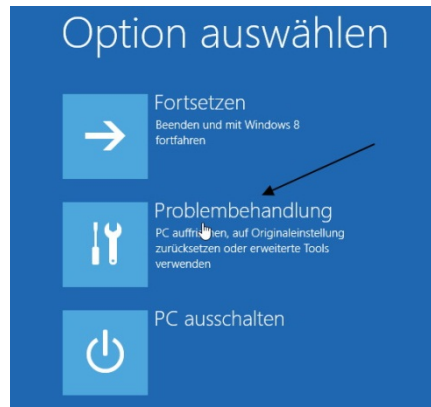
In Windows 8, it is no longer possible to install unsigned drivers by default. However, you can allow unsigned drivers.

This tutorial shows how this can be done.

- Key +i
- Press and hold the Shift key and click Restart. Do not release the Shift key until the following screen appears.



- Now click on Troubleshoot



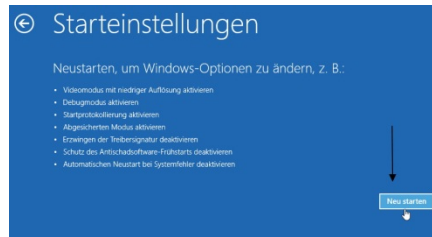
- And then click on Advanced Options



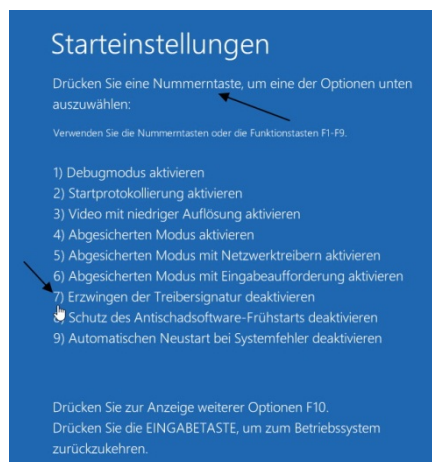
- Then click on Startup Settings



- Click on "Restart" in the subsequent message.



- The computer will then restart.
- When restarting, the startup settings appear



- Now allow the unsigned drivers with the number key 7 or the function key F7. Windows is then started.
- During the installation of the driver, a prompt will now appear. Press "Install this driver software anyway".



11 Technical data

General data	
Ambient temperature	+5 to 40 °C
Storage temperature, approx.	-10 to +60 °C
Humidity	0% to 80% rel. humidity
Dimensions, iSR900, approx.	100 mm x 251 mm x 305 mm (HxWxD without socket)
Weight, iSR900, approx.	< 5 kg
Maximum housing temperature	< 30 °C
Firmware version	2.0.2

Mounting position, minimum distances	
Body position	horizontal
Minimum distances, top	2 cm
Minimum distances, lateral	2 cm

Spectral ranges	
Classification of spectral ranges	According to CIE
UV-C	200 - 280 nm
UV-B	280 - 315 nm
UV-A	315 - 400 nm
VIS	380 - 780 nm

Spectroradiometric data	
Spectral range	350 nm to 500 nm // 200 - 1100 nm
CMOS detector	2048 Pixel
Grid	1800 lines/mm
Pixel pitch	~ 0.08 nm // 0.56 nm
spectral resolution	~ 0.43 nm // 2.4 nm
Order filter	305 nm
Input gap	50µm
Density filter	none

Connection	
Mains voltage and frequency	200-240VAC / 50/60 Hz
Maximum input power	See nameplate
Fuse	See nameplate
I/O Connector	Phoenix Contact

	MC 1.5/15-STF-3.81 Order number: 18 27 83 9
Control input	24 V, input current < 20 mA High level > 15 V, positive logic Low level < 12 V
Signal output	24 V, output current max 2 mA

Control port and optical parameters		
Use control cable with minimum cross-section of 0.25 mm ² .		
Interface, rear control	Signal	Function
Pin 1	No Measurement active OUT	Status output Low = Measurement running High = Ready for commands
Pin 2	IN	Reserved for future use
Pin 3	+24 V	Auxiliary voltage (max. 2 mA)
Pin 4	Reference mass	
Pin 5	IN	Reserved for future use
Pin 6	IN	Reserved for future use
Pin 7	Trigger IN	Trigger input, external control
Pin 8	Data Ready OUT	Status output
Pin 9	OUT	Reserved for future use
Pin 10	RX+ [RS485]/ RS232	Communication
Pin 11	RX- [RS485]	
Pin 12	TX- [RS485]	
Pin 13	TX+ [RS485]/ RS232	
Pin 14	Not Connected	-
Pin 15	Not Connected	



When using the RS232 interface option, only RX+ and TX+ are required.

Light guide	
Fiber optic cable connection	SMA-905
Bending radius	> 200 mm

Preferences	
Set measurement duration	10 ms

Measurement rating: PASS	Control > 10% and < 99%; Dark measurement takes place
Dark measurement rating: PASS	Level control < 30%
Averaging	3



The iSR900 automatically stores the measurement duration and averages.

Measurement, AD conversion	
AD converter	16 bit ADC
Integration time	1-10000 ms
Averages	1-32
Measuring time	approx. (integration time+100 ms) * averages +200ms

Communication	
Type:	RS485, 4 wire
Baud rate	115200 baud
Parity	None
Data Bits	8
Stop bit	1
Control	MASTER
iSR900	SLAVE

CRC checksum	
Type:	CRC-16
Parameter	CRC Polynomial: 0x8005 Init CRC value: 0x0000 Final XOR value: 0x0000 Reflect data (byte): No Reflect CRC (word): No

12 Control

The sequence control is shown here for the iSR900:

1. Initialization
2. Set parameters
3. Test modulation
4. Dark measurement
5. Measurement

It is possible to jump back to point 2 Set parameters. The dark measurement must then be repeated.

The iSR900 is controlled via the rear programming interface*. Depending on the selected option, the connection is USB, RS485 or RS232.

Operation via the programming interface is called remote and is visualized on the display.

Remote operation cannot be selected via the menu. In remote mode, operation on the device is not possible.



Remote operation (with locked keys) is activated by a command. The command must be sent after starting the iSR900.

After starting the device, the logo first appears on the display



In remote mode is displayed:



The communication takes place as ASCII communication, which is illustrated below using the example **"Serial number query"**:

Controller sends: `iSRSerialNr? {CR}{LF}`

iSR900 answers: `iSRSerialNo : 000010 (CRC) {CR}{LF}`

The iSR900 will only transmit when prompted by the controller.

Only one command/query is processed at a time.



Communication is available after initialization. Depending on the version, initialization may take a few seconds.

Definitions:

- Baud rate: 115200 baud
- Parity: None
- Data bits: 8
- Stop bit: 1
- iSR900: SLAVE

Type definition:

- **BOOL:** ASCII representation of the value: "1" = TRUE; "0" = FALSE
- **INT:** ASCII representation of the value: 12345
- **FLOAT:** ASCII representation of the value: 1.2345E+01
- **STRING:** ASCII representation of an alphanumeric string
- **ARRAY[1..8] of** Separated by {Tab}

Unused digits in INT or FLOAT specifications must be written with "0".

E.g. default power with 50.1% corresponds to 050.0 as transfer value.

Defaults for the command structure:

- Separation of answers and values is done by {Tab}
- Command end by {CR}{LF}
- Command and data separation by ":" ({tab} before and after :)
- Commands are executed with "!" Request for data is executed with "?" at the end (no {Tab})
- Commands including request for data are executed with "!" at the end (no {tab})
- For data that can be set (!?), the command (without data) is sent with ? to query the data. Example "LOnOff":
 - Set: `iSRMeasAVG{Tab}:{Tab}00010{Tab}!?`
 - Queries: `iSRMeasAVG?`
- Command length limit of 200 characters
- Non-understandable commands are confirmed by:
 - `NACK:No such command!{CR}{LF}`

Error handling / timeout:

- Timeout for command processing; default value: 200 ms
- Time interval for retransmission; default value: 200 ms
- Error codes can be queried with the command iSRError?

Checksum:

The checksum is omitted for commands to the iSR900.

In the answers, the checksum is always at the end. Example:

All responses that are sent with data content must be provided with a checksum (CRC-16). This is evaluated accordingly for correctness. The checksum is always at the end of the message, separated by TAB, which is part of the data to be checked.

The checksum is defined as follows:

Type: CRC-16

CRC Polynomial: 0x8005

Init CRC value: 0x0000

Final XOR value: 0x0000

Reflect data (byte): No

Reflect CRC (word): No

Example (ASCII): 123456789

Result: 0xFEE8

13 Requests/commands of the iSR900



Individual functions are not available for every firmware. Therefore, always ask for the firmware version.



{Tab} corresponds to the tabulator. Often also described as /t or \x09

Usage	Command	Reply	Value range
Query serial number	iSRSerialNo?	iSRSerialNr : STRING (CRC)	STRING

Example: Serial number request

```
iSRSerialNo?
iSRSerialNr{Tab} : {Tab}000010{Tab}0x06A7
```

Usage	Command	Reply	Value range
Dark measurement by control	iSRStartDark!?	iSRStartDark (CRC)	none

Example: Command to start dark measurement by control

```
iSRStartDark!?
iSRStartDark{Tab}0x197C
```

Usage	Command	Reply	Value range
Dark measurement after trigger	iSRStartTriggerDark!?	iSRStartTriggerDark (CRC)	none

Example: Command to start dark measurement with trigger (Waits for trigger = HIGH)

```
iSRStartTriggerDark!?
iSRStartTriggerDark{Tab}0x5AEA
```

Usage	Command	Reply	Value range
Single measurement by control	iSRStartMeas!?	iSRMeasStart: (CRC) iSRMeasResult : Peak : NUMBER nm E : NUMBER mW/cm2 SAT : NUMBER % (CRC)	None Peak: decimal number E : Decimal number SAT: 0-100% (modulation)

Example: Command to start measurement by control

```
iSRMeasStart!?  
iSRMeasStart{Tab}0x1B28
```

Usage	Command	Reply	Value range
Single measurement after trigger	iSRStartTriggerMeas!?	iSRStartTriggerMeas: (CRC)	none

Example: Command to start measurement with trigger (Waits for trigger = HIGH)

```
iSRStartTriggerMeas!?  
iSRStartTriggerMeas{Tab}0x582E
```

Usage	Command	Reply	Value range
Retrieve measurement result	iSRMeasResult?	iSRMeasResult : Peak : NUMBER nm E : NUMBER mW/cm2 SAT : NUMBER % (CRC)	Peak: decimal number E : Decimal number SAT: 0-100% (modulation)

Example: Request of the measurement result

```
iSRMeasResult?  
iSRMeasResult{Tab} : {Tab}Peak{Tab} : {Tab}483.76{Tab}nm{Tab}E{Tab} : {Tab}0000.09{Tab}mW/cm2{Tab}SAT{Tab} : {Tab}004%{Tab}0x4EA0
```



No communication is possible during the measurement. The data can be requested with the command iSRMeasResult? (again) can be requested. Measurement data is deleted if the integration time or dark measurement is changed.



One measurement takes approx. (integration time + 100 ms) * averages + 200 ms



The iSR900 will automatically send the measurement data after the measurement is completed. The automatic sending of the measurement data can be prevented with the command "iSRsendResult :0 !? " to prevent it.

Usage	Command	Reply	Value range
Continuous measurement	iSRStartContMeas!?	iSRMeasContStart{Tab}(CRC) iSRMeasResult : Peak : NUMBER nm E : NUMBER mW/cm2 SAT : NUMBER % (CRC)	None Peak: decimal number E : Decimal number SAT: 0-100% (modulation)

Example: Command to start continuous measurement (until any character is received).

```
iSRStartContMeas!?  
iSRMeasContStart{Tab}0xA0A6  
iSRMeasResult{Tab}:{Tab}Peak{Tab}:{Tab}381.25{Tab}nm{Tab}E{Tab}:{Tab}  
0000.01{Tab}mW/cm2{Tab}SAT{Tab}:
```



The communication may not be available once after the continuous measurement and is confirmed with NACK: no such command.

Usage	Command	Reply	Value range
Measure modulation	iSRMeasAussteuerung?	iSRMeasAussteuerung: ZAHL (CRC)	0-100% (modulation)

Example: Request of the control

```
iSRMeasAussteuerung?  
iSRMeasAussteuerung{Tab}:{Tab}004{Tab}0xEE07
```

Usage	Command	Reply	Value range
Query type number	iSRMeterType?	iSRMeterType: STRING (CRC)	STRING

Example: Request ELI measuring device type

```
iSRMeterType?  
iSRMeterType{Tab}:{Tab}840312{Tab}0x1540+
```

Usage	Command	Reply	Value range
Query firmware	iSRFirmware?	iSRFirmware: STRING (CRC)	V0.0.0 - 99.99.99

version			
---------	--	--	--

Example: Firmware version request

```
iSRFirmware?
iSRFirmware{Tab}:{Tab}2.0.2{Tab}0x73AD
```

Usage	Command	Reply	Value range
Query calibration date	iSRCalibDate?	iSRCalibDate: STRING (CRC)	DD.MM.YYYY

Example: Request of the calibration date

```
iSRCalibDate?
iSRCalibDate{Tab}:{Tab}25.07.2019{Tab}0xDF36
```

Usage	Command	Reply	Value range
Query integration time	iSRIntTime?	iSRIntTime: XXXXX (CRC)	00001-02000 ms

Example: Requesting the integration time (in ms steps)

```
iSRIntTime?
iSRIntTime{Tab}:{Tab}00100{Tab}0x3906
```

Usage	Command	Reply	Value range
Set integration time	iSRIntTime : XXXXX!?	iSRIntTime : XXXXX (CRC)	00001-02000 ms

Example: Setting the integration time (in ms steps)

```
iSRIntTime{Tab}:{Tab}00001{Tab}!/?
iSRIntTime{Tab}:{Tab}00001{Tab}0x2B06
```

Usage	Command	Reply	Value range
Query averages	iSRMeasAVG?	iSRMeasAVG: XXXXX (CRC)	00001-00032

Example: Request of the averages

```
iSRMeasAVG?
iSRMeasAVG{Tab}:{Tab}00010{Tab}0x02C7
```

Usage	Command	Reply	Value range
Set averages	iSRMeasAVG : XXXXX !/?	iSRMeasAVG : XXXXX (CRC)	00001-00032

Example: Setting the averages

```
iSRMeasAVG{Tab}:{Tab}00010{Tab}!/?
```

iSRMeasAVG{Tab} : {Tab}00010{Tab}0x02C7

Usage	Command	Reply	Value range
Query averages	iSRError?	iSRError : XXX (CRC)	000 - 999 (error code)

Example: Request of the error messages

```
iSRError?
iSRError{Tab}:{Tab}000{Tab}0x4EF3
```

Usage	Command	Reply	Value range
Reset (identical to Disconnect voltage)	iSRReset!?	iSRReset (CRC)	N/A

Example: Command to reset the iSR900s

```
iSRReset!?
iSRReset{Tab}0xA49C
```

Usage	Command	Reply	Value range
Switch remote mode on/off	iSRRemote :X !?	iSRDisplaySpec : X (CRC)	X = 1 = on X = 0 = off

Example: Setting the remote mode (keys locked) / resetting (keys not locked)

```
iSRRemote{Tab}:{Tab}1{Tab}!?
iSRRemote{Tab}:1{Tab}0xBE9D
```

Example: Resetting the remote mode (keys not locked)

```
iSRRemote{Tab}:{Tab}0{Tab}!?
iSRRemote{Tab}:0{Tab}0x389E
```

Usage	Command	Reply	Value range
Switch remote mode on/off	iSRsendResult : X !?	iSRsendResult: X (CRC)	X = 1 = on X = 0 = off

Example: Automatic sending of the measurement result after finishing the measurement active

```
iSRsendResult{Tab}:{Tab}1{Tab}!?
iSRsendResult{Tab}:1{Tab}0x7E8E
```

Example: No automatic sending of the measurement result after finishing the measurement, measurement result must be requested

```
iSRsendResult{Tab}:{Tab}0{Tab}!?
iSRsendResult{Tab}:0{Tab}0xF88D
```

Usage	Command	Reply	Value range
-------	---------	-------	-------------

Displaying the spectrum once on the device display	iSRDisplaySpec!?	iSRDisplaySpec : (CRC)	X = 1 = on X = 0 = off
---	------------------	------------------------	---------------------------

Example: Command to show the spectrum once on the display

```
iSRDisplaySpec!?  
iSRDisplaySpec{Tab}:{Tab}0xC7C8
```

Usage	Command	Reply	Value range
Output of the shaft length as a list	iSRExportLamda!?	iSRExportLamda : lamda[nm]: NUMBER	Decimal number per pixel

Example:

```
iSRExportLamda?  
iSRExportLamda{Tab}  
lamda [nm] :  
346.674  
346.762  
346.849  
...
```

Usage	Command	Reply	Value range
Output of the shaft length as a list	iSRIntegral?	iSRIntegral : UV_OFR : Number UVC : Number UVB : Number UVA : Number VIS : Number (CRC)	Decimal number per pixel

Example:

```
iSRIntegral?  
iSRIntegral{Tab}:{Tab}  
UV_OFR{Tab}:{Tab}0000.5{Tab}  
UVC{Tab}:{Tab}0000.9{Tab}  
UVB{Tab}:{Tab}0000.4{Tab}  
UVA{Tab}:{Tab}0002.0{Tab}  
VIS{Tab}:{Tab}0082.0{Tab}0x2490
```

Usage	Command	Reply	Value range
Output of the spectral irradiance as a list	iSRExportSpectrum!?	iSRExportSpectrum : Integration time:{Tab}00001{Tab}ms Mittelungen:{Tab}00003 Aussteuerung:{Tab}004{Tab}% Measured value [mW/cm2/nm] NUMBER	STRING HEADER Decimal number per pixel

Example: iSRExportSpectrum?

```
iSRExportSpectrum{Tab}:
Integration time:{Tab}00001{Tab}ms
Mittelungen:{Tab}00003
Aussteuerung:{Tab}004{Tab}%
Measured value [mW/cm2/nm]
00.00000
...
```

Usage	Command	Reply	Value range
Command not recognized / faulty transmission	N/A	NACK:No such command!	N/A

Example: Command not recognized?

```
NixDate{Tab}?
NACK:No such command!
```


14 Error codes

Error codes can be queried via the "iSRError" command.

Only the last error is displayed.

Error confirmations always with NACK:No such command!

Subsequently, the error register contains the error code

If a command is sent correctly, the error is cleared.

general	Error number	Description
no error	000	There is no error

Data reception error	Error number	Description
iSRReset!?	600	Reset requested but not yet performed
iSRType!?*	664	Type not set (function is optional*)
iSRStartDark!?	665	No dark measurement available
iSRStartDark!?	666	Dark value too high
iSRMeasResult?	700	No current data available
iSRMeasResult?	701	Level control too low
iSRMeasResult?	702	Level control too high
general	800	No command detected

Only the last error is displayed.

Error confirmations for format errors always with NACK:No such command!

Subsequently, the error register contains the error code

15 Maintenance

This chapter is intended for qualified users with maintenance tasks.

The iSR900 is largely maintenance-free. We recommend regular calibration.



It is not possible to make a universal statement about the duration of the validity of the calibration. The calibration reflects the properties of the calibration object at the time of calibration. The determination of and compliance with recalibration periods is always the responsibility of the user.

We recommend an inspection at intervals of 6 months. In case of heavy use, this period may be too long. If damage or soiling is suspected, we strongly recommend an immediate inspection.



In case of increased dirt accumulation in the surrounding area, the sensor surface must be cleaned regularly.



Clean the optical components only when necessary.
Use only oil-free compressed air and isopropanol to clean the sensor surface.

For cleaning the top of the sensor:

1. Use isopropanol only
2. Carefully clean the top of the sensor. Wear gloves when doing this.

16 Spare parts , calibration and maintenance



Contact for replacements, recalibrations, and other maintenance 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

17 Error / malfunction

The following notes and error messages are intended for the user. The explanations are intended to help ensure proper operation. Possible reasons and remedies are given.

Function / Display	Meaning	Measures
iSR900 is not recognized	Driver not installed COM settings are not correct	Check the installation of the driver in the device manager Check the settings of the RS-485 port
iSR900 does not record values	Trigger not active Trigger time wrong	Check trigger signal Check measurement delay, irradiate iSR900 continuously
iSR900 does not output any values ("FAIL")	Level control is too low (< 50%) Level control is too large (> 90%)	Set integration time Set integration time
iSR900 returns "NACK:No such command!\{CR\}\{LF\}" back	Command or structure incorrect	Customize command and structure
The modulation is too low	iSR900 dirty Integration time too short	Clean sensor surfaces (e.g. with ISOPROPANOL) Set integration time

18 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 technical documentation:	Company name: Opsytec Dr. Gröbel GmbH Street: Am Hardtwald 6-8 Place: 76275 Ettlingen Country: Germany
Product:	Spectrometer iSR900
Type number:	840312

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 guideline(s) in this declaration:

2014/35/EU

"Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to the provision of electrical Equipment for use within certain voltage limits on the market (Low Voltage Directive)".

2014/30/EU

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

Ettlingen, 08.07.2019

gez. Dr. Mark Paravia