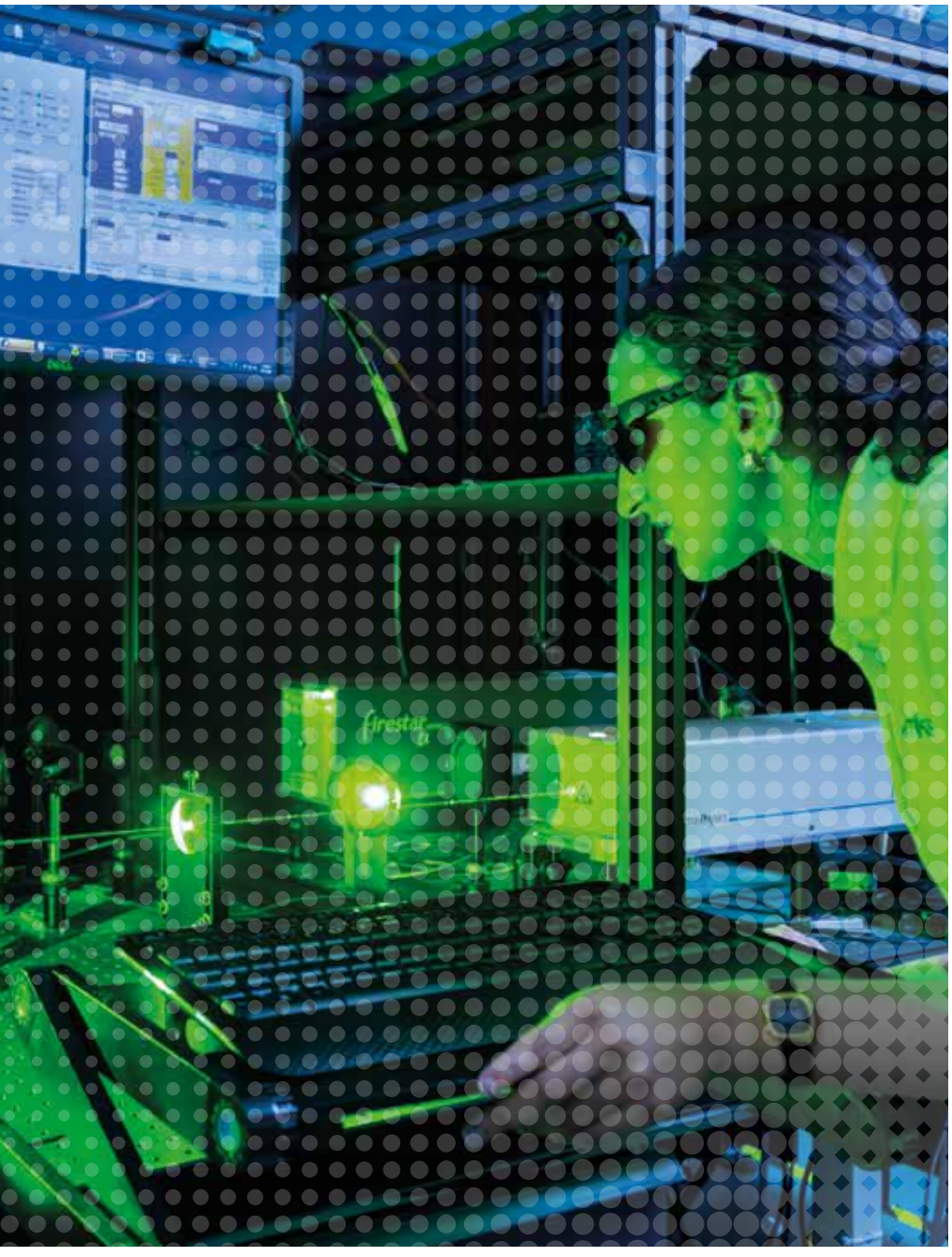
MKS OPHIR® SERVICE
ENSURE RELIABLE MEASUREMENTS



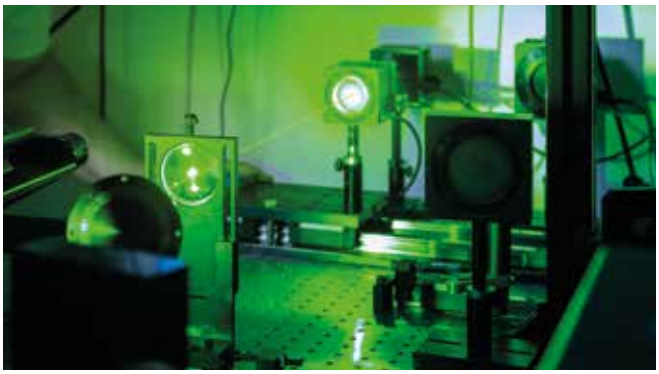
MKS OPHIR® SERVICE IN EUROPE
LEVERAGE YOUR PROCESS – PROTECT YOUR DEVICES

Measuring a laser is quite a challenging task; many parameters need to be taken into consideration. While choosing the right sensor is key, it is not the end of the story. Regular calibration of power and energy sensors, recertification of beam profilers, and distinctive expertise in handling the measurement device gives you confidence in your measurement. Learn more about how you can benefit from the enhanced services MKS offers in its Ophir laboratories around the world.

During the past few years, we have heavily invested in the expansion of our Ophir Service Laboratory in Europe. Located in Darmstadt, Germany; it serves as a central hub for providing fast and efficient service to our customers.

Our dedicated service benches for pyroelectric, thermal, and photodiode sensors are equipped with state-of-the-art lasers. Sensors used in medical applications are calibrated on an individual medical bench; high power calibrations are performed in a safe housing with a 3kW laser.
All camera-based profilers are recertified and serviced by specially trained personnel on a separate bench.

In addition to standard recalibrations or recertifications, we offer multiple service options such as Extended Warranty, Expedite Service or OEM calibrations. Our highly educated and well-trained laboratory staff delivers high-end repair services.



Harsh industry environments, sensitive medical applications, precise R&D labs and stressful service tasks – no matter how you use your Ophir measurement devices, we want to make sure you get the best results in terms of safety and cost-effectiveness.

This brochure delivers valuable insights and best practices for ensuring that your measurements remain reliable long into the future.

The key insights include:

- **How do recalibration and recertification affect your work?**
- **Why does an OEM sensor increase accuracy?**
- **How can you protect your power and energy sensors?**
- **How can common handling errors with beam profilers be avoided?**
- **Why does recertifying your beam profiler improve your product quality?**

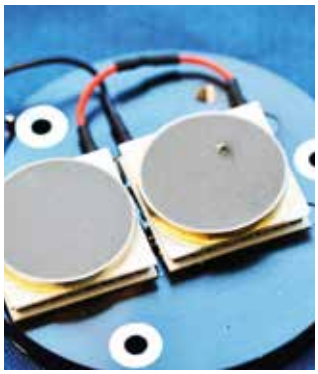
SHARPEN YOUR KNIFE

Recalibration of power and energy sensors

During the recalibration process, we identify the current state of your equipment by comparing it to NIST-or PTB-traceable standards. All sensors need to stay within tolerances to pass the recalibration. As equipment ages and is exposed to contamination, it tends to drift further and further away from the nominal values. Recalibration and servicing bring those deviations back within tolerance and closer to the nominal values. For this reason we recommend yearly calibration.

- When the equipment is functioning properly: we do minimal servicing and return it to you.
- When we detect that the sensor is not working properly: our service team contacts you to get approval for any further actions to bring it back into tolerance.
- In all cases: regular servicing of your equipment can prevent damage and mitigate future repair costs.

Figures 1 and 2: Gradual contamination is hard to notice; grease from fingerprints can cause serious damage.



Figures 3 and 4: Local overheating directly results in burn marks. Usually, it is the discs that need to be replaced.

PROTECT YOUR SENSORS

How to avoid damage

Ophir sensors can be used for many years without needing repairs when used with the proper laser optical setup. However, there are some common handling errors that regularly cause damage across all our sensors, as well as some additional constraints when using photodiode or pyroelectrical sensors.

1. Avoid surface contamination

Often, an out-of-tolerance condition can be explained simply by surface contamination induced by environmental conditions. Even if the risk of contamination is higher in industrial applications, any environment may allow foreign material to be deposited on the sensor. Unfortunately, contamination can be gradual and uniform in distribution, preventing the end user from noticing a change (as seen in Fig. 1). With pyroelectric sensors, even a few specks of dust can cause serious burn marks. Another common source of contamination is grease from fingerprints, as it can be burned into the surface of the absorber (Fig. 2).

Summary

- Determine the source of any contamination.
- Do not use burn paper or any other combustible material near the sensor.
- Isolate sensor from future contamination.
- Never touch the sensor surface with your fingers.
- Broadband coated pyroelectric sensors must not be touched or cleaned in any way.
- Store the sensor in a proper container when not in use.

2. Prevent localized overheating of the coating

Heat damage to the coating is the number one reason for replacing the disc in an Ophir sensor. Each coating type offered by MKS has a specific threshold for localized power and energy shots incident on the surface of the absorber. Although the specification sheet for each sensor includes the general limit for power and energy, the numbers are calculated based on a few assumptions that may not always be true.

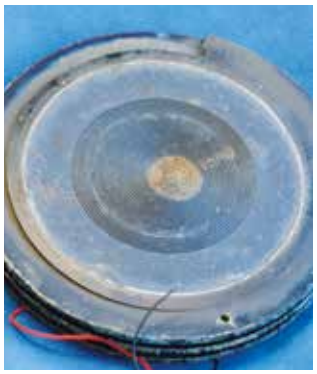
The first premise is that the laser beam profile is a homogenous one, i.e. with a flat top profile. This is not the case for all lasers. Many lasers have a Gaussian profile, while others have spikes or other abnormalities in the profile. These spikes can have power and energy densities many times greater than the beam has on average, resulting in small burn marks and localized overheating of the coating.

Another subtle but extremely important thing to keep in mind is that pulsed lasers, particularly those with short pulse lengths (< ~500 us), have extremely high instantaneous energy densities. Many users occasionally get away with this type of use as the sensor is exposed to the instantaneous energy density so briefly that the coating is literally being disintegrated in microscopic layers. Due to the subtle nature of this type of damage, many times the user will not notice it occurring until after a significant number of pulses.

Summary

- Make sure your laser beam profile is homogenous.
- Expand the laser beam to reduce power and energy density (1/3 of the aperture diameter is usually a good size).
- Use volume absorbers with pulsed lasers.

Figure 5: Local overheating of a photodiode sensor.



Figures 6 and 7: Large-scale discoloration of the coating surface.

Figure 8: Example of grease contamination just from overheating.

3. Prevent the housing from overheating – thermopile sensors

The housing of a thermopile sensor can overheat when the disc is used continuously at powers higher than it is rated for. Many of our sensors are rated at one specific power level for continuous laser power and a separate, higher level for shorter periods of use. Numerous thermopile sensors have names ending in the letter “C” – which means they need to be used with a heat sinking system for convection cooling. When not installed with a heatsink, the maximum power level is reduced significantly.

Two types of damage can occur from overheating the housing of a thermopile sensor. The first is coating failure resulting in a large discoloration of the coating surface that is not removable by cleaning. Refer to Figures 6 and 7.

The second type of damage is grease contamination. When the disc is overheated, the thermal coupling grease between the sensor and its housing will begin to deteriorate. This can result in a ring of grease contamination that slowly migrates onto the surface of the absorber. Grease contamination typically does not affect the readings in the far infrared region; however, near infrared and shorter wavelengths will read greater than actual once contaminated. Any time the grease of a sensor is disturbed, both the single shot energy and the response time are typically no longer within specification (Fig. 8).

Summary

- Refer to the limitations of the sensor as outlined in the specification sheet.
- Do not exceed the temperature limit of the disc.
- Use a proper heatsink.

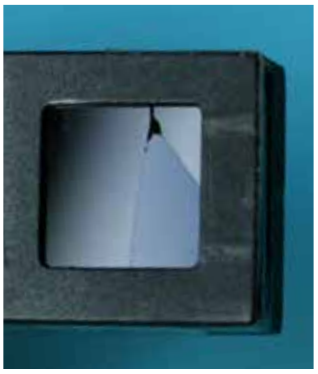
OEM Calibration

For the individual needs of our customers, we develop OEM sensors that may differ from standard sensor characteristics in terms of technology, construction, or calibration. With an OEM calibration, the absolute accuracy of the sensor can technically be increased. Any wavelengths not used by the customer will not be considered in the calibration process.

Your benefits:

- Lower cost per calibration: Initial costs pay off as soon as one or more sensors of that type need to be calibrated regularly
- Less organizational effort, faster calibration process
- Absolute accuracy can be optimized to 2-2.5%

Figure 9: Overheating of photodiode sensors can cause burn spots or discoloration of the coating surface.



Figures 10 and 11: Photodiode sensors must be handled with care; otherwise they can crack.

4. Prevent internal/removable filters from overheating – photodiode sensors

Overheating of a filter occurs with photodiode sensors when the unit is used continuously at a power density level higher than it is rated for.

Two types of damage can occur from overheating the sensor filter. The first is coating failure resulting in a discoloration of the coating surface that may or may not be seen clearly on the filter surface. The discoloration is not removable with cleaning. In this situation, the filter must be replaced due to inconsistent absorption across the surface. Refer to Figure 9.

The second type of damage is local melting of the glass of the filter; this is typically caused by exceeding the filter power density. If the beam is focused to a small spot, it will increase the power density and create a thermal distortion on the filter surface. This distortion might appear wavy from the spot where the glass melted.

5. Protect sensor from scratches or cracked filters – photodiode sensors

In most photodiode sensors, a minor scratch will not affect the sensor operation; if the scratch is deeper, the filter absorption may change and cause incorrect readings. If the filter is cracked, it will need to be replaced. Please refer to Figures 10 and 11.

6. Ensure you are using correct accessories

Most photodiode sensors have a removable filter option to allow for higher power usage. Make sure to use the removable filter when taking measurements with higher power. Make sure to remove the filter when taking a low power measurement and to change the filter setting on the display.

Summary

- Refer to the damage threshold of the sensor as outlined in the specification sheet originally.
- Expand the laser beam to reduce power and energy density (1/3 of the aperture diameter is usually a good size).

Extended Warranty

In addition to our two-year warranty, we offer to extend this period for an additional year. Extended Warranty can be booked individually for each product at the time you purchase your Ophir device.

Your benefits:

- One free recalibration after the first year
- All parts and labor for the additional third year are covered in the event that warranty issues are identified
- Additional security against unforeseen repair costs

MAINTAIN CAMERA PERFORMANCE

Recertification of beam profilers

In contrast to sensor calibrations, NIST and PTB do not offer a Gold or Silver Standard for a beam profiling camera system. Therefore, we refer to “recertification” processes when talking about beam profilers. To help you maintain camera performance, MKS recommends that customers return their Ophir camera-based beam profilers on a regular basis (every 12 months is recommended under normal use) for a verification and recertification process.

A combination of recalibration and recertification is performed for some of our beam caustic measurement devices. For the Ophir BeamSquared device we do both a recertification of the camera as well as a recalibration of the mechanical parts within the beam path. Recalibration and recertification of the Ophir BeamWatch Integrated devices include a thorough cleaning of the units in the Ophir R&R lab.

- This process will correct bad pixels if needed, clean the imager, and certify that your camera is still performing to factory specifications.
- Or you will be advised of any changes that may be serious enough to require limiting use, repair or replacement.

ENSURE YOUR QUALITY

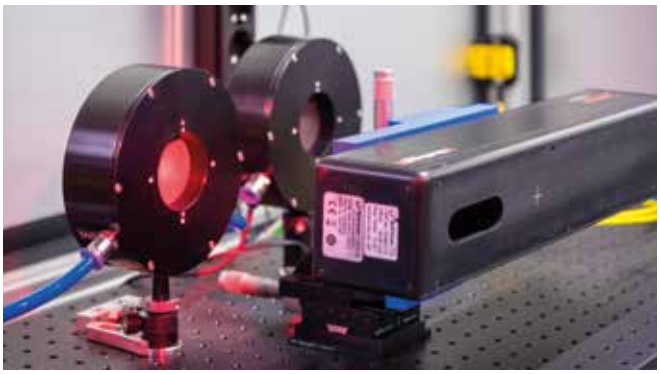
Prolong the life of your beam profilers

There are many different types of Ophir beam profilers. In this section we want to outline some of the major damages we have encountered. Because we are confident of the longevity of our measurement systems when used according to specifications, we want you to be aware of several key points.

General use of CCD cameras

1. The CCD sensors in our beam profilers cannot be cleaned by customers. It is imperative that they remain free from impurities in the form of dust, aerosols, or other physical adulterants such as the oils from fingerprints or mishandling. When camera devices are not in use, they should be stored in a clean, dry area, preferably in an enclosed bag to prevent contamination.

2. CCD cameras are sensitive and must not be dropped, otherwise the imager may crack or the wire bonds may become damaged.



Tips for BeamWatch product family

1. Correct alignment and timing

When aligning the BeamWatch, BeamWatch Integrated or BeamWatch AM measurement devices, make sure to use the alignment laser only. Otherwise, the alignment tool and the device itself can be damaged. Parts of the measurement chamber inside the product may be burned, making reliable measurement impossible.
For the BeamWatch Integrated, additional care needs to be taken with the shutter. The timing between “laser-on” and “open/close shutter” needs to be correctly set by the SPS developer. If the shutter is showing a burn hole, the measurement chamber will be flooded with particles that can damage mirrors and optics.

2. Keep the chamber clean

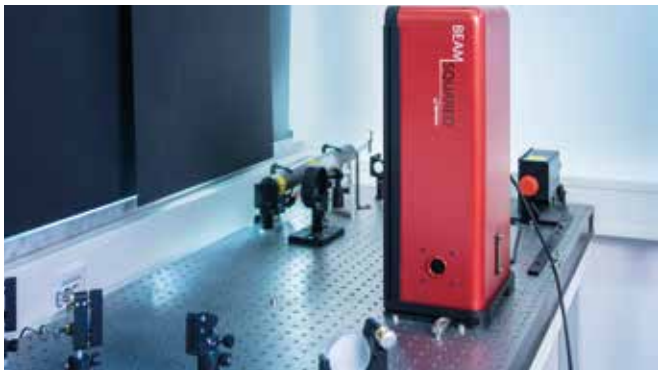
In order to avoid comets or streaks in the images of the laser beam when measuring with a BeamWatch device, care has to be taken to supply only clean, dry, filtered air or nitrogen to the BeamWatch. It is important to keep the dust covers over the openings of the BeamWatch in place until the purge air is flowing in order to prevent dust contamination prior to operation. Also, the pressure of the purge gas is important: while too-low pressure allows dust to enter the measurement chamber, a too-high pressure can lead to turbulence. In either case, imprecise measurements are the result.

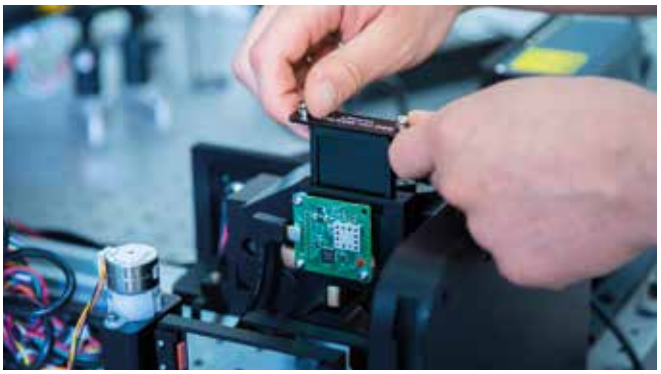
3. Ensure smooth processes by using pure water

Sometimes when industrial measurement devices are used at production sites, the quality of the water is not sufficient. To avoid any issues, only deionized water should be used for water-cooled laser power sensors.
In any case, the water must be clear, clean and sediment-free. The size of any particles in the water must not exceed 150 microns, and the total number of particles must be less than 1000 ppm. To achieve this kind of water quality, a suitable filter should be installed upstream of the sensor, directly before its connection to the water. An overview of the recommended water quality is provided in the following table:

Water quality

Quality	Limit values
Appearance	Clear, clean, no sediment. Ideally deionized (DI) water.
Particle size	< 150 µm – Important: Install filters in front of the water inlet.
Total dissolved solids (TDS)	< 200 ppm
Total suspended solids (TSS)	< 25 ppm
Conductivity	< 30 mS/m (300 µS/cm)
Alkalinity	< 100 ppm
Total hardness	< 100 ppm
Chloride	< 25 ppm (50 mg/L)
Sulfate	< 25 ppm (130 mg/L)
pH value	6.5 – 8.2





Summary

- Use only the alignment laser with alignment tool
- Supply clean, dry, filtered air or nitrogen
- Adjust the air pressure

BeamWatch Integrated (and all water-cooled sensors)

- Ensure high water quality for water-cooled sensors
- Periodically flush closed-loop water systems
- Maintain seals on a regular basis

Expedite Service

Our typical response times for calibration services are exemplary in the industry. Standardized RMA checklists and well-trained service experts allow us to achieve a standard processing in 3-5 business days. However, since some of our customers require more, we also offer even faster turnaround with our Expedite Service options: choose between our 24-hour and 72-hour guaranteed response times.

Your benefits:

- Guaranteed lead time
- No need for backup sensors

Best practices with BeamSquared

1. Keep an eye on the camera

CCD cameras as used with the BeamSquared can be damaged by power in excess of 0.15 mW/cm^2 or energy in excess of 1 µJ/cm^2. BeamSquared employs a focusing optic. While it may be that the laser input power or energy density measures well below this damage threshold, it can easily exceed these levels when focused onto the camera sensor. Do not align the laser through the BeamSquared until the beam has been properly attenuated. Applying an unattenuated beam to the BeamSquared may damage the optics. The camera imager is windowless and can be easily damaged if it comes in contact with any foreign objects. Clean the camera imager only by gently blowing clean dry air or nitrogen across it – and only if absolutely necessary.

Summary

- Never add or detach USB connectors while using the device
- Never insert objects through the openings – this risks scratching the optics
- Be sure only to apply a correctly attenuated beam through the device
- Only use clean dry air or nitrogen for cleaning if necessary

SIMPLIFY YOUR CALIBRATION

Tips and best practices to get your RMA

How do I receive an RMA (Return to Manufacturer Authorization) number?

1. For every repair and/or calibration, we will issue an individual RMA number for you so that we can easily identify your devices (RMAs can include 1-10 devices).

2. Please check the serial number(s) of the product(s) listed in the RMA Checklist and update us with necessary changes before the shipment. Please bear in mind, that an evaluation charge of €100 will apply if you decide not to have your devices repaired or calibrated after sending them in. This also counts for any device we receive that is then determined to be obsolete. Please check here whether your device is obsolete before sending it in: https://www.ophiropt.com/laser--measurement/replaced-pn

3. Please contact your Customer Service Representative (CSR) before returning any equipment to Ophir Spiricon Europe. We will provide you with a checklist that we kindly ask you to fill out and return to your CSR.

4. Furthermore, you may provide us a binding repair release (up to €500 / €1000) on the checklist by ticking the corresponding field. Should a repair be necessary, it will be done immediately, which leads to shorter turnaround times.

5. Please note that we can only assign an RMA number if you have entered on the checklist a valid purchase order covering the cost of recalibration. We consider every shipment we receive as a direct order for calibration.

6. Your CSR will then send the checklist back to you with an RMA number.

7. Please note: The completed RMA Checklist MUST be included in the shipping box together with your device(s). Any additional items included in the shipment will be added to the RMA, processed, and quoted with the original equipment request, and you will be provided with a final order confirmation or a final quote in case any repairs are needed.

8. Please attach the provided label clearly on the outside of the package.

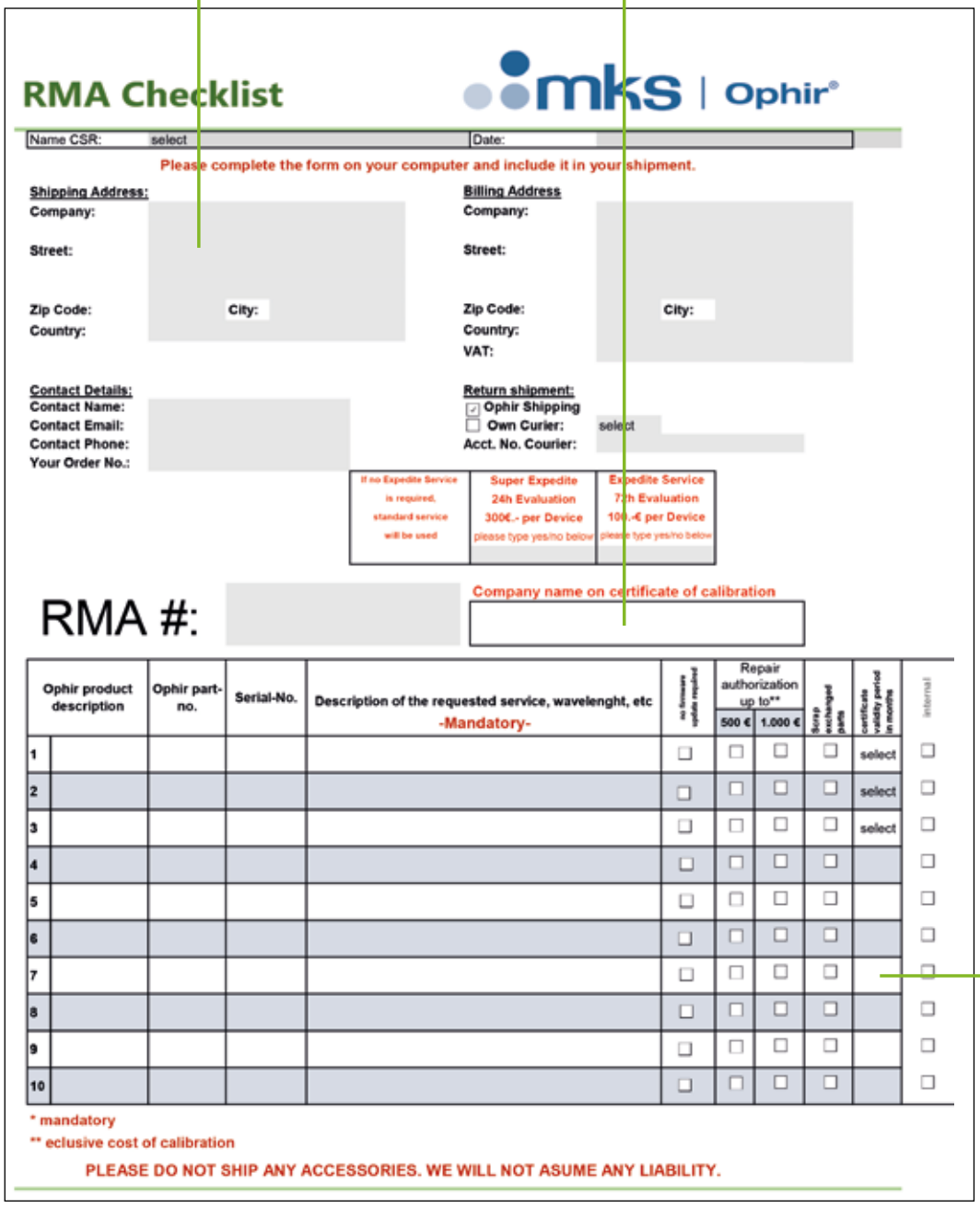
9. Please send your RMA to the specified address.

Please note:
Shipments from outside of the EU must be shipped according to Incoterms DDP Exclusive (Delivery Duty Paid without VAT).

Please add the exact delivery address to which you would like the device returned.

Please enter the name of the company that should appear on the certificate.

Certificate validity in months: Please add the period of time that should appear on the certificate. A standard period is 12 months, but this individually depends on the application of the sensor and the requirements of your company.



RMA Checklist

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Name CSR: select Date:

Please complete the form on your computer and include it in your shipment.

Shipping Address:
Company:
Street:
Zip Code: City:
Country:

Billing Address
Company:
Street:
Zip Code: City:
Country:
VAT:

Contact Details:
Contact Name:
Contact Email:
Contact Phone:
Your Order No.:

Return shipment:
☑ Ophir Shipping
☐ Own Curier: select
Acct. No. Courier:

If no Expedite Service is required, standard service will be used	Super Expedite 24h Evaluation 300€.- per Device please type yes/no below	Expedite Service 72h Evaluation 100.-€ per Device please type yes/no below

RMA #:

Company name on certificate of calibration

	Ophir product description	Ophir part-no.	Serial-No.	Description of the requested service, wavelenght, etc -Mandatory-	no firmware update required	Repair authorization up to** 500 €	Repair authorization up to** 1.000 €	Scrap exchanged parts	certificate validity period in months	internal
1					☐	☐	☐	☐	select	☐
2					☐	☐	☐	☐	select	☐
3					☐	☐	☐	☐	select	☐
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9					☐	☐	☐	☐		☐
10					☐	☐	☐	☐		☐

* mandatory
** eclusive cost of calibration

PLEASE DO NOT SHIP ANY ACCESSORIES. WE WILL NOT ASUME ANY LIABILITY.

WHY MKS?

CRITICAL TECHNOLOGIES

World-class technology and development capabilities for leading-edge processes

PROVEN PARTNER

Recognized leader delivering innovative, reliable solutions for our customers' most complex problems

OPERATIONAL EXCELLENCE

Consistent execution across all aspects of our business

COMPREHENSIVE PORTFOLIO

Largest breadth of product and service solutions for the markets we serve

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North Logan, UT 84341, USA
Tel: +435-753 3729

Ophir Spiricon Europe GmbH
Guerickeweg 7, D-64291 Darmstadt, Germany
Tel: +49-6151-708-0

Ophir Japan Ltd.
6F Kudan First Place, 4-1-28 Kudan Kita
Chiyoda-ku, Tokyo, 102-0073 Japan
Tel: +81-3-3556-2781

Ophir Optronics Solutions Ltd
POB 45021, Har Hotzvim 9145001
Jerusalem, Israel
Tel: + 972-2-548 4444

WHY OPHIR? Ophir is a brand within the MKS Instruments Light & Motion division. The Ophir product portfolio consists of high-performance measurement technology for lasers and LEDs. Ophir stands for:

- **Stability** – For more than 40 years, Ophir has developed laser measurement systems. This integrates perfectly with the long-term stability and growth of MKS, which itself was founded in 1961.
- **Variety of products** – Ophir's product range includes sensors to measure laser power and energy; beam profilers to measure focus shift and beam quality, including industry-leading non-contact measurement systems; and technologies to measure LED luminaires
- **Individuality** – In addition to the continuously growing portfolio of standard sensors, Ophir develops customer-specific OEM solutions for individual application requirements.
- **Service** – Ophir offers service and calibration centers worldwide that are ISO17025 certified or are in the process of accreditation.

For further information please visit **www.ophiropt.com**