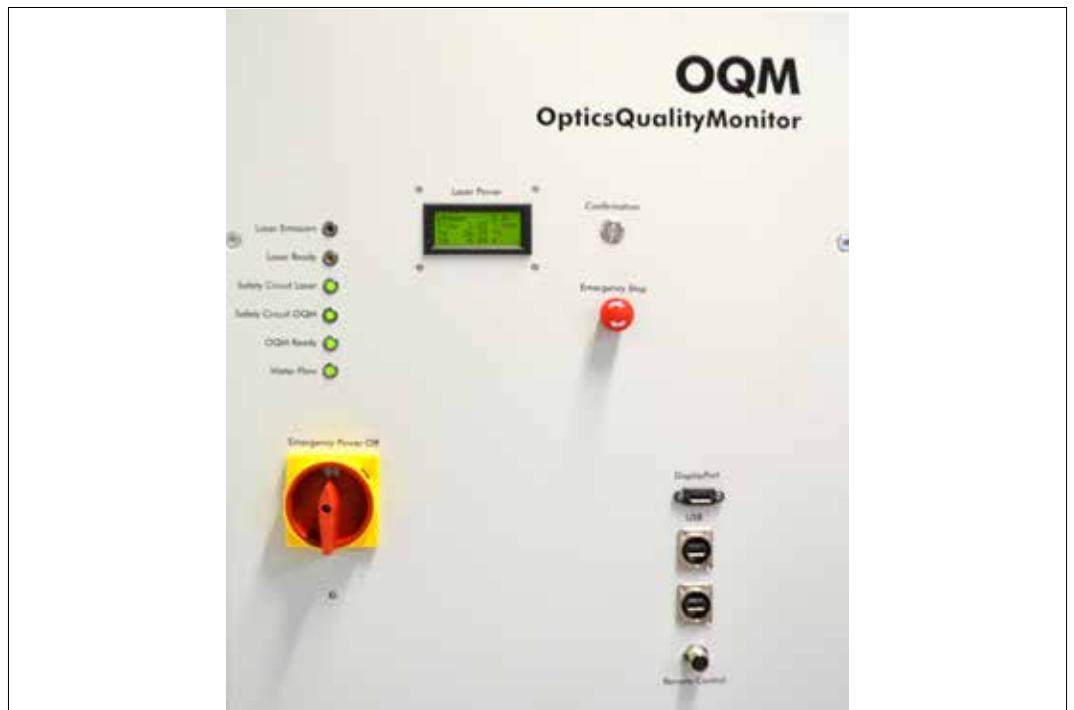


Operating Manual

Translation of the Original Instructions



OpticsQualityMonitor

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1 PRIMES - The Company

PRIMES is a manufacturer of measuring devices used for the characterization of laser beams. These devices are used for the diagnostics of high power lasers that range from high power CO₂-lasers and solid-state to fiber lasers and diode lasers. A great variety of measuring devices for the determination of the following parameters is available:

- The laser power
- The beam dimensions and the beam position of an unfocussed beam
- The beam dimensions and the beam position of a focussed beam
- The diffraction index M^2
- The polarization of the laser beam

Both the development and the production of the measuring devices are effected by PRIMES. This is how we ensure an optimal quality, excellent service and a short reaction time which is the basis to meet our customers' requirements fast and reliably.



2 Basic Safety Instructions

Intended Use

The OpticsQualityMonitor OQM is used to check absorption characteristics of optics in comparison with reference measurements. The OQM checks the absorption of a transmissive optical element (lens or flat optics) with anti-reflection coating in the outgoing- and incoming goods inspection. Other forms of usage are improper. To ensure a safe operation, the instructions given in this manual have to be strictly observed.

Improper usage of the device is strictly prohibited and could lead to health endangering or even deadly injuries. When operating the device, it must be ensured that there are no potential hazards to human health.

During the intended normal operation, **when all housing doors are closed properly**, the laser is guided within the device. Independent of the performance level of the used laser, the laser radiation remains inside the device and does not reach the operator or his/her environment.

When operated as intended and **with lasers which fulfill the Performance Level PLe**, the OQM system meets the requirements of laser class 1, even when the housing doors are open (the respective certificate can be found in chapter „21.1 Laser Safety Certificate“ on page 33).

Any kind of modification to the device, especially when it comes to the safety functions, results in the immediate invalidity of the certificate.

Observing Applicable Safety Regulations

Personal protection is required when humans are present in a dangerous zone with uncovered visible or invisible laser radiation or particularly uncovered laser beam systems, beam guiding systems or process regions. This holds true for any application of this equipment. During measurement procedures there is always an unavoidable risk of laser radiation through direct or reflected emissions. The applicable safety regulations are stipulated in ISO/CEN/TR standards as well as in the IEC-60825-1 regulation, in ANSI Z 136 “Laser Safety Standards” and ANSI Z 136.1 “Safe Use of Lasers”, published by the American National Standards Institute, and additional publications, such as the “Laser Safety Basics”, the “LIA Laser Safety Guide”, the “Guide for the Selection of Laser Eye Protection” and the “Laser Safety Bulletin”, published by the Laser Institute of America, as well as the “Guide of Control of Laser Hazards” by ACGIH.

Taking Necessary Safety Measures

If there are people present within the danger zone of visible or invisible laser radiation, for example near laser systems that are only partly covered, open beam guidance systems or laser processing areas, the following safety measures need to be taken:

- Please wear safety goggles adapted to the laser wave length that is in use.
- Please protect yourself from direct laser radiation, scattered radiation as well as from beams generated from laser radiation (e.g. by using appropriate shielding walls or by weakening the radiation to a harmless level).
- Please use beam guidance- or beam absorber elements which do not emit any hazardous particles as soon as they get in contact with laser radiation and which resist the beam sufficiently.
- Please install safety switches and / or emergency safety mechanisms which enable an immediate closure of the laser shutter.
- Please ensure a stable mounting of the measuring device in order to prevent a relative motion of the device to the beam axis. This reduces the risk of scattered radiation and is also necessary to ensure an optimal performance for the measurement.

Employing Qualified Personnel

All users of the device must have been introduced to the handling of the measuring device and they need to have a basic knowledge about the work with high power lasers, beam guidance systems as well as focusing units.

Modifications

The device must not be modified, neither constructional nor safety-related, without our explicit permission. Modifications of any kind will result in the exclusion of our liability for resulting damages.

Liability Disclaimer

The manufacturer and the distributor of the measuring devices do not claim liability for damages or injuries of any kind resulting from an improper use or handling of the devices or the associated software. Neither the manufacturer nor the distributor can be held liable by the buyer or the user for damages to people, material or financial losses due to a direct or indirect use of the measuring devices.

3 Symbol Explanation

The following symbols and signal words indicate possible residual risks:

 **DANGER**

means that death or serious physical injuries **will** occur if necessary safety precautions are not taken.

 **WARNING**

means that death or serious physical injuries **can** occur if necessary safety precautions are not taken.

 **CAUTION**

means that a slight physical injury **can** occur if necessary safety precautions are not taken.

NOTICE

means that property damages **can** occur if necessary safety precautions are not taken.

The device itself bears the following symbols to indicate possible dangers:



Warning for laser beam



Wear safety goggles



Read and observe the operating instructions and safety guidelines before the start-up!

Further symbols that are not safety-relevant:



Here you can find useful information and helpful hints.

CE With the CE marking the manufacturer guarantees that his product is in conformity with the EC guidelines.

- ▶ Call for action

4 Scope of Delivery

- OQM system (with 4 sample holders)
- PowerLossMonitor (with hoses)
- Cooler
- Laser
- PC with Windows® 7
- LaserDiagnosticsSoftware LDS 3.0

5 System Description

The OQM system consists on a movable control cabinet, in which the laser, the cooler, the PLM as well as the computer are included. The inspection chamber, in which the test module itself can be found, is fastened to the control cabinet.

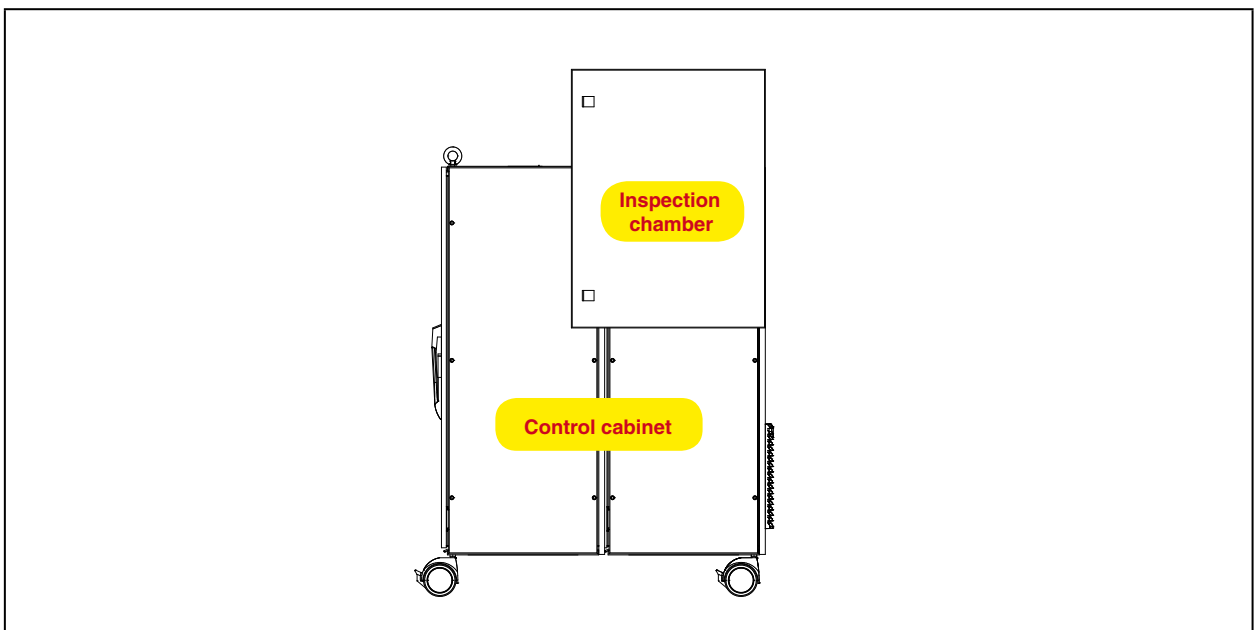


Fig. 5.1: System components of the OQM

The OpticsQualityMonitor is an absorption test module for transparent optics as well as those with an anti-reflection coating. The temperature difference before and after the measurement, which is dependent on the absorptance, is determined. It is then compared with the admissible temperature difference.

6 Measuring Principle

If a sample is put into the test module and a measurement is carried out, the laser is turned on after the thermalization time. It penetrates the sample and is partially absorbed, which simultaneously heats the sample. This temperature rise is proportional to the entire absorption of the sample. The initial temperature as well as the final temperature are determined by means of a pyrometer after stipulated irradiation time and these values are then used to calculate the temperature difference.

The data is evaluated by means of the PRIMES LaserDiagnosticsSoftware 3.0 and is compared with a reference value.

7 Optomechanical Set-Up

There is a collimation optics in the test module which collimates the laser beam to a size of 2 mm. The beam penetrates the scraper mirror and hits the sample. Then the beam is absorbed by the water-cooled absorber.

The thermal radiation resulting from the temperature rise of the sample is projected onto the pyrometer via the scraper mirror using an imaging optics.

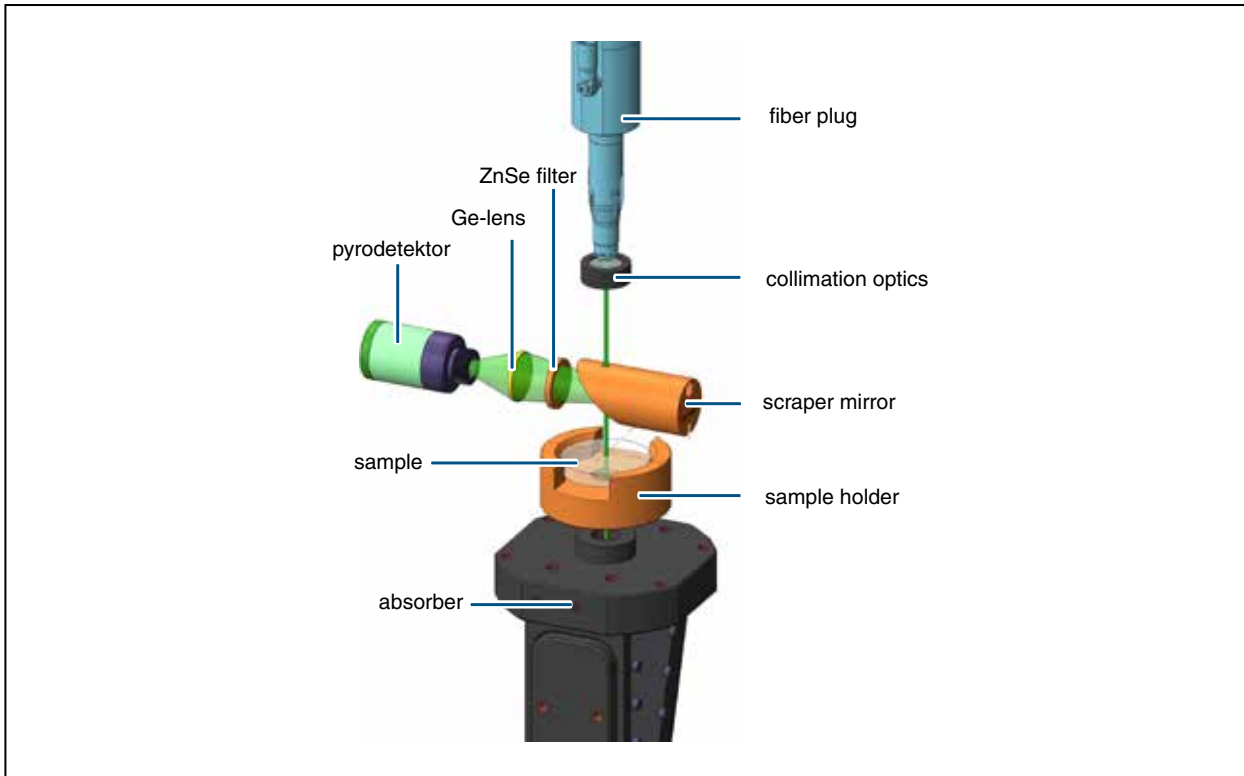


Fig. 7.1: Schematic illustration of the optomechanic set-up

A major advantage of this set-up is the coaxial view of the sample, due to which the geometry of the sample that is to be measured only plays a minor role.

The OQM is only intended for samples with certain focal lengths.

NOTICE

Danger of damage to the absorber.

Inserting unsuitable samples may damage the absorber of the device.

- ▶ **Do not insert samples with focal lengths between 55 mm and 115 mm.**

8 Transport

The OQM must only be transported in a horizontal position.

NOTICE

Danger of damage during the transportation.

Hard impacts or dropping can damage optical parts.

- ▶ **Please handle the device with care during transport and installation!**



WARNING

Danger of injuries.

The test module is very heavy (approx. 340 kg).

- ▶ **Please ensure that adequately dimensioned safety devices as well as hoists are used when transporting it.**

9 Conditions at the Installation Site

The measuring device must not be operated in a condensing atmosphere.

10 Setting Up the Device

- ▶ The device has to be set up horizontally.
- ▶ Lock the casters when the final position has been reached.



WARNING

Danger of injuries due to overturning.

The test module is very heavy and its center of gravity lies above the device center. An inclination or the collision with obstacles can lead to the overturning of the device.

- ▶ **Before moving the device, the casters have to be unlocked.**
- ▶ **Only move the test module by exerting force below the device center.**
- ▶ **Lock the casters again.**

11 Electrical Connections

11.1 Power Connection

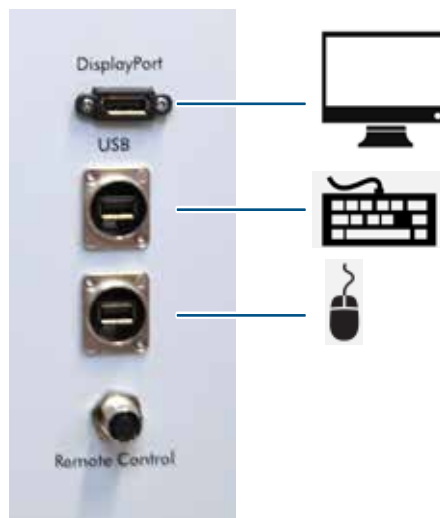
Connect the OQM to a 400 V three-phase network. The device is equipped with a multiple plug as well as a 2 m cable.

11.2 Interfaces

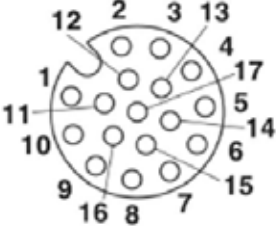


Interface	Function
Display Port	Monitor connection
USB	Two USB connections (keyboard, mouse)
Remote Control	Connection for external control panel (option)

11.2.1 Connecting the PC Periphery



11.2.2 Remote Control Socket

17-pole Socket (view: connector side)	Pin	Function
	1	Emergency Stop (send 1. opener)
	2	Emergency Stop (send 2. opener)
	3	Emergency Stop (return 2. opener)
	4	Emergency Stop (return 1. opener)
	5	Confirmation (send)
	6	Confirmation (return)
	7	Switched Voltage Supply Push-Button-LED (confirmation)
	8	Status-LED Water Flow
	9	Status-LED OQM Ready
	10	Status-LED Safety Circuit OQM
	11	Status-LED Safety Circuit Laser
	12	Status-LED Laser Ready
	13	Status-LED Laser Emitting
	14	Not connected
	15	Not connected
	16	24 V
	17	GND

Suitable plug: Phoenix Contact SACC-MS-17PCON SCO 1559602.

12 Control Elements



No.	Labeling	Function
1	Confirmation	Release button for a measurement (has to be pressed before every measurement, otherwise no measurement can be started in the LDS. It remains active for 30 minutes, after that it has to be pressed again.
2	Emergency Stop	Emergency stop button which turns off the laser.
3	Emergency Power Off	Emergency shutdown button which turns off all components (laser, cooler, PC).

13 Displays



13.1 Status Display

LED	Color	Function
Laser Emission	Red	The laser emits.
Laser Ready	Yellow	The laser is ready for operation (Idle).
Safety Circuit Laser	Green	The safety circuit of the laser (fiber, doors of the switchboard is ok).
Safety Circuit OQM	Green	The safety circuit of the OQM (absorber temperature, sample drawer) is ok.
OQM Ready	Green	The OQM is ready for operation.
Water Flow	Green	The cooling circuit is turned on, the cooling water flow rate is ok.

13.2 Measuring Value Display

The LCD (laser power) displays the following measuring values:

- LPower: Laser power in watt
- Flow: Flow rate of the cooling water in l/min
- Te: Inlet temperature in °C
- Td: Temperature difference in kelvin



14 LaserDiagnosticsSoftware

14.1 Starting the Software



Do not start the software until the measuring device is turned on, the cooling circuit is ready for operation and the power in the FLT software has been stipulated (see chapter „15.2 First Start-up“ on page 20).

Start the software by double-clicking the PRIMES symbol in the new start menu group or the desktop shortcut . The start window appears.



14.2 Graphical User Interface

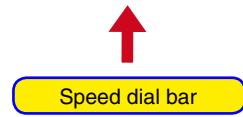
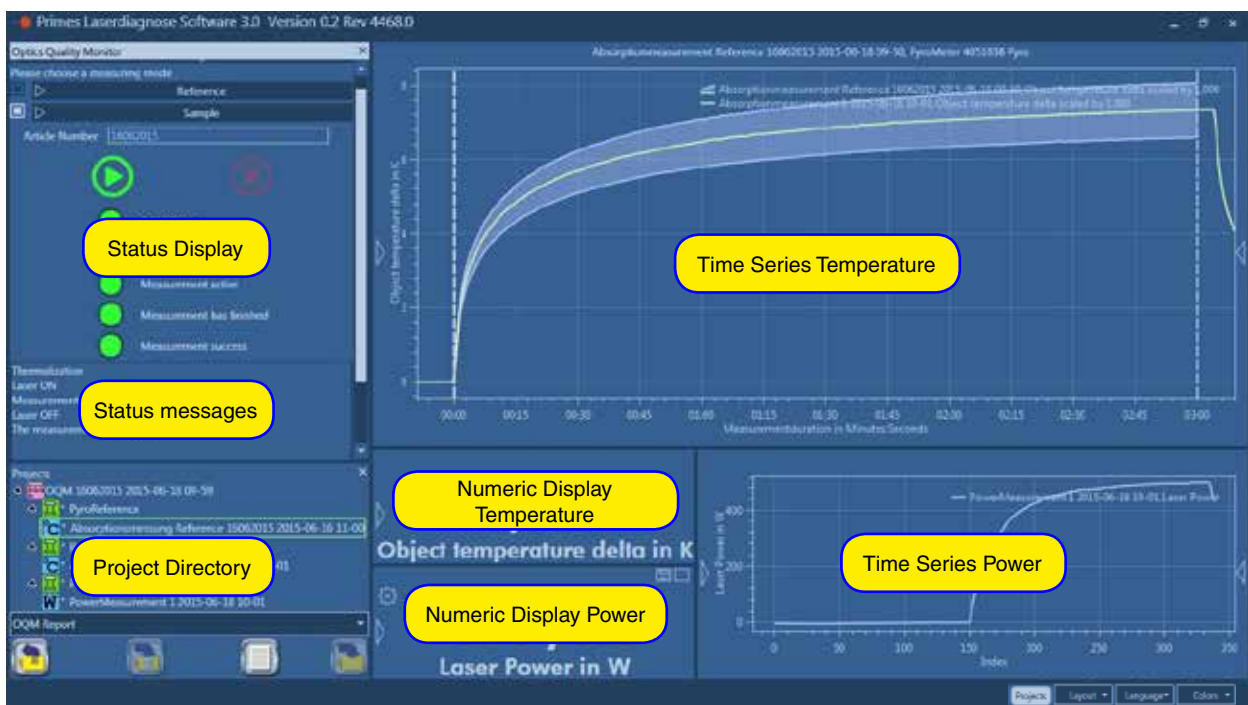
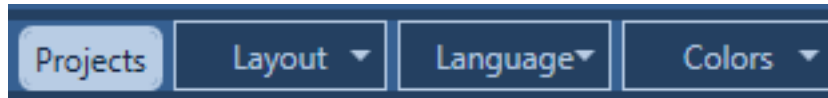


Fig. 14.1: Graphical user interface LDS3

Tabs of the speed dial bar



The tabs of the speed dial bar have the following functions:

Tab	Function
Layout	Show / hide the layout selection.
Projects	Show / hide the project window.
En/De	Switch the language German / English.
Colors	Switch between day and night mode of the user interface.



Open / load local file.



Save file locally.



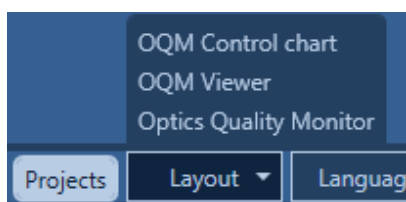
Save file in database



Report

14.2.1 Layout

The **Layout** tab in the speed dial bar opens the layout window in which you can choose from three different display options.



OQM Control Chart

In this layout all measurements of a selected reference can be displayed. You can limit the time frame and filter by certain batch numbers.

Choose the desired reference in the drop-down menu and click the Load button. The graph shows the measuring results (hubs) above the absorption time.

Moreover, you have the option to only choose “gold standard measurements”, which were drawn up by means of the “gold samples” in order to receive information on the system (e.g. drift); please also refer to chapter „15.4.1 Measurement with “Gold Samples”“ on page 29.

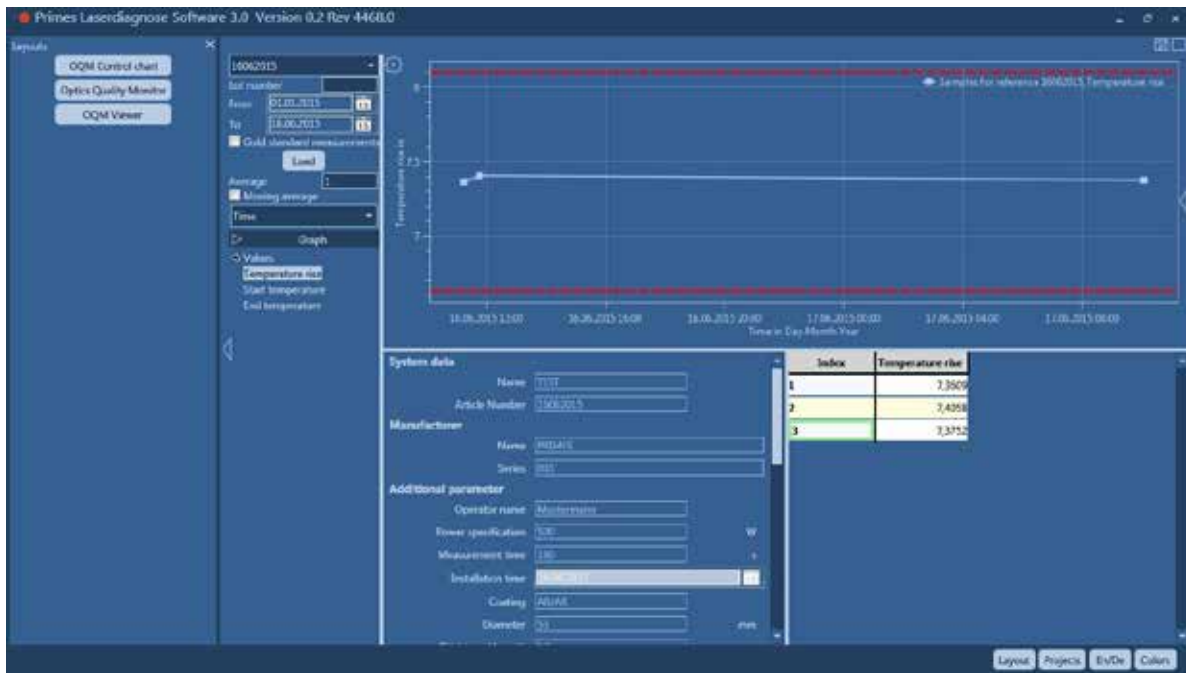



Fig. 14.2: Layout OQM Control Chart

Optics Quality Monitor

This is the standard user interface which opens when the LDS is started; please also refer to Fig. 14.1 on page 16.

OQM Viewer

The layout OQM Viewer is used to analyze drawn up or saved data. You can take a look at the measured curves of the absorption measurement and the power measurement (also several ones in one graph), and it is also possible to export them to Excel (click ). The table view lists the final values. For this purpose, the data can be dragged and dropped into the respective graph. In case of the table view, the entire series has to be dragged, in case of the graphs the individual measurements (by means of the control button it is also possible to select several ones).

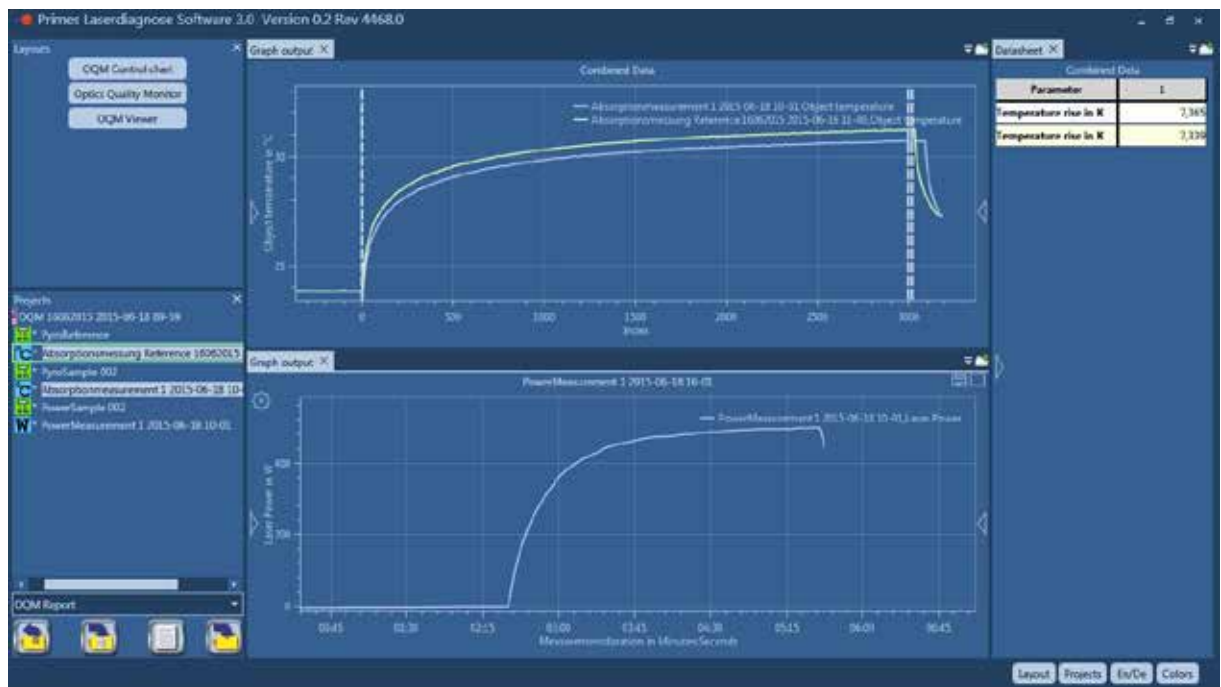



Fig. 14.3: Layout OQM Viewer

15 Measurement

15.1 Measurement Preparation

15.1.1 Cleaning the Samples

Contaminations of the sample would distort the measuring result. For this reason, the sample has to be cleaned thoroughly before the measurement.

- ▶ Take the sample out of the packaging under clean room conditions (class 6).
 - ▶ Remove coarse contaminations by means of cleaned and dry compressed air.
 - ▶ Wipe the sample twice on both sides using high purity acetone (99%) and optics paper.
-  We recommend a following visual check with a green LED.

15.1.2 Inserting the Sample in the Sample Drawer

DANGER

Danger of eye- and skin injuries due to laser radiation.

When opening the inspection chamber door in order to put in the sample, it is possible that laser radiation emits from lasers which do not fulfill the Performance Level PLe.

- ▶ **In this case wear safety goggles, which are adapted to the used wavelength, as well as protective clothing when exchanging the optical elements. The wavelength is indicated on a warning sign on the inspection chamber door.**

There are different holders for different samples which must not be confused and are therefore marked accordingly.

Especially in case of curved optics the marking in the sample holder (bottom/top) has to be observed.

15.1.3 Closing the Sample Drawer

The sample drawer has to be closed manually.

15.2 First Start-up



In case of the first start-up, the test module has to be thermalized by means of the cooler approximately two hours before the measurement.

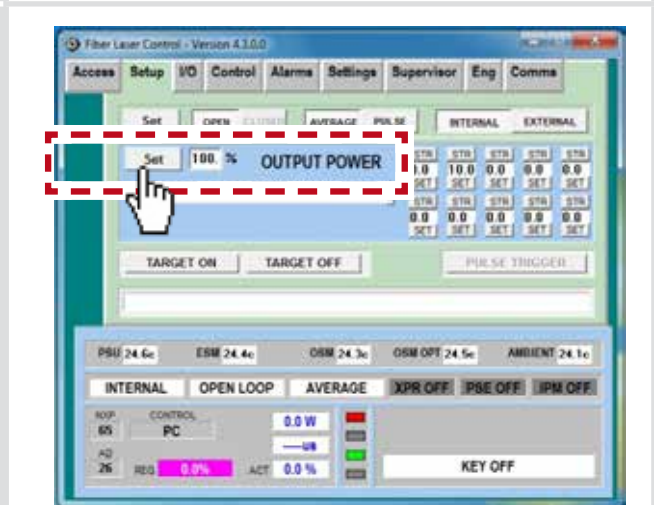
- ▶ Start-up: Turn the Emergency Power Off switch to the right.
- ▶ Open the door of the switchboard.
- ▶ Turn on the PC.
- ▶ Turn on the cooler.

- **The cooler has be on for approx. 2 hours before the first measurement can be carried out.**
- ▶ Turn on the laser by turning the key to the right until it reaches the ON position. In this position, the laser is “enabled” and thus recognized by the control system.
- ▶ Close the door of the switchboard.
- ▶ Check the status display. The following LEDs have to be green:
 - Safety Circuit Laser
 - Safety Circuit OQM
 - OQM Ready
 - Water Flow

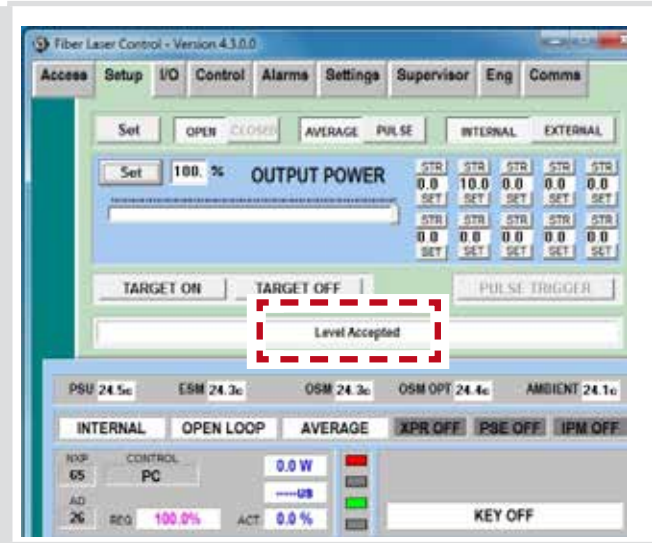
- ▶ Start the software **Fiber Laser Tool** on the PC using a double-click.
- ▶ Click the **Setup** tab.



- ▶ Enter 100 % in the input field **OUTPUT POWER** and click the **Set** button.



👁️ A correct entry is confirmed by the status message “Level Accepted”.


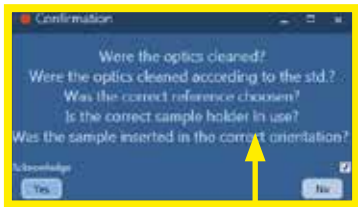

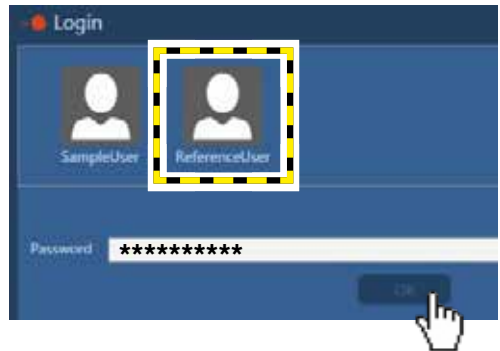
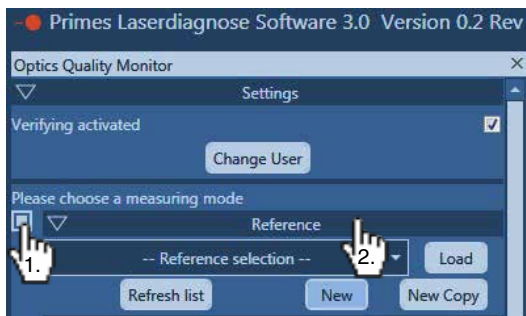


15.3 Reference Measurement

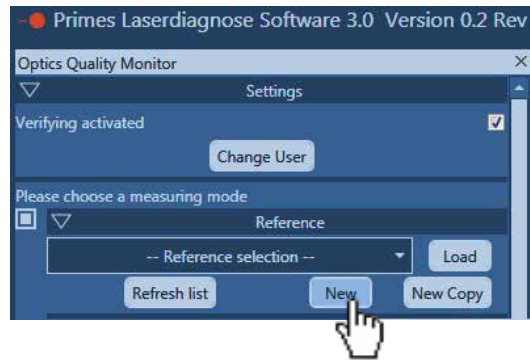
In order to carry out a reference measurement, you have to login as a “ReferenceUser” using the respective password.


The data of the reference measurement is later compared with the sample data and rated OK (okay) or NOK (not okay).

15.3.1 Creating a New Reference

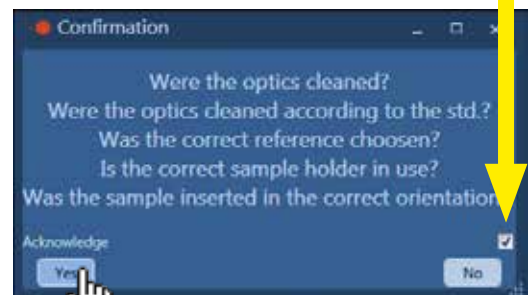
<ul style="list-style-type: none"> ▶ Click the Settings button. ▶ Activate the check box Verifying activated if you want a confirmation enquiry before the measurement. ▶ Click the Change User button. 	  
<ul style="list-style-type: none"> 👁 The login window appears. ▶ Click the pictogram ReferenceUser and enter the password. ▶ Confirm the entered password by clicking OK. 	
<ul style="list-style-type: none"> ▶ Activate the check box to the left of the Reference button. ▶ Click the Reference button. 👁 The reference window appears. 	

- ▶ Click the **New** button.
- 👁 The input window for the manufacturer -, material-, and tolerance details appears.
- ▶ Enter the data of the reference optics.



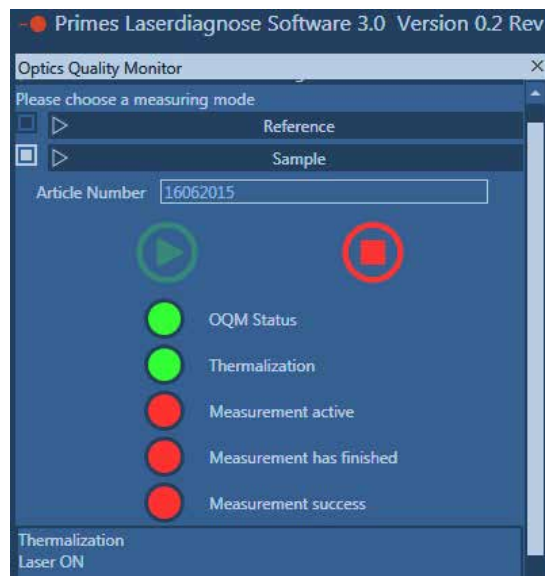
- ▶ Press the **Confirmation** button on the device.
- ▶ Click the  button.
- 👁 The confirmation window is opened (if the function was activated before).
- ▶ Activate the check box **Acknowledge** and click the **Yes** button.

1.



2.

- 👁 The measurement is started. The thermalization begins and the status message "Thermalization" appears in the status window. This process continues until there is a thermal balance between the test module and the inserted sample. As soon as the temperature is equal, the status message "Laser on" appears and the status LED "Thermalization" turns green.



The laser is turned on, and the absorption test module starts the measurement. It is terminated automatically after 180 seconds.

- 👁 The status message "Laser off" appears in the status window.
- ▶ Turn off the laser (the switch-off time does not have an influence on the completed measurement).

- ▶ Mark the project file

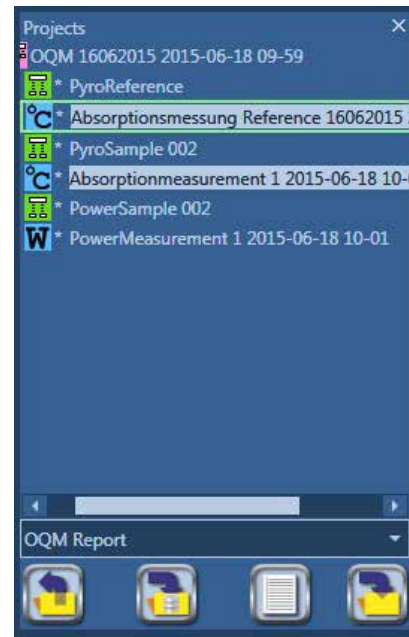
You have the option to save the measurement in a data base or locally on your computer.

Notice: If you wish to save it in a database, this has to be done before the measurement is saved locally!

- ▶ Save the measurement into the database by clicking the **Save in DB** button.
- ▶ Save the measurement locally by clicking the **Save Locally** button.

Please note: The LDS only lists the measurement in the reference selection after the next relaunch if it was saved in a database.

As an alternative, you can click the **Refresh List** button to update the selection.



Save Locally



Save in DB

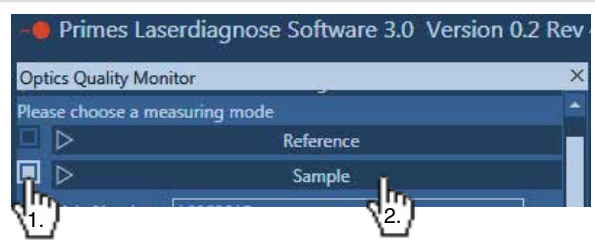
Graphical user interface of the LDS after a successful reference measurement.



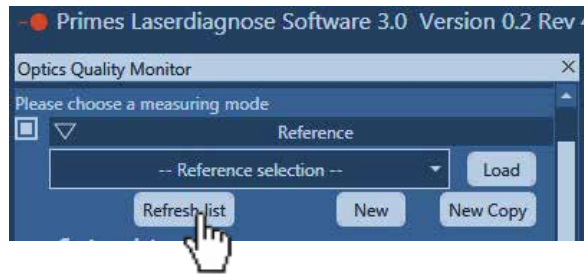
15.4 Sample Measurement

In order to carry out a sample measurement, a password is not necessary. Here, the current measurement results are compared with the saved data of the reference measurement and are rated OK (okay) or NOK (not okay) depending on the stipulated tolerance.

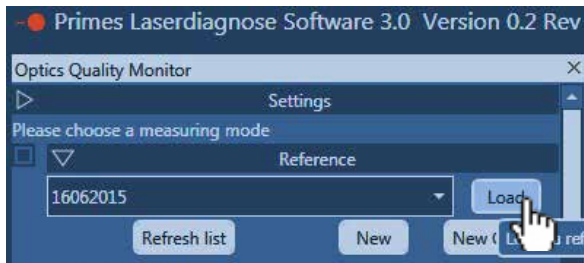
- ▶ Activate the check box next to the **Sample** button.
- ▶ Click the **Sample** button.
- 👁 The reference selection window appears.



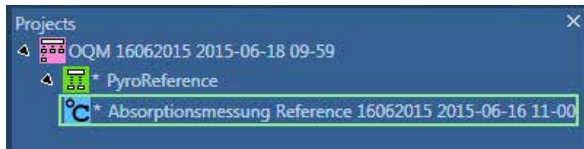
- ▶ Click the **Refresh List** button.
- (You can skip this step if the program was restarted between the reference measurement and the sample measurement)



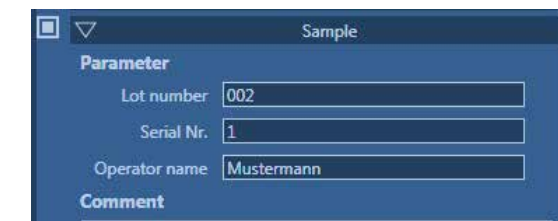
- ▶ Select the respective reference of your sample in the **Reference Selection** list.
- ▶ Click the **Load** button.




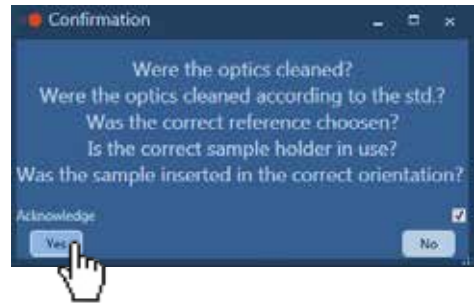
- ▶ The reference project with the respective subdirectories appears in the project window.



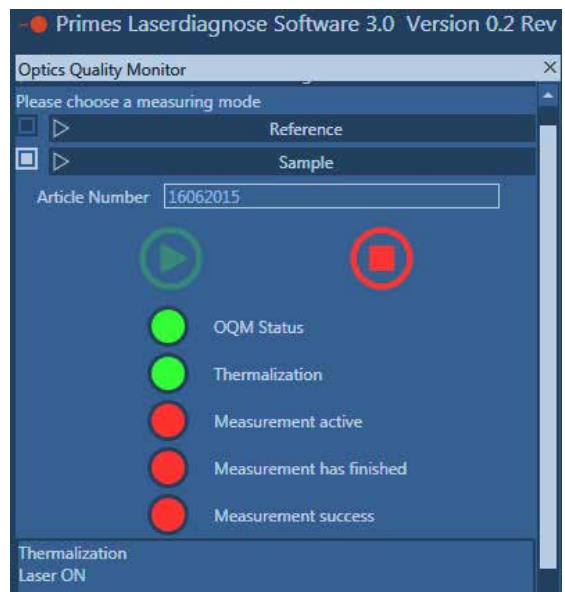
- ▶ Enter the sample parameters; peculiarities can be entered in the comment field.



- ▶ Press the **Confirmation** button on the device.
- ▶ Click the  button.
- 👁 The confirmation window appears (if this function was activated before).
- ▶ Activate the check box **Acknowledge** and click the **Yes** button.



- 👁 The measurement is started. The thermalization begins and the status message "Thermalization" appears in the status window. This process continues until there is a thermal balance between the test module and the inserted sample. As soon as the temperature is equal, the laser is turned on.



The absorption test module starts the measurement. It is terminated automatically after 180 seconds. The laser is turned off.

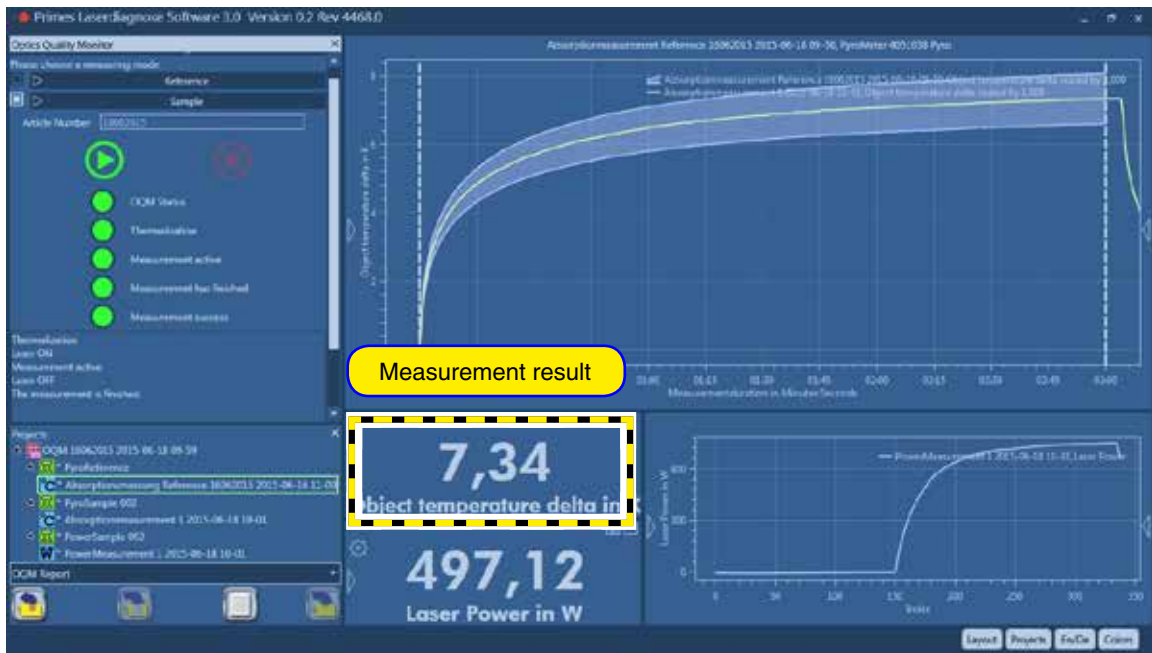
- ▶ Save the measurement by clicking the **Save Locally** button.

You also have the possibility to save the measurement in a database (**Save in DB** button).



Save in DB

Graphical user interface of the LDS after a successful sample measurement.



15.4.1 Measurement with “Gold Samples”

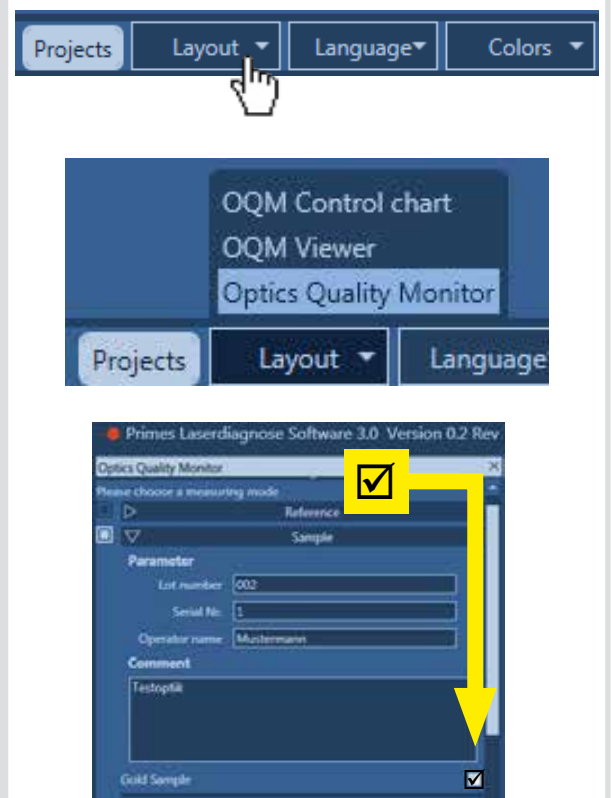
It is possible to measure so called “gold samples”, whose perfect characteristics serve as reference material for the measurement. We recommend the measurement with gold samples in regular intervals in order to check the proper functioning of the system.

The option requires the login as administrator and can be selected in the OpticsQualityMonitor layout under Sample.

▶ Click the **Layout** button in the speed dial bar.

▶ Click the **OpticsQualityMonitor** button.

▶ Activate the check box **Gold Sample**.



You can also have the gold standard measurements displayed by means of the OQM Control Charts button.



In order to check the system, we recommend a Gold Sample measurement before each new series measurement.

16 Maintenance

Under ordinary operating conditions, the OQM is maintenance free. However, we recommend a service by the manufacturer every 12 to 18 months.

16.1 Cooler

- ▶ Regularly check the filling level of the cooling water. If water is necessary, only refill filtered water (< 25 µm).
- ▶ Exchange the water filter every six months or every 4000 operating hours, respectively.
- ▶ Check the air in- and outlet of the cooler regularly and clean it if necessary.

For further information please refer to the enclosed documentation by the manufacturer of the cooler (Thermotek AG).

17 Storage and Transport

Please note before storing or transporting:

NOTICE**Danger of damage due to freezing cooling water**

A storage or transport at a temperature that is close to or below the freezing point can lead to device damages if the cooling circuit is not completely empty.

- ▶ **Empty the cooling circuit completely!**
-

18 Measures for the Product Disposal

Due to the Electrical and Electronic Equipment Act ("Elektro-G") PRIMES is obliged to dispose PRIMES measuring devices manufactured after August, 2005, free of charge. PRIMES is a registered manufacturer in the German "Used Appliances Register" (Elektro-Altgeräte-Register "EAR") with the number WEEE-Reg.-No. DE65549202.

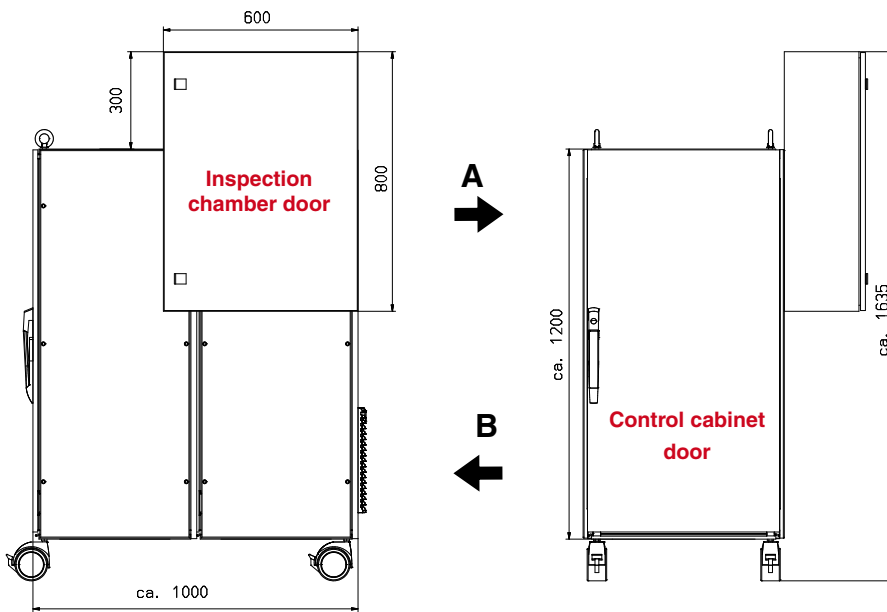
Provided that you are located in the EU, you are welcome to send your PRIMES devices to the following address where they will be disposed free of charge:

PRIMES GmbH
Max-Planck-Str. 2
64319 Pfungstadt
Germany

19 Technical Data

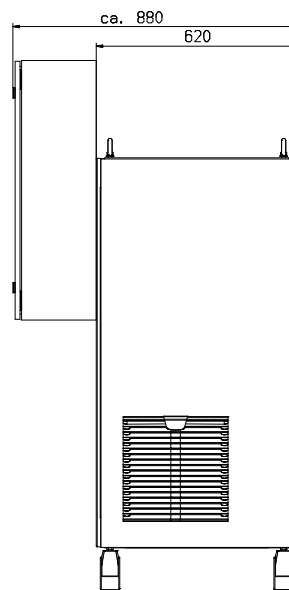
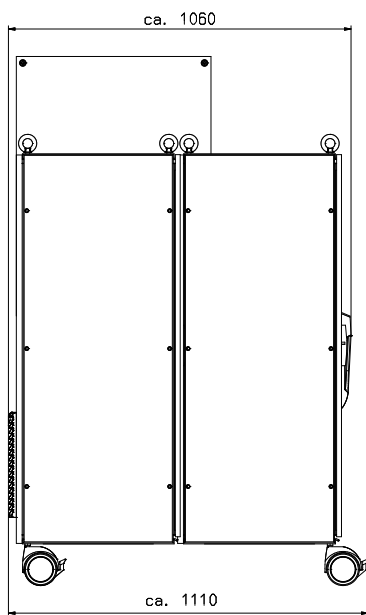
Type	OQM	
Supply Data		
Supply Voltage (three-phase network)	V	400
Max. current consumption	A	16
Measurement Parameters		
Accuracy	mK	± 200
Reproducibility	mK	± 100
Environmental Conditions		
Operating temperature range	°C	20 ... 30
Storage temperature range	°C	5 ... 45
Reference Temperature	°C	24
Permissible relative humidity (non condensing)	%	0 ... 80
Dimensions and Weight		
Dimensions, L x H x W	mm	1000 x 1635 x 880
Weight, approx.	kg	340
Unsuitable Probes		
With focal lengths from ... to	mm	55 ... 115

20 Dimensions



View A


View B




All dimensions in mm

21 Appendix

21.1 Laser Safety Certificate



ZERTIFIKAT LASERSICHERHEIT



Das unten bezeichnete Lasermesssystem wurde durch uns, gemäß den aufgeführten Normen, geprüft und bezüglich der Lasersicherheit, wie angegeben, bewertet. Messverfahren und Prüfergebnisse sind im angegebenen Gutachten dokumentiert.

Gutachten	1506110844_GUT		
Hersteller / Vertrieb	Primes GmbH		
Strasse	Max Planck Str. 2		
PLZ / Ort	D – 64319 Pfungstadt / Hahn		
Produkt / System	OpticsQualityMonitor (OQM)		
Bezeichnung	9301		
Prüfmuster S/N			
Bestimmungsgemäße Verwendung	Absorptionsmessungen an optischen Komponenten für NIR Laser		
Laserquelle(n)			
Hersteller	SPI Laser UK Limited		
Modell & S/N	R4.3 High Power Fibre Laser	SM-S00397	
Laserart / Wellenlänge	Faserlaser, Single Mode	λ	1.050 nm – 1.250 nm
Betriebsart / Leistung	CW	P_{max}	500 Watt
Normen / Vorschriften	60 825-1 // 60 825-2		
ISO IEC EN	/.		
FDA ANSI	EG RIL 2006/25/EG // OStrV 2010-07 // BGV-B2 (alt)		
EG bzw. nationale			
Klassifizierung			
Betriebsart / Zustand	Normalbetrieb	Einrichten / Warten	Service / Reparatur
Berechtigung / gilt für	Anwender	Hersteller	Hersteller
Erfüllt die Bedingungen der Laserklasse	1	4	4
Augensicherheit gegeben	JA	nur mit PSA	nur mit PSA
Laserschutzbeauftragter	NEIN	JA	JA
Laserschutzbrillen	NEIN	JA	JA

Unser SV-Gutachten bestätigt, dass die Bedingungen der genannten Laserklassen, für die drei beschriebenen Betriebszustände, gemäß Tabelle oben, eingehalten werden. Berücksichtigt wurde die optische Strahlensicherheit des Lasermesssystems für den Anwender, in den oben genannten bestimmungsgemäßen Betriebszuständen, laut Bedienungsanleitung des Systemherstellers, bezogen auf den original ausgelieferten Zustand. Eine Risikoanalyse wurde vom SV lediglich für den Laserschutz durchgeführt; elektrische und/oder mechanische Gefahren waren nicht Gegenstand dieser Prüfung.

Darmstadt, den 14. Juli 2015


 Prof. Klaus R. Goebel
 Öffentlich bestellter und vereidigter Sachverständiger
 für Lasertechnik der IHK Darmstadt



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- Öffentlich bestellte und vereidigte Sachverständige für Lasertechnik
- Beratende Ingenieure der Kammer Hessen / Reg.: B 902
- Akkreditiertes Prüflabor für optischen Strahlenschutz / PL 12023-01



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- Internet: www.goebel-laser.de
- E-Mail: info@goebel-laser.de