

Original Instructions



CompactPowerMonitor CPM

CPM C-9, CPM F-1, CPM F-10, CPM F-20, CPM F-30

LaserDiagnosticsSoftware LDS

PowerMonitorSoftware PMS

IMPORTANT!

READ CAREFULLY BEFORE USE.

KEEP FOR FUTURE USE.

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PRIMES - The Company

PRIMES manufactures measuring devices used to analyze laser beams. These devices are employed for the diagnostics of high-power lasers ranging from CO₂ lasers and solid-state lasers to diode lasers. A wavelength range from infrared through to near UV is covered, offering a wide variety of measuring devices to determine the following beam parameters:

- Laser power
- Beam dimensions and position of an unfocused beam
- Beam dimensions and position of a focused beam
- Beam quality factor M^2

PRIMES is responsible for both the development, production, and calibration of the measuring devices. This guarantees optimum quality, excellent service, and a short reaction time, providing the basis for us to meet all of our customers' requirements quickly and reliably.



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1 Basic safety instructions

Intended use

The CompactPowerMonitor CPM is exclusively intended for measurements which are carried out in or near-by the optical path of high power lasers. Please mind and adhere to the specifications and limit values given in chapter 18 „Technical data“ on page 50. Other forms of usage are improper. The information contained in this operating manual must be strictly observed to ensure proper use of the device.

Using the device for unspecified use is strictly prohibited by the manufacturer. By usage other than intended the device can be damaged or destroyed. This poses an increased health hazard up to fatal injuries. When operating the device, it must be ensured that there are no potential hazards to human health.

The device itself does not emit any laser radiation. During the measurement, however, the laser beam is guided onto the device which causes reflected radiation (**laser class 4**). That is why the applying safety regulations are to be observed and necessary protective measures need to be taken.

In measuring mode, the laser control's safety interlock must be connected with the device.

Observing applicable safety regulations

Please observe valid national and international safety regulations as 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.

Necessary safety measures

If people are 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 must be implemented:

- Connect the laser control's safety interlock to the device. Check that the safety interlock will switch off the laser properly in case of error.
- Please wear **safety goggles** adapted to the power, power density, laser wave length and operating mode of the laser beam source in use.
- Depending on the laser source, it may be necessary to wear suitable **protective clothing** or **protective gloves**.
- Protect yourself from direct laser radiation, scattered radiation, and beams generated from laser radiation (by using appropriate shielding walls, for example, or by weakening the radiation to a harmless level).
- Use beam guidance or beam absorber elements that do not emit any hazardous substances when they come in to contact with laser radiation and that can withstand the beam sufficiently.
- Install safety switches and/or emergency safety mechanisms that enable immediate closure of the laser shutter.
- Ensure that the device is mounted securely to prevent any movement of the device relative to the beam axis and thus reduce the risk of scattered radiation. This is the only way to ensure optimum performance during the measurement.

Employing qualified personnel

The device may only be operated by qualified personnel. The qualified personnel must have been instructed in the installation and operation of the device and must have a basic understanding of working with high-power lasers, beam guiding systems and focusing units.

Conversions and modifications

The device must not be modified, neither constructionally nor safety-related, without our explicit permission. The device must not be opened e.g. to carry out unauthorized repairs. 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.

2 Symbol explanations

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 **may** occur if necessary safety precautions are not taken.



CAUTION

Means that minor physical injury **may** occur if necessary safety precautions are not taken.

NOTICE

Means that property damage **may** occur if necessary safety precautions are not taken.

The following symbols indicating requirements and possible dangers are used on the device:



Warning against a danger zone.



Do not touch.



Read and observe the operating instructions and safety guidelines before startup!

Further symbols that are not safety-related:



Here you can find useful information and helpful tips.



With the CE designation, the manufacturer guarantees that its product meets the requirements of the relevant EC guidelines.

► Call for action

3 About this operating manual

This documentation describes the installation and operation of the CompactPowerMonitor CPM and performing measurements using the CompactPowerMonitor CPM, the optional LaserDiagnosticsSoftware LDS or the PowerMonitorSoftware PMS.

For measurement operation with a PC, the LaserDiagnosticsSoftware LDS (option) or the PowerMonitorSoftware PMS must be installed on the PC. The PowerMonitorSoftware PMS is included in the scope of delivery.

For a detailed description of the software installation, file management and evaluation of the measured data, please refer to the separate operating manual LaserDiagnosticsSoftware LDS.

4 Conditions at the installation site

- The device must not be operated in a condensing atmosphere.
- The ambient air must be free of organic gases.
- Protect the device from splashes of water and dust.
- Operate the device in closed rooms only.

5 Introduction

5.1 System description





The CompactPowerMonitor CPM is a measuring device for the determination of the laser power of laser beams in the multikilowatt range. The main field of application is the control of laser powers of CO₂ or solid-state lasers as well as high power diode lasers available at the work piece. The device is able to measure both collimated and divergent beams.

5.2 Measuring principle

The CompactPowerMonitor CPM measures the laser power according to a calorimetric principle. The irradiated laser power is absorbed by a water-cooled absorber inside the device. By measuring the cooling water flow rate and the respective temperature difference between the inflowing and the outflowing water, the absorbed power is determined.

5.3 Overview of the CompactPowerMonitor CPM types

The various CompactPowerMonitor CPM types differ mainly in regards to the inlet aperture, the absorber size, the measurable laser power, and the cooling water flow rate required by this. The port and operating unit is the same on each device.

Device type		Entrance aperture in mm	Average power density in kW/cm ²
CPM C-9		55	5 (Ø < 10 mm) 5 (Ø 10–30 mm) 0,5 (Ø 30–55 mm)
CPM F-1		45	0.5
CPM F-10		90	0.5
CPM F-20		135	0.5
CPM F-30		180	0,5

Tab. 5.1: Overview of the CompactPowerMonitor CPM types

5.4 Connection overview

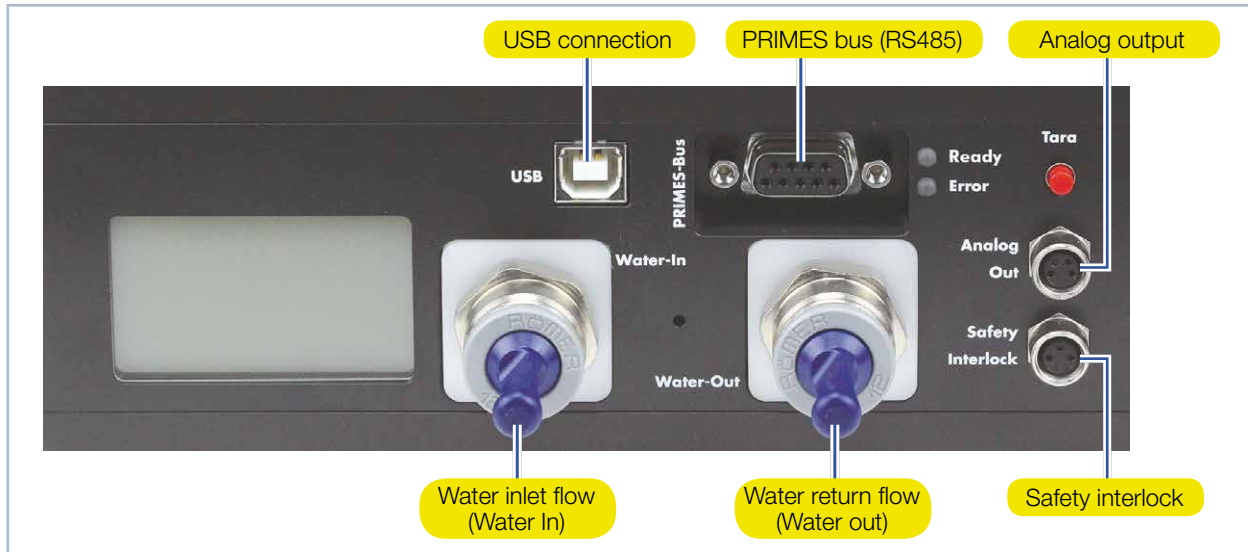


Fig. 5.1: Connections of the CompactPower Monitor CPM

5.5 Short overview installation

<p>1. Installing the LaserDiagnosticsSoftware LDS on the PC (option)</p> <ul style="list-style-type: none"> • Please contact PRIMES or your PRIMES distribution partner to order the software 	<p>See separate Operating Manual of the LaserDiagnosticsSoftware LDS</p>
<p>2. Taking safety precautions</p>	<p>Chapter 1 on page 7</p>
<p>3. Installing the device</p> <ul style="list-style-type: none"> • Follow the safety instructions • Set the installation position • Mount the device stably 	<p>Chapter 7 on page 15</p>
<p>4. Connect the water-cooling</p> <ul style="list-style-type: none"> • Determine flow rate according Tab. 8.5 on page 22 • Connect hoses (hose outer diameter of 12 mm) 	<p>Chapter 8 on page 20</p>
<p>5. Power supply</p> <ul style="list-style-type: none"> • Connect power supply • Connect safety interlock 	<p>Chapter 9.1 on page 24 Chapter 9.3 on page 25</p>
<p>6. Connection with the PC</p> <ul style="list-style-type: none"> • Via USB (scope of delivery) • Via RS232/RS485 converter (optional) 	<p>Chapter 9.4 on page 26 Chapter 9.5 on page 28</p>
<p>7. Parallel operation of CompactPowerMonitor PMC and,</p> <ul style="list-style-type: none"> • For example, the FocusMonitor 	<p>Chapter 9.6 on page 30</p>
<p>8. Perform the measurement</p> <ul style="list-style-type: none"> • Follow the safety instructions • Perform the measurement with the optional LaserDiagnosticsSoftware LDS 	<p>Chapter 11 on page 34</p>
<p>9. Installing the PowerMonitorSoftware PMS on the PC</p> <ul style="list-style-type: none"> • Software is part of the scope of delivery 	<p>Chapter 12 on page 38</p>
<p>10. Perform the measurement</p> <ul style="list-style-type: none"> • Follow the safety instructions • Perform the measurement with the PowerMonitorSoftware PMS 	<p>Chapter 13 on page 41</p>

6 Transport

NOTICE

Damaging/destroying the device

Hard hits or falls may damage the device.

Touching the absorber can lead to burn-in by the laser radiation at the points of contact. Burn-in lead to damage to the absorber and increase the scattered radiation.

- ▶ Do not touch the absorber.
- ▶ Handle the device carefully when transporting it.
- ▶ Only transport the device in the original PRIMES transport box.

NOTICE

Damage/destruction of the device caused by leaking or freezing cooling water

Leaking cooling water can damage the device. Transporting the device at temperatures near or below freezing and without emptying the cooling circuit completely can damage the device.

- ▶ Empty the lines of the cooling circuit completely.
- ▶ Even when the lines of the cooling circuit have been emptied, a small amount of residual water will remain in the device at all times. This may leak out and end up inside the device. Close the connector plug of the cooling circuit with the included sealing plug.

NOTICE

Damaging/Destruction of the flow rate meter

The flow rate meter is not designated for high rotational speed.

- ▶ Do not use compressed air for emptying the cooling circuit.
-

7 Installation

7.1 Preparation

Check the space available before mounting the device, especially the required space for the connection cables and hoses (please see chapter 19 „Dimensions“ on page 52). The device must be firmly assembled and must be mounted with screws (see chapter 7.4 on page 16).

7.2 Installation position

The CPM F-1 is to be operated in a horizontal position. With regard to the other device types, the installation position can be chosen freely. Concerning the versions with a oval wheel meter, please mind the mounting position according to chapter 20.2 on page 59.

7.3 Align the CompactPowerMonitor CPM

The laser beam must hit the center of the entrance aperture not only with a collimated but also with a divergent beam. Please make sure that the beam diameter, the power, and the power density do not exceed the limit values stated in the technical data.

For the correct alignment - especially with regard to divergent radiations behind the focusing optics - the specifications in Fig. 7.1 on page 15 are to be considered.

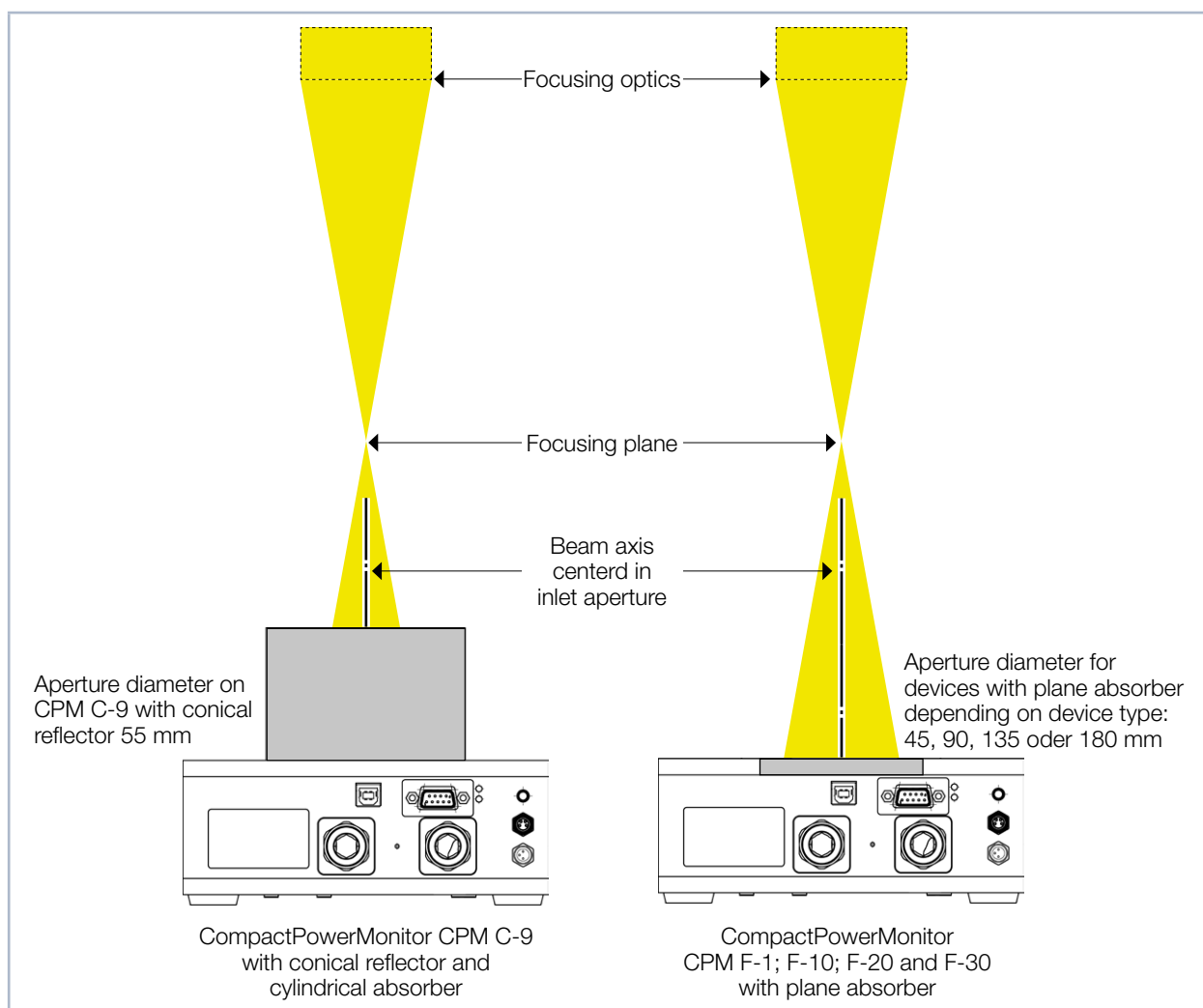


Fig. 7.1: Alignment of the CompactPowerMonitor CPM to the laser beam

7.4 Install the CompactPowerMonitor CPM



DANGER

Serious eye or skin injury due to laser radiation

If the device is moved from its calibrated position, increased scattered or directed reflection of the laser beam occurs during measuring operation (laser class 4).

- ▶ Mount the device so that it cannot be moved by an unintended push or a pull on the cables or hoses.

NOTICE

Damage/Destruction of the device

Too long fixing screws can damage internal components in the device.

- ▶ The fastening screws must not be screwed in more than 8 mm into the housing.

There are fastening screw threads M4 and M6 in the bottom of the housing which are intended for the mounting on a customer's mount. We recommend screws of the strength class 8.8 and a tightening torque of 5 N·m.

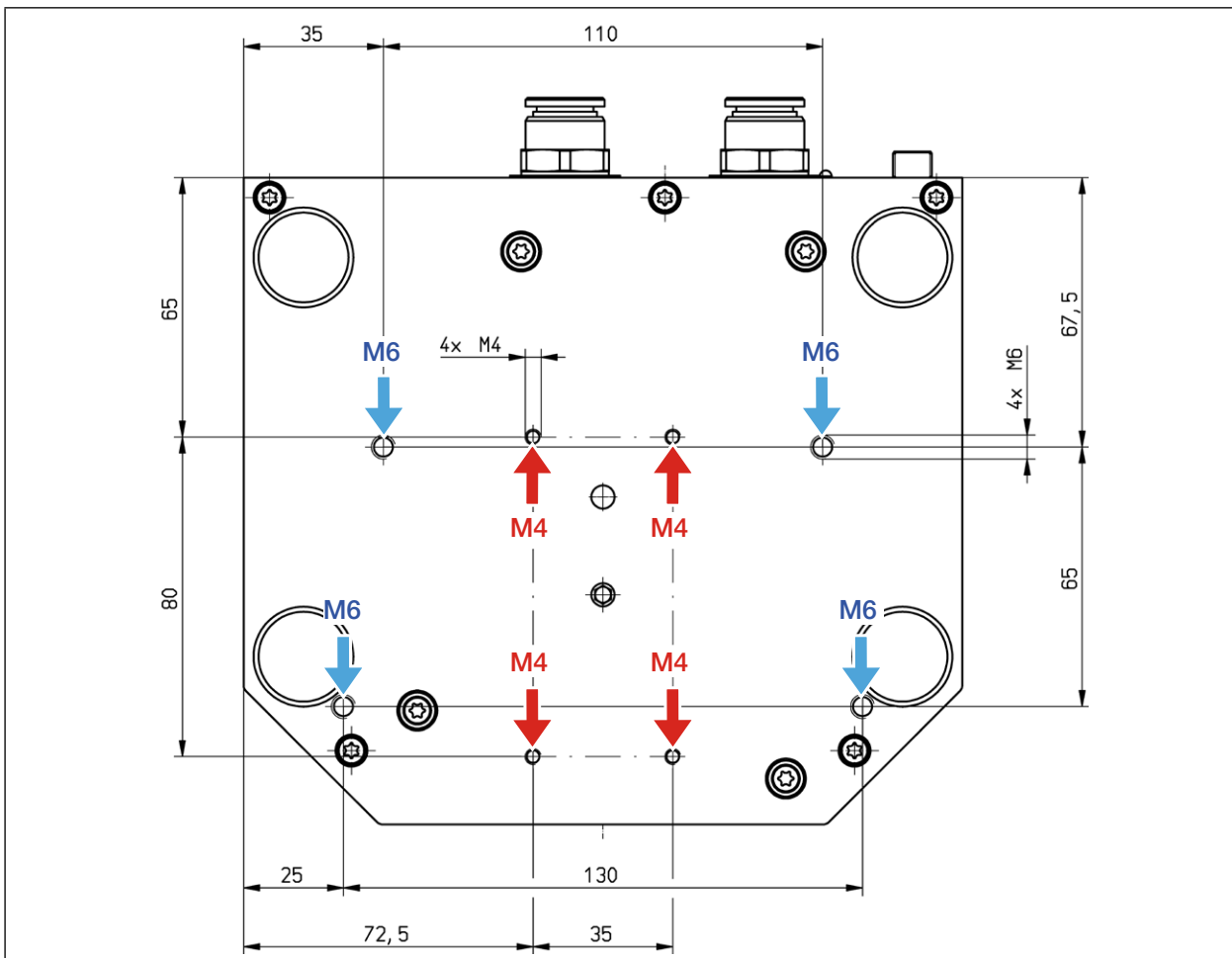


Fig. 7.2: Fastening screw threads in the bottom of the housing of the CPM C-9

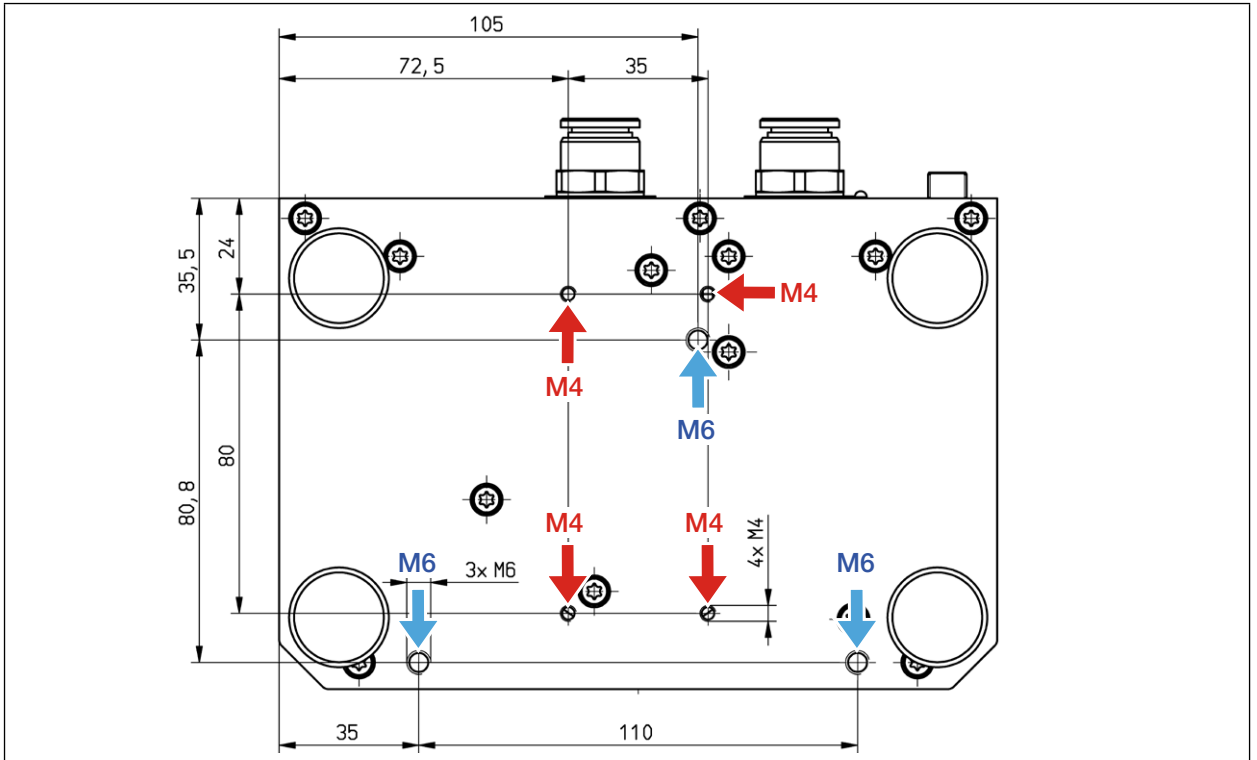


Fig. 7.3: Fastening screw threads in the bottom of the housing of the CPM F-1

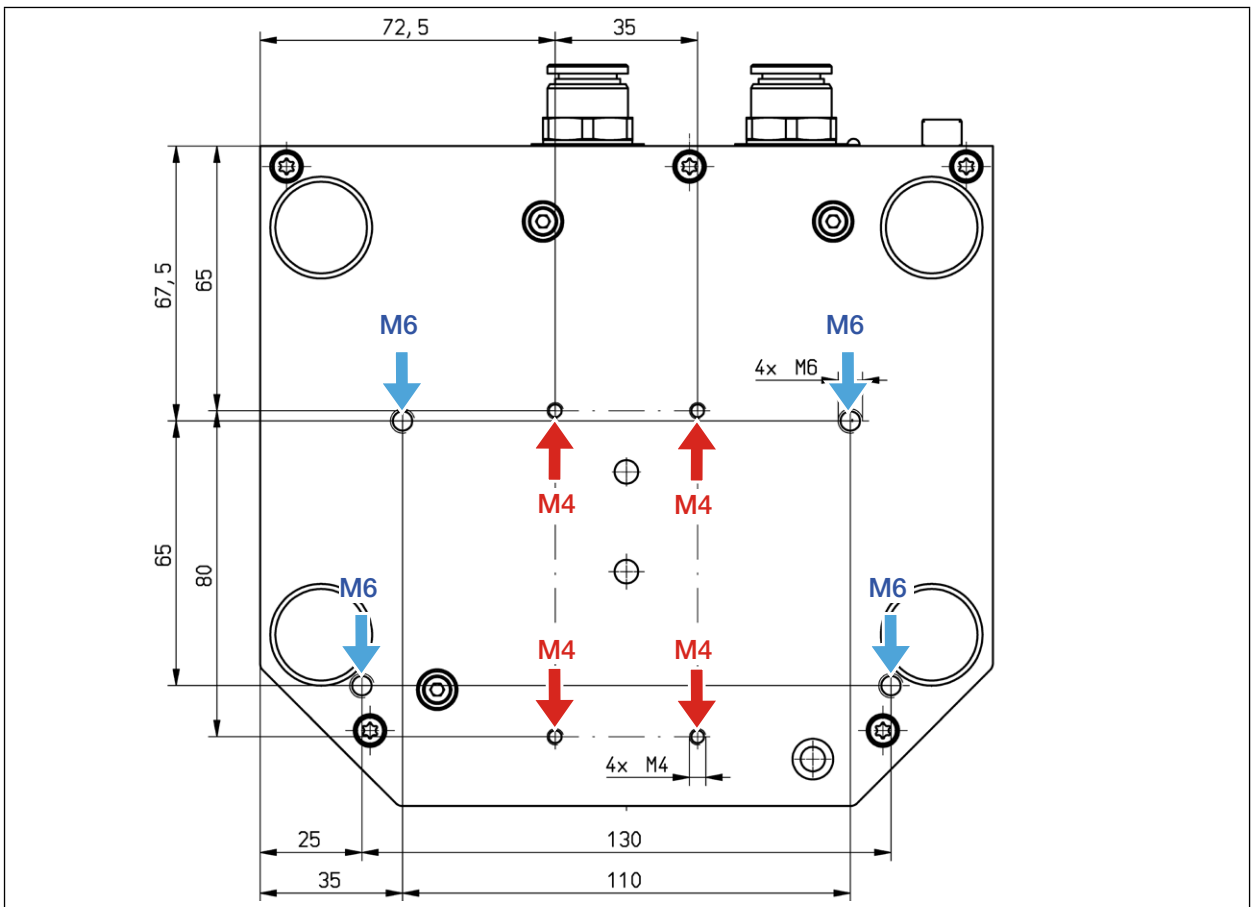


Fig. 7.4: Fastening screw threads in the bottom of the housing of the F-10

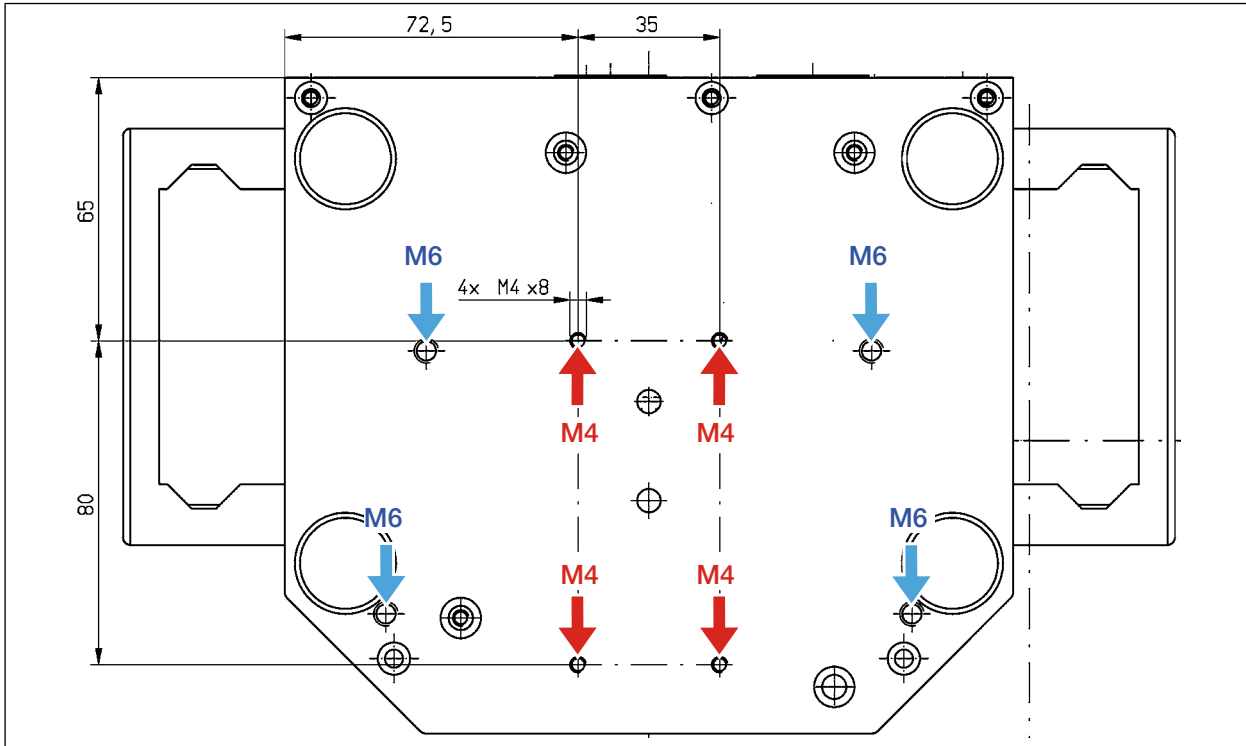


Fig. 7.5: Fastening screw threads in the bottom of the housing of the CPM F-20

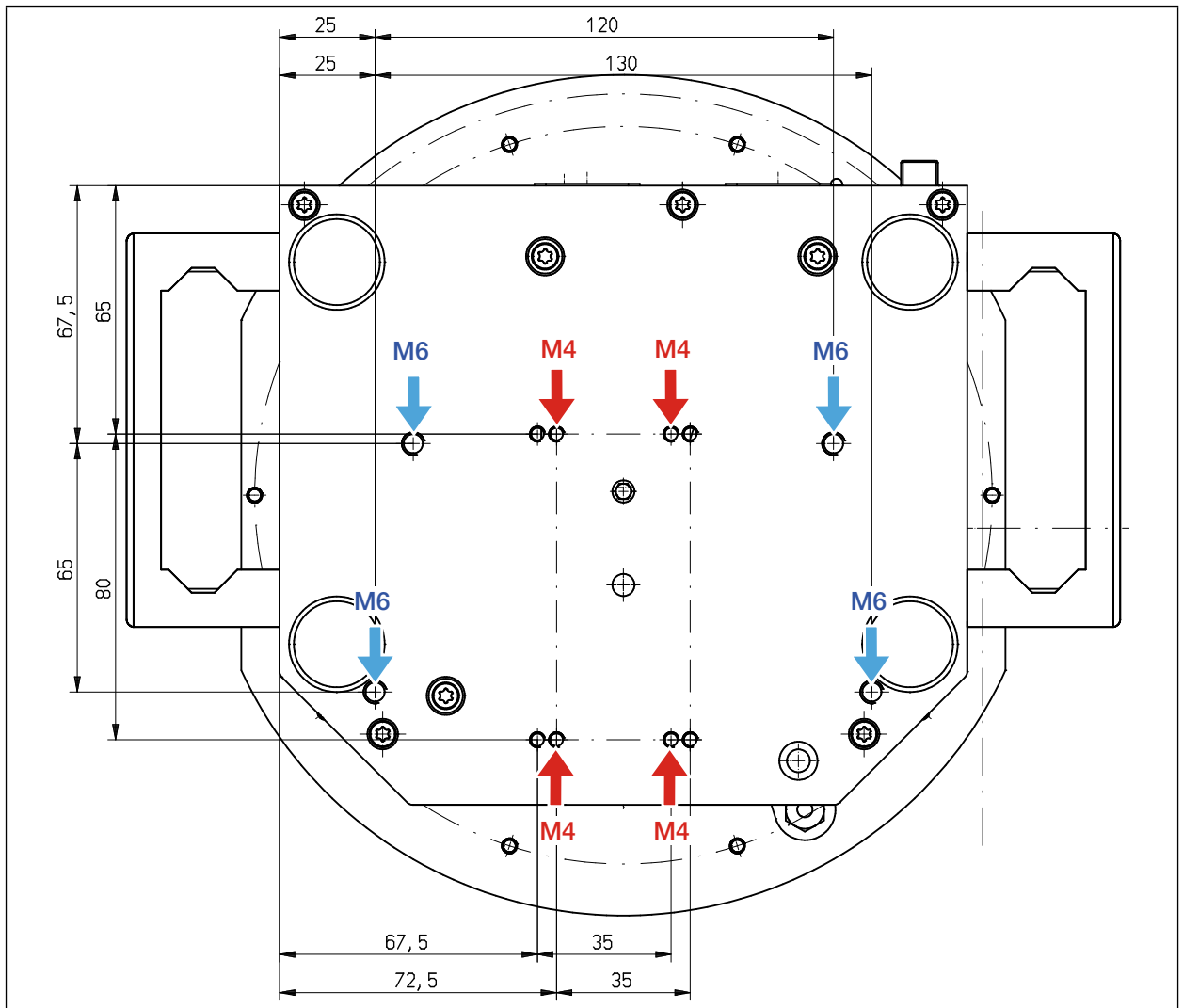


Fig. 7.6: Fastening screw threads in the bottom of the housing of the CPM F-30

7.5 Remove the CompactPowerMonitor CPM

1. First of all turn the the laser source off.
2. Turn off the voltage supply.
3. Ensure that moving parts, e.g. robot arms, etc. are at a standstill and that they cannot be set in motion unintentionally.
4. Switch the cooling circuit off.
5. Remove all connection cables and hoses of the cooling circuit.
6. Remove the device.

NOTICE

Damaging/Destruction of the flow rate meter

The flow rate meter is not designated for high rotational speed.

- ▶ Do not use compressed air for emptying the cooling circuit.

7. Empty the cooling circuit completely and seal the connector plugs by means of the enclosed sealing plugs.

8 Connect cooling circuit



DANGER

Fire hazard; Damage/Destruction of the device due to overheating

If there is no water cooling or a water flow rate which is insufficient, there is a danger of overheating, which can damage the device or set it on fire.

- ▶ Operate the device with a connected water cooling only and a sufficient water flow rate (see chapter 8.5 on page 22).
- ▶ Connect the laser control's safety interlock with the device. The safety interlock is only released if there is a minimum of cooling.

8.1 Water quality

NOTICE

Damage/Destruction of the device due to different chemical potentials

The parts of the device which get in contact with cooling water consist of copper, brass or stainless steel. Connecting the unit to a cooling circuit containing aluminum components may cause corrosion of the aluminum due to the different chemical potentials.

- ▶ Do not connect the device on a cooling circuit in which aluminum components are installed.

- The device can be operated with tap water as well as demineralized water.
- Do not operate the device on a cooling circuit containing additives such as anti-freeze.
- Do not operate the device on a cooling circuit in which aluminum components are installed. Especially when it comes to the operation with high powers and power densities, it may otherwise lead to corrosion in the cooling circuit. In the long term, this reduces the efficiency of the cooling circuit.
- Should the cooling fail, the device can withstand the laser radiation for a few seconds. In this case, please check the device as well as the water connections for damages.
- Large dirt particles or teflon tape may block internal cooling circuits. Therefore, please thoroughly rinse the system before connecting it.



An operation with strongly deionized water (DI-water, conductivity < 30 µS/cm) is only possible with the respective connection parts – we would be glad to advise you as necessary.

8.2 Water pressure

Normally, 2 bar primary pressure according to Tab. 8.1 on page 20 at the entrance of the absorber are sufficient (in case of an unpressurized outflow).

Device type	Primary pressure
CPM C-9, CPM F-1	2 bar
CPM F-10, CPM F-20, CPM F-30	3 bar

Tab. 8.1: Primary pressure

NOTICE

Damage/Destruction of the device due to overpressure

- ▶ The maximum permissible water inlet pressure must not exceed 4 bar.

8.3 Humidity

- The device must not be operated in a condensing atmosphere. The humidity has to be considered in order to prevent condensates within and outside the device.
- The temperature of the cooling water must not be lower than the dew point (see Tab. 8.2 on page 21).

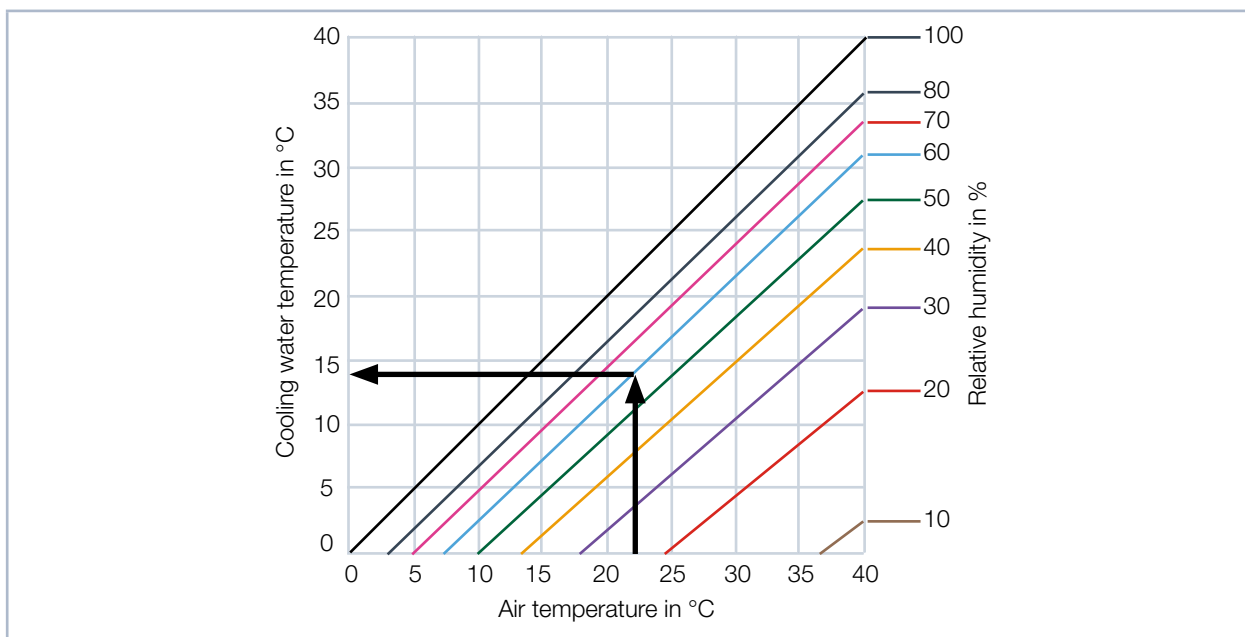
NOTICE

Damage/Destruction of the device due to condensing water

Condensation water inside of the device can lead to damage.

- ▶ Mind the dew-point in Tab. 8.2 on page 21.

Do only cool the device during the measuring operation. We recommend starting the cooling approx. 2 minutes before the measurement and terminating it approx. 1 minute after the measurement.



Tab. 8.2: Dew point Diagram

Example

Air temperature: 22 °C
 Relative humidity: 60 %

The cooling water temperature cannot fall below 14 °C.

8.4 Temperature fluctuations of the inflowing cooling water

It is important that the temperature of the inflowing water remains constant. The fluctuation of temperature should not exceed 1 K per minute or 0.05 K per 5 seconds (a temperature difference of 1 K corresponds to a temperature difference of 1 °C).

8.5 Flow rate

The safety interlock is unblocked at:

Device type	Flow rate in l/min
CPM F-1	0.5
CPM F-10, CPM C-9	4
CPM F-20	8
CPM F-30	15

Tab. 8.3: Minimum flow rate

The highest measurement accuracy is reached at a typical flow rate of:

Device type	Flow rate in l/min
CPM F-1	1.5 – 2
CPM F-10, CPM C-9	8 – 11
CPM F-20	15 – 22
CPM F-30	25 – 30

Tab. 8.4: Recommended flow rate

For the maximum laser power in case of a fixed flow rate the following rule is applicable: Flow rate multiplied by 1.4 = maximum laser power. For 5 l/min this equals about 7 kW. This calculation serves to prevent a possible overload.

Typical flow rates and temperature rises can be found in Tab. 8.5 on page 22.

		Laser power in kW									
		8	7	6	5	4	3	2	1,5	1	0,5
Flow rate in l/min	12	9.55	8.36	7.17	5.97	4.78	3.58	2.39	1.79	1.19	0.60
	11	10.42	9.12	7.82	6.51	5.21	3.91	2.61	1.95	1.30	0.65
	10	11.46	10.03	8.60	7.17	5.73	4.30	2.87	2.15	1.43	0.72
	9	12.74	11.15	9.55	7.96	6.37	4.78	3.18	2.39	1.59	0.80
	8	14.33	12.54	10.75	8.96	7.17	5.37	3.58	2.69	1.79	0.90
	7	16.38	14.33	12.28	10.24	8.19	6.14	4.09	3.07	2.05	1.02
	6	19.11	16.72	14.33	11.94	9.55	7.17	4.78	3.58	2.39	1.19
	5	22.93	20.06	17.20	14.33	11.46	8.60	5.73	4.30	2.87	1.43
		Temperature rise in °C									

Tab. 8.5: Flow rates / temperature rise / beam power - a linear extrapolation up to 30 kW is possible

The red marked fields are calculated with flow rates below 1 l/kW and are not recommended.

8.6 Connect hoses

The flow direction (Water In/Water Out) indicated on the device has to be strictly observed. If the flow direction is swapped, the algebraic sign of the measured power is reversed.

Please refer to Tab. 8.6 on page 23 for the hose outer diameters of the plug connectors:

Device type	Hose outer diameter
CPM F-1	12 mm
CPM F-10, CPM C-9	12 mm
CPM F-20	12 mm
CPM F-30	16 mm

Tab. 8.6: Hose outer diameter of the plug connectors

The plug connectors are sealed with sealing plugs in order to ensure that no residual water can escape. Please remove the the sealing plugs and keep for future transportations or shipping.

Remove the sealing plugs of the water connections

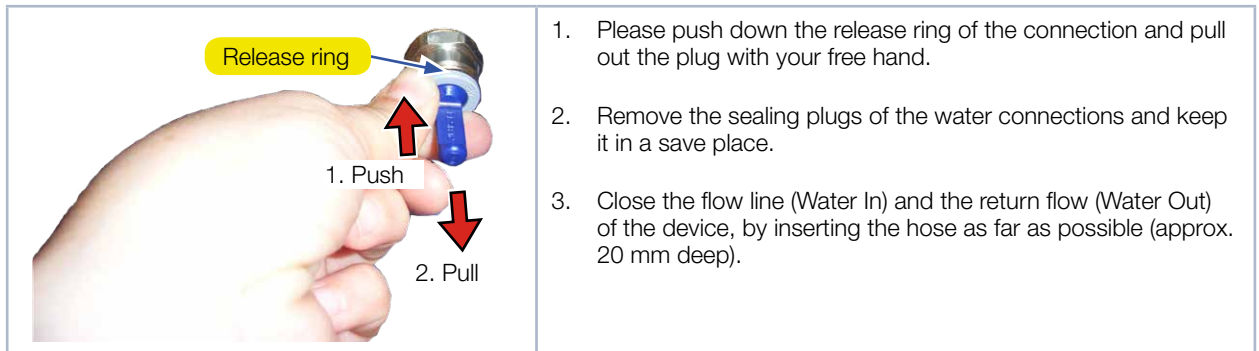


Fig. 8.1: Remove the sealing plugs of the water connections

9 Electrical connection

9.1 Power supply

The CompactPowerMonitor CPM requires a supply voltage of 24 V ± 5 % (DC) for the operation. A suitable power supply with an adapter is included in the scope of delivery.

Please use only the provided PRIMES power supply and connection lines.

When the CompactPowerMonitor CPM is connected via the USB interface, the power is supplied by the PC through the USB interface. If other devices are connected to the PC that also consume power, it may be necessary to use a separate power supply.

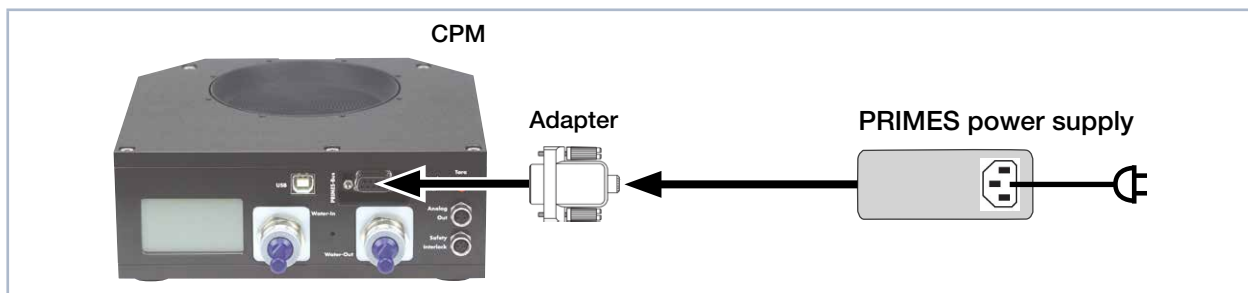


Fig. 9.1: Connect power supply using the example of the CPM F-10

Connect the power supply unit via the adapter to the 9 pin D-Sub socket (RS485) of the CompactPowerMonitor CPM.

9.2 PRIMES bus

The device is supplied with power by means of the 9 pin D-Sub socket. Using an optional PRIMES converter or a PRIMES power supply with integrated converter, the socket can also be used to connect a PC to enable communication (see chapter 9.5 on page 28).

D-Sub socket, 9 pin (top view, plug-in side)	Pin	Function
	1	Ground
	2	RS485 (+)
	3	+24 V
	4	Not assigned
	5	Not assigned
	6	Ground
	7	RS485 (-)
	8	+24 V
	9	Not assigned

Tab. 9.1: Pin assignment PRIMES bus

9.3 Connect the safety interlock

The device can be damaged when the water flow rate is too low, the inlet temperature T_{in} too high, or the temperature difference T_D too great. The safety interlock protects the device from damages by turning off the laser in this case.

If the water flow rate is too low, the inlet temperature T_{in} is too high, or the temperature difference T_D is too great, then Pin 1 and Pin 4 are connected. Pin 1 and Pin 3 are connected when required by the operating condition values.

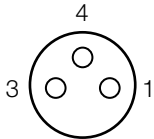
NOTICE

Damaging/Destruction of the device

If the safety interlock is not connected, this may lead to damages to the device due to overheating.

- ▶ **Make sure to connect the safety interlock of the laser control in a way that ensures that the laser is turned off whenever this connection is interrupted.**

A suitable connection cable with a device plug and free ends is included in the scope of delivery

Pin assignment socket (top view, plug-in side)	Pin	Wire color	Function
	1	Brown	Mutual pin
	3	Blue	Connected with Pin 1 when ready for operation
	4	Black	Connected with Pin 1 when in safety interlock mode (water flow rate too low)

Tab. 9.2: Pin assignment safety interlock

9.4 Connecting the PC via the USB interface

9.4.1 Scope of delivery

For the communication with the PC via USB the following is required:



Fig. 9.2: Scope of delivery

9.4.2 Connect PC



If the PRIMES USB connecting cable and PRIMES power supply are connected simultaneously during initial installation, the USB driver may not be recognized in exceptional cases. During initial installation, only connect the device via the USB connecting cable. Once the USB connection has been established, the power supply can be connected as necessary.

1. Connect the device to the PC via the PRIMES USB connection cable (plug/plug):
 - For a PC with an Internet connection, the USB driver is automatically installed.
 - For a PC without an Internet connection, the USB driver must be installed manually (see chapter 9.4.3 on page 27). The USB driver has to be installed before the device is connected.
2. If necessary, connect the power supply unit via the adapter to the 9 pin D-Sub socket (RS485) of the device.

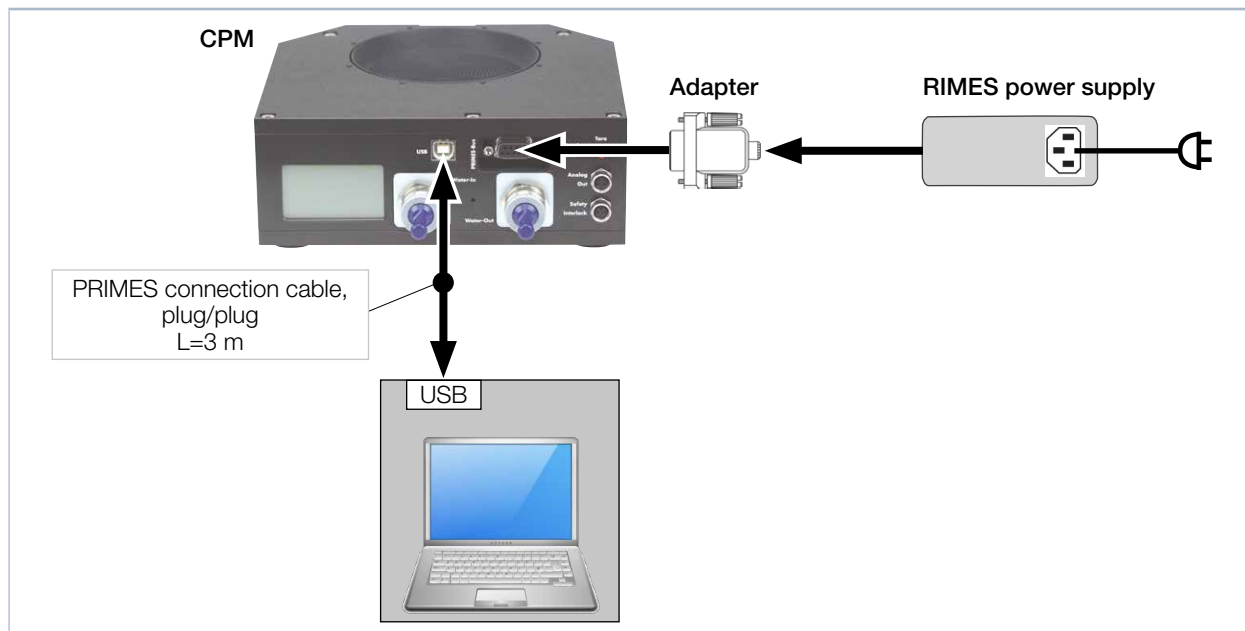


Fig. 9.3: Connection of the PC via USB using the example of the CPM F-10



In general, a USB interface without additional interference suppression measures is not in conformity with the EMC directive. In industrial environments with strong sources of interference, there could therefore be disruptions in the connection and disruptions in data transmission.

9.4.3 Install the USB driver manually

The PRIMES USB driver for all USB-capable devices can be found on the enclosed PRIMES data medium or on the PRIMES website at: <https://www.primes.de/en/support/downloads/software.html>

The USB driver can be installed for 32 bit and 64 bit Windows® operating systems by means of the PRIMES data medium included in the scope of delivery. Administrator rights are necessary in order to install the USB driver.

- Driver installation software ***dpinst_x64.exe*** for Windows® 7/8/10 (64 bit)
 - Driver installation software ***dpinst_x86.exe*** for Windows® 7 (32 bit)
1. Connect the supplied PRIMES data medium to your PC.
 2. Open the ***USBdriver*** folder.
 3. Start the desired USB driver installation software (32- or 64 bit) by double-clicking.
 4. Follow the instructions on the screen.

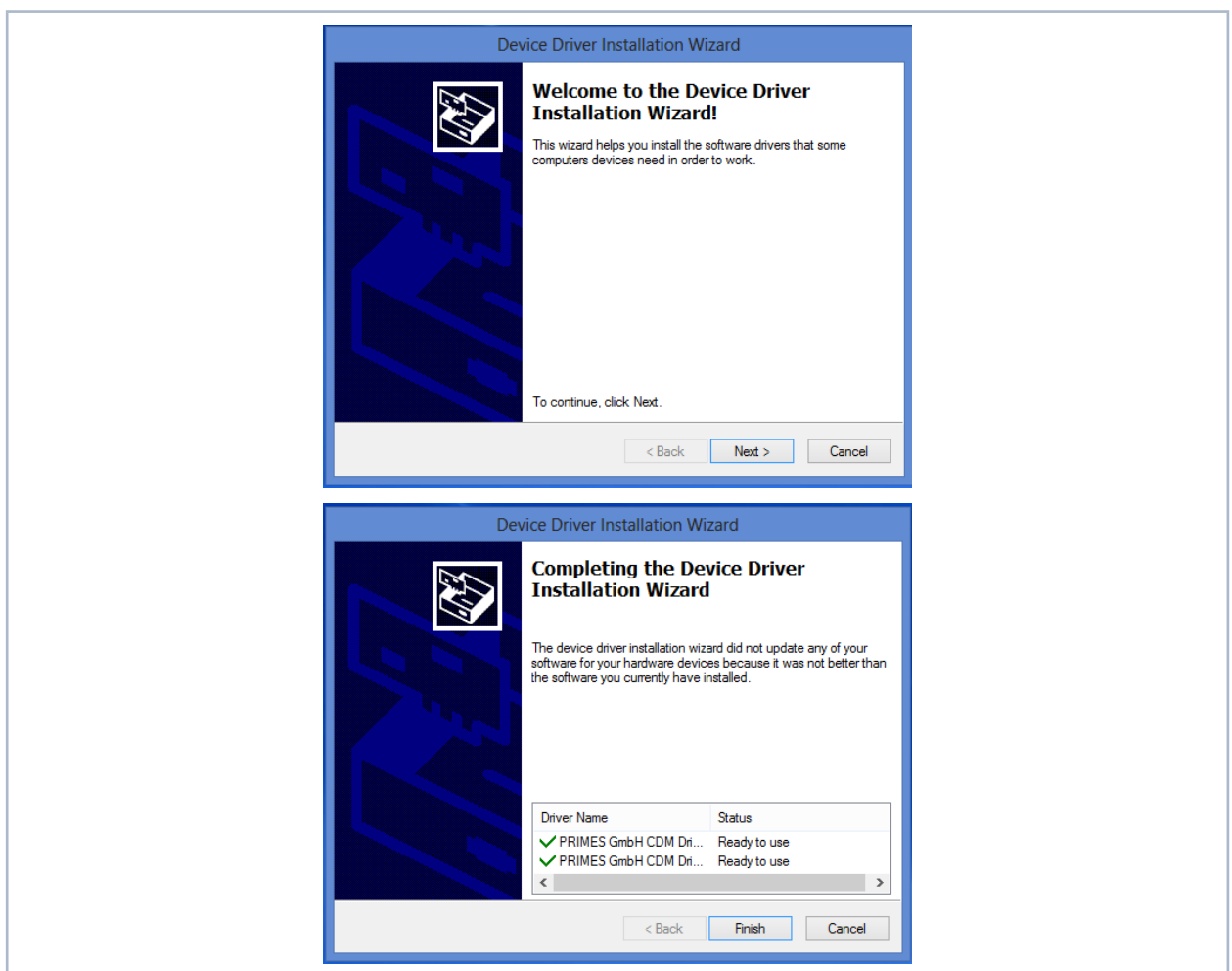


Fig. 9.4: Windows® menu for USB driver installation

5. Click ***Finish*** in order to complete the installation.
6. Connect the CompactPowerMonitor CPM according to chapter 9.4.2 on page 26.

9.5 Connecting the PC via RS232 interface and optional PRIMES converter

When there is no free D-sub socket on the PC, the device can be connected to the PC with the optional PRIMES USB converter and the PRIMES connecting cable (socket/socket).

9.5.1 Scope of delivery

For the communication with the PC via RS232 interface, you require:



Fig. 9.5: Scope of delivery

9.5.2 Connect PC

NOTICE

Damaging/Destruction of the device

Connecting or disconnecting the bus cable when it is connected with the supply voltage leads to voltage peaks, which may damage communication modules of the measuring device.

- ▶ Only establish connections when the power supply unit is turned off. Do not disconnect any plugs as soon as the supply voltage is switched on.

NOTICE

Damaging/Destruction of the PC

The supply voltage of 24 V is ensured by means of the RS485-based PRIMES bus. If the measuring device is directly connected with the PC, the PC may be damaged.

- ▶ Only connect your PC with the measuring system via a PRIMES RS485/RS232 interface converter.

1. Connect the device with the PRIMES converter via the PRIMES connector cable (plug/plug).
2. Connect the PC with the PRIMES converter via the PRIMES connector cable (socket/socket).
3. Connect the power supply unit via the adapter to the 9 pin D-Sub socket (RS485) of the PRIMES converter.

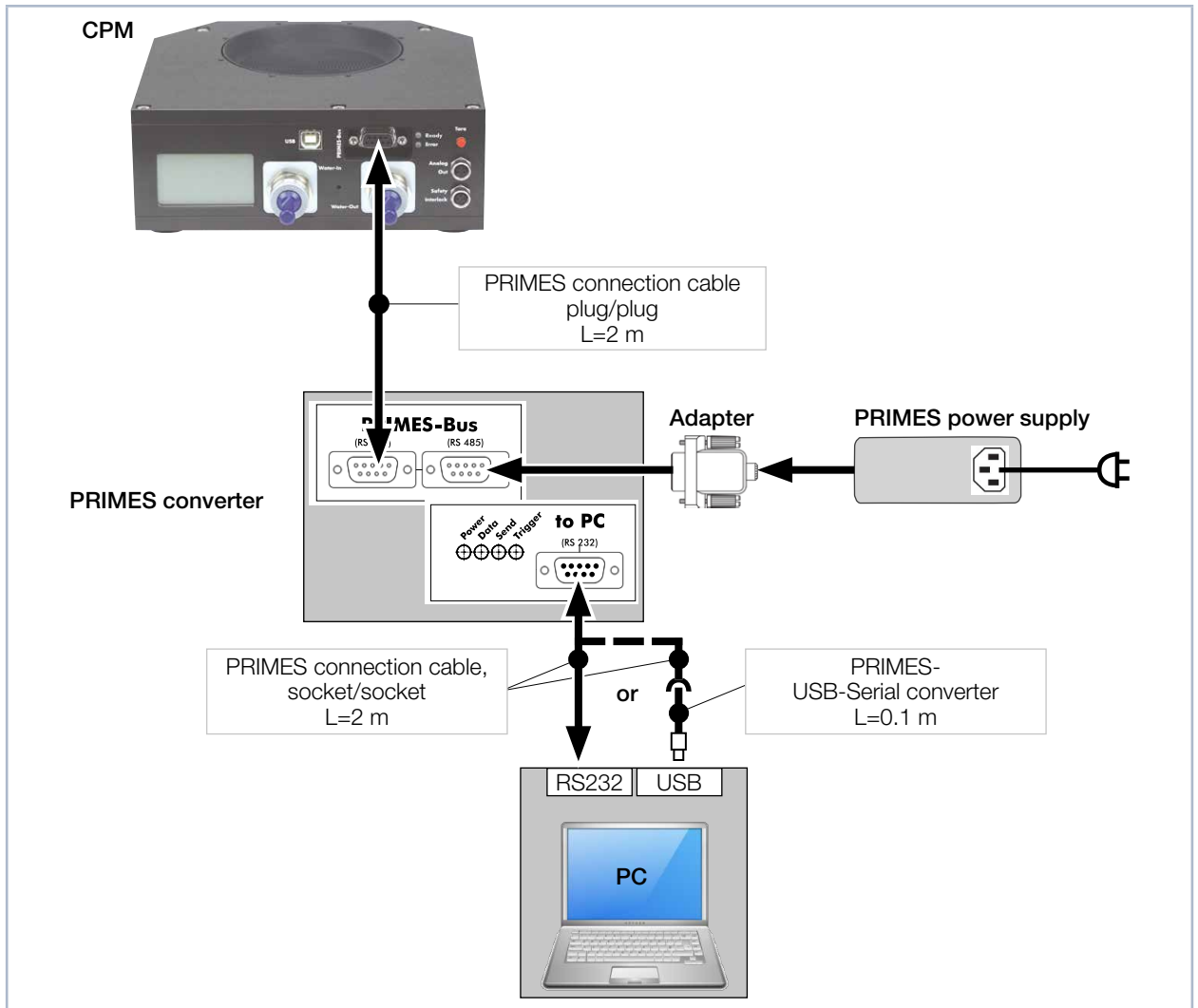


Fig. 9.6: Connection to the PC via RS232 and PRIMES converter using the example of the CPM F-10

9.6 Parallel operation of the CompactPowerMonitor PMC and, for example, the FocusMonitor FM+

A measuring device, such as the FocusMonitor FM+, can be connected with the CompactPowerMonitor CPM via the RS485 interfaces (PRIMES bus). The signal of the CompactPowerMonitor CPM is transmitted to the PC through the ethernet interface of the FocusMonitor FM+.

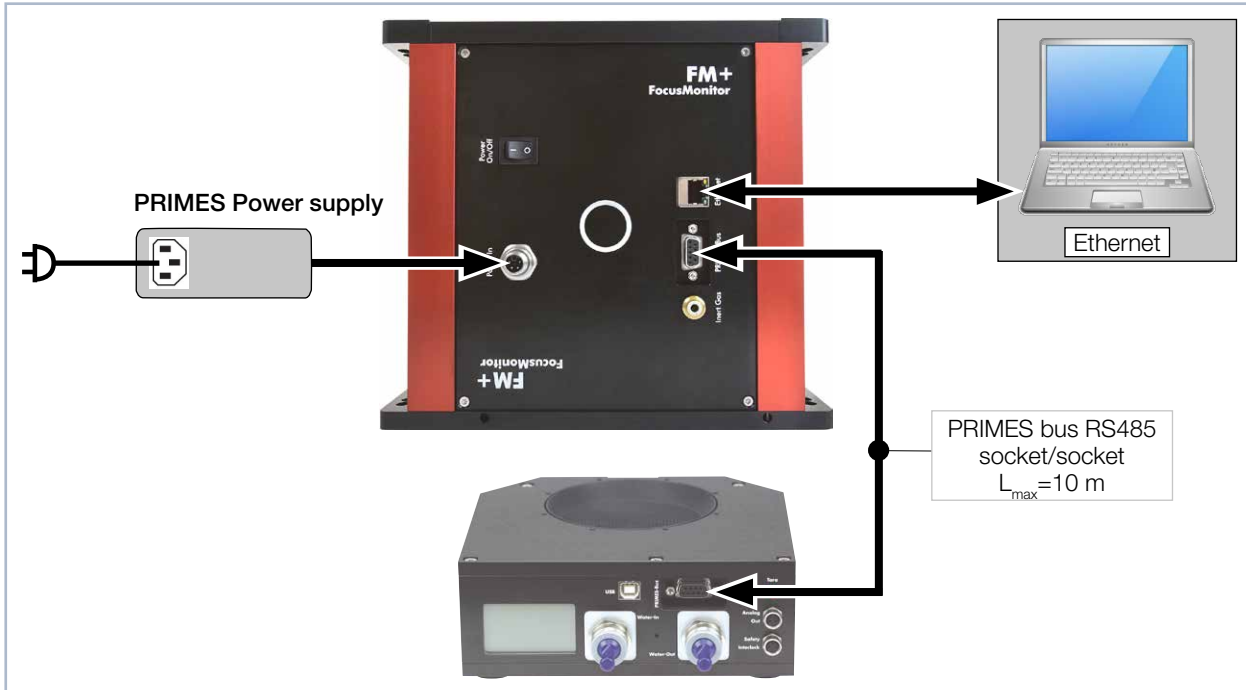


Fig. 9.7: Connection of the FocusMonitor FM + with the CompactPowerMonitor using the example of the CPM F-10

NOTICE

Damage/Destruction of the device due to overvoltage

When disconnecting the electric cables during operation (when the supply voltage is connected), voltage peaks can be generated that could destroy the communication modules of the measuring devices.

- ▶ Turn off the power supply before disconnecting the bus cables.

9.7 Analog output

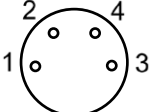
The CompactPowerMonitor CPM has an analog voltage output (analog output) that emits a voltage value analogous to the measured laser power. The analog signal is effected via the 4-pin device socket M8 (see Fig. 5.1 on page 12). The output voltage amounts to a maximum of 10 V. The output voltage of 10 V is scaled to the maximum output value of the connected device (see Tab. 9.3 on page 31). A suitable connection cable is included in the scope of delivery.

The load resistance at the analog output should not be smaller than 100 kOhm.

	CPM C-9	CPM F-1	CPM F-10	CPM F-20	CPM F-30
An output voltage of 1 V equals approx.	1 000 W	250 W	1 000 W	2 500 W	4 000 W

Tab. 9.3: Output voltage and laser power

When power is supplied through the USB port, it is not necessary to hook up 24 V through Pin 1 and Pin 2.

Pin assignment socket (top view, plug-in side)	Pin	Wire color	Function
	1	Brown	24 V (input power supply)
	2	White	Ground for the power supply
	3	Blue	Ground for the analog signal
	4	Black	Analog signal 0 – 10 V (output)


Tab. 9.4: Socket assignment of the analog output

10 Display, control elements and audible signals

10.1 Measured value display

The display on the connector side of the device shows the following measurement values:

Display	Meaning
W	Laser power in W
Flow	Water flow rate in l/min
Te	Water temperature at the entrance in °C
Td	Temperature difference between water input and output in Kelvin (a temperature difference of 1 K corresponds to a temperature difference of 1 °C).



Tab. 10.1: Meaning of the measured display

10.2 Status display

The status displays indicate different states of the CompactPower Monitor CPM.

LED	Color	Meaning
Ready	Green	Voltage supply is turned on.
Error	Red	Possible errors: Safety interlock has triggered: The water flow rate is too low, the inlet temperature T_n is too high, or the temperature difference T_D is too great.

Tab. 10.2: Meaning of the status display



Fig. 10.1: Display

After the connection of all cables you can turn on the power supply. The green status display (Ready) on the front of the CompactPowerMonitor CPM lights up. In case of an error, the red status display (Error) lights up.

10.3 External display (Option)

The external display (PanelDisplay, Order-No. 130-005-003) allows the measured power to be displayed without PC at a maximum distance of approx. 20 m from the measuring position (see chapter 20.1 on page 57).

10.4 Control Elements

By means of the Tara button, the measurement values can be reset to zero. We recommend the following procedure before every measurement:

1. Turn on the cooling and wait for approx. 2 minutes.
2. Push the Tara button.
3. Start the measurement according to chapter 11 on page 34 or chapter 13 on page 41.



Fig. 10.2: Tara button

10.5 Audible signals

When the temperature of the absorber exceeds 60 °C, the warning signal will sound:

1. Turn off the laser immediately.

If water leaks out of the device after the warning signal has sounded, the device may be damaged by overheating and cease to be operable. The overpressure caused in the standing cooling water can also cause leaks in the hoses and connectors.

2. Check the device for leaks.
 - In the case a leak is identified, please send the device to PRIMES for inspection.

If no leaks are identified:

3. Check the absorber for possible damage.
4. Check the flow rate and proper flow rate in accordance with Chapter 8.5 on page 22.
5. Perform a function test:
 - Check that the safety interlock will turn off the laser properly in case of error.
 - If the device stops working properly, please send the device to PRIMES for inspection.

11 Measuring with the optional LaserDiagnosticsSoftware LDS

11.1 Safety instructions



DANGER

Serious eye or skin injury due to laser radiation

During the measurement the laser beam is guided on the device, which causes scattered or directed reflection of the laser beam (laser class 4).

For example, with 10 kW of laser power, some 100 W of scattered radiation can occur.

The CompactPowerMonitor CPM must not be operated in any of the available configurations without taking the following precautions.

- ▶ Please wear safety goggles adapted to the power, power density, laser wave length and operating mode of the laser beam source in use.
- ▶ Wear suitable protective clothing and protective gloves.
- ▶ Protect yourself from laser radiation by separating protective devices (e.g. by using appropriate shielding).



DANGER

Serious eye or skin injury due to laser radiation

If the device is moved from its calibrated position, increased scattered or directed reflection of the laser beam occurs during measuring operation (laser class 4).

- ▶ When mounting the device, please ensure that it cannot be moved, neither due to an unintended push or a pull on the cables or hoses.



DANGER

Fire hazard; Damage/Destruction of the device due to overheating

If the safety interlock is not connected, the unit may overheat and be damaged or catch fire if there is no water or too low flow.

- ▶ Connect the laser control's safety interlock to the device. Check that the safety interlock will switch off the laser properly in case of error.



WARNUNG

Burn hazard; Damage of the absorber – Do not touch

Touching the hot absorber can cause severe burns.

Touching the absorber can lead to burn-in by the laser radiation at the points of contact. Burn-in lead to damage to the absorber and increase the scattered radiation.

- ▶ Do not touch the absorber.

11.2 Getting ready for operation

1. Connect the laser control's safety interlock to the device.
 - Check that the safety interlock will switch off the laser properly in case of error.
2. Turn on the voltage supply.
 - The green status display (Ready) must light up.
3. Please wait, until the measured value display is illuminated.
4. Turn on the water cooling.
 - After a few seconds the red status display (Error) must extinguish.
5. After approx. 2 minutes, the device temperature equals the temperature of the cooling water.
 - The CompactPowerMonitor CPM is now ready for operation.

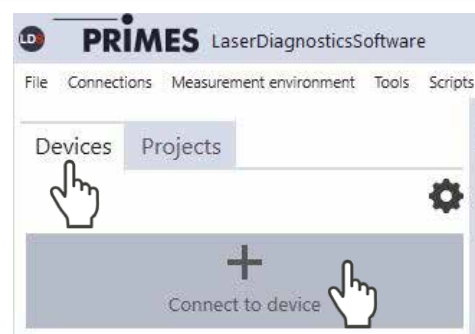
11.3 Perform power measurement

For the purpose of getting to know the CompactPowerMonitor CPM, this chapter describes a power measurement with the LaserDiagnosticsSoftware LDS as an example.

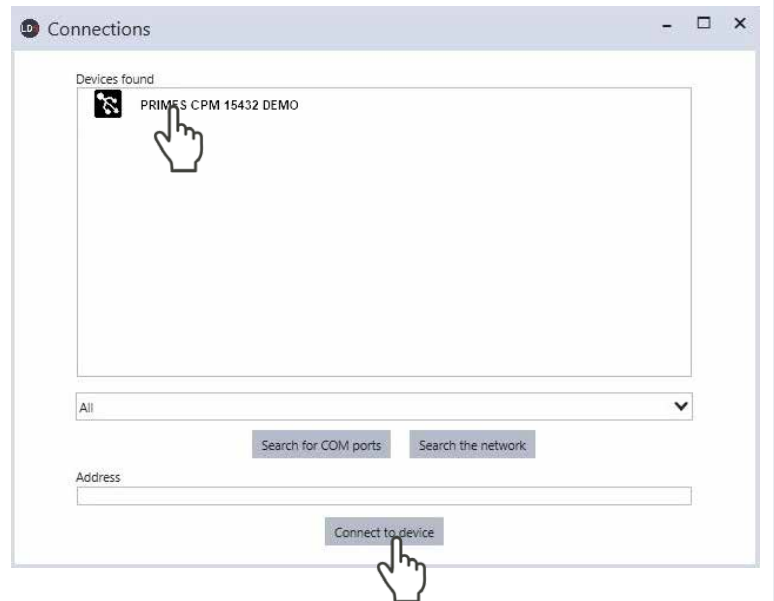
For a detailed description of the software installation, file management and evaluation of the measured data, please refer to the separate operating manual LaserDiagnosticsSoftware LDS.

11.3.1 Connect the CompactPowerMonitor CPM with the LaserDiagnosticsSoftware LDS

1. Start the LaserDiagnosticsSoftware LDS.
2. Click on the **Devices** tab.
3. Click on the **+ Connect to device** button under the tab.



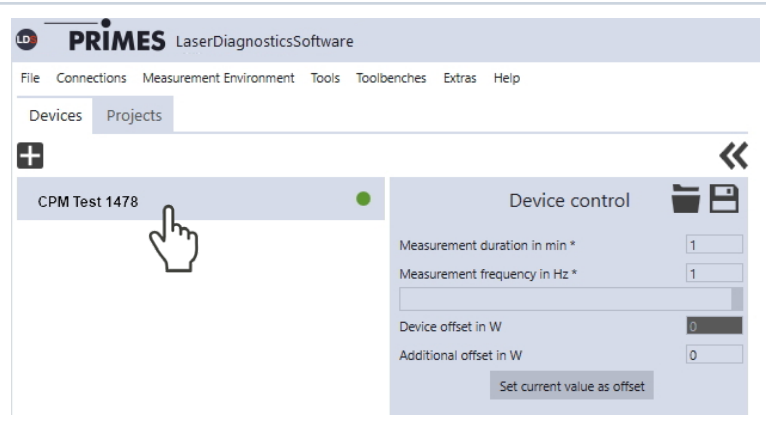
4. The **Connections** window appears.
4. Click on the desired device.
5. Click on the **Connect to device** button.



11.3.2 Choose power measurement mode

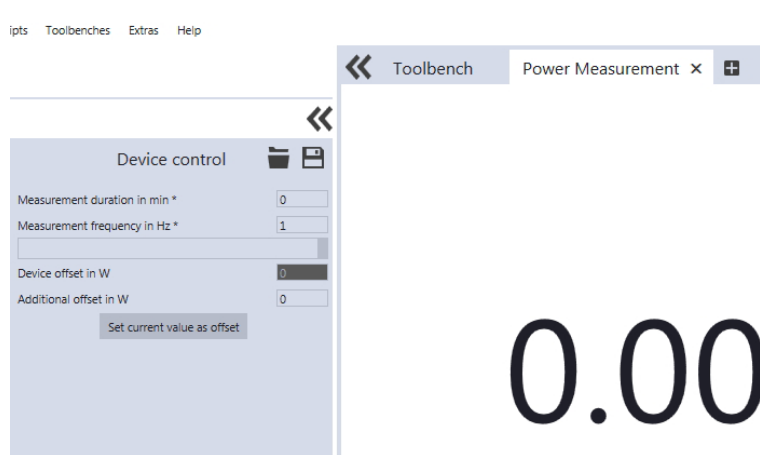
👁 The CompactPowerMonitor CPM is displayed as a connected device.

1. Click on the connected device.



👁 The corresponding **Device control** opens.

👁 The **Power Measurement** toolbench opens.

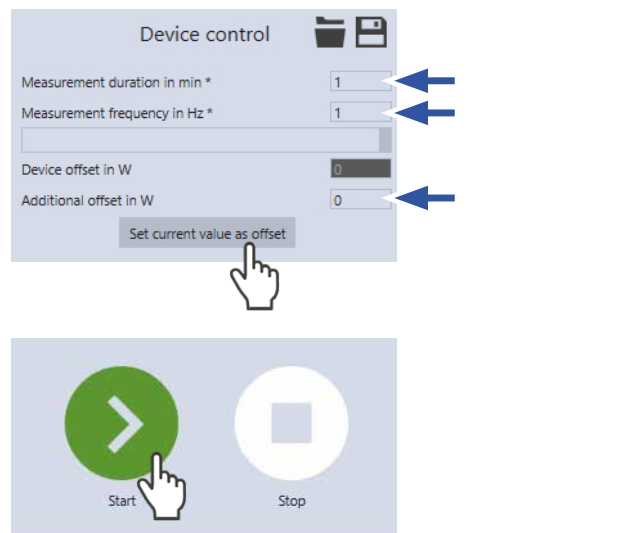


11.3.3 Configure settings (**Device control**)

1. Start and end a measurement as described in chapter 11.3.4 on page 37.

Before the device offset can be determined, the device must go through a thermalization period.

2. After a measurement has ended and without the laser turned on, press the **Start** button.
3. After the display in the **Power Measurement** tool stabilizes, click on the **Stop** button.
4. Click on the **Set current value as offset** button.
 - The value will show up in the **Additional Offset in W** entry window.
 - The device offset can also be entered manually with the tara key on the device (see chapter 10.4 on page 33).
5. Enter the **measurement duration in min.**
 - If a measurement duration is not entered, the power will be measured indefinitely.
6. Enter the **Measurement frequency in Hz.**



11.3.4 Starting a power measurement

1. Follow the safety instructions in chapter 11.1 on page 34.
2. Turn on the laser.
3. Click on the **Start** button.

👁 The progress of the measurement is displayed.

When a measuring period is entered in the **Device control > Measurement duration in min.** entry window, the measurement is terminated automatically.

4. Click on the **Stop** button.
 - The measurement is completed.
5. Turn off the laser.



Status



11.3.5 Measurement results display

👁 The measurement results are shown in the opened tool **Power Measurement** after the measurement is completed (see below).


A detailed description of the tools and the assessment of the measuring results can be found in the separate operating manual for the LaserDiagnosticsSoftware LDS.



12 Install the PowerMonitorSoftware PMS

For the operation of the CompactPowerMonitor CPM with a PC, the PowerMonitorSoftware PMS has to be installed. The installation is started by double-clicking the file “PMS v.2.xx Setup” and following the instructions on the screen.

12.1 Start software and select operating mode

Start the PowerMonitorSoftware PMS by double-clicking the PowerMonitorSoftware PMS-Icon .

12.1.1 For connection via the RS232 and PRIMES converter

See „Fig. 9.6: Connection to the PC via RS232 and PRIMES converter using the example of the CPM F-10“ on page 29.

After the start-up the software tries to establish a connection with the serial interface “COM2”. If the serial interface “COM1” is the only one available, as it is the case with most notebooks, you have to select it explicitly in **Com port** in the menu **Communication > Free Communication**.

When using the USB serial converter, please choose the operating mode **USB2Serial**.

12.1.2 For connection via the USB interface

See „Fig. 9.3: Connection of the PC via USB using the example of the CPM F-10“ on page 26.

If the device was connected via USB, the operating mode **USB** has to be selected in the menu **Communication > Free Communication**. Then press the **Scan** button.

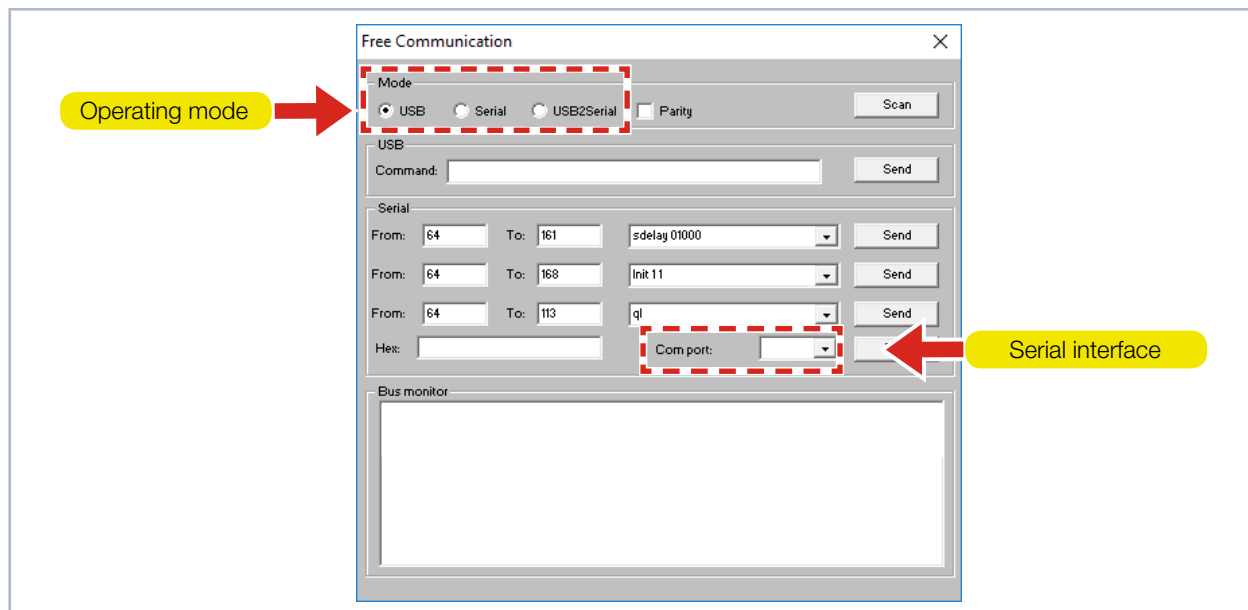


Fig. 12.1: Menü **Free Communication**

12.2 Testing the Interface

After connecting the devices, the communication between the PC and the measuring system can be checked. This is what the menu **Communication > Free Communication** is there for. First of all, the interface is checked by starting the software on the PC.

Possible error message

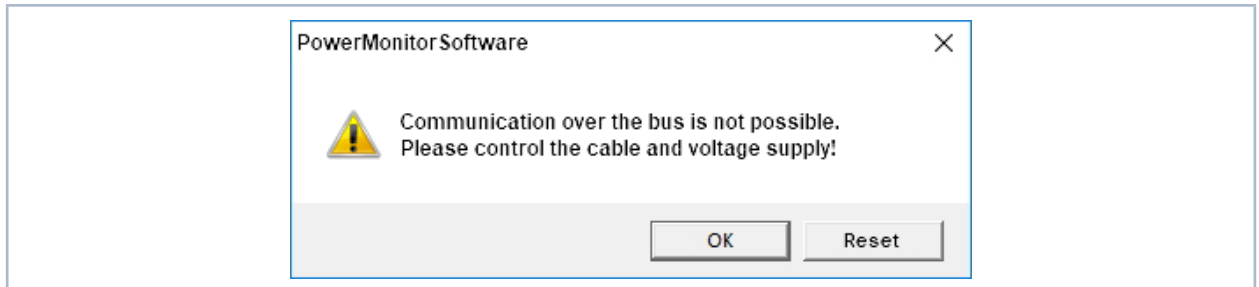


Fig. 12.2: Possible error message

Reason

- The communication via the bus system is not possible.

Remedy

1. Check the cabling of the devices.
2. Ensure that the voltage supply is connected and turned on (the communication is only possible if the bus is supplied with 24 V direct current voltage).
3. Turn off the voltage supply and turn it on again.

Possible error message (only when operated with the PRIMES converter)

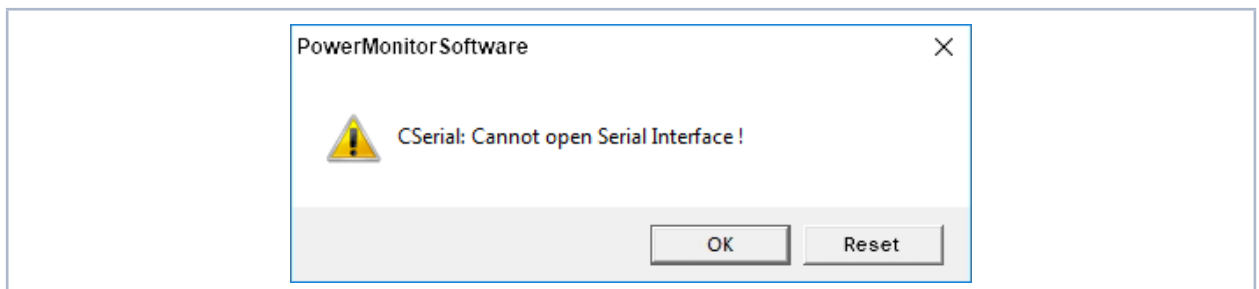


Fig. 12.3: Possible error message

Reason

- The software can not open the preset interface.

Remedy

1. Check whether another software, e.g. a fax software or a parallel running LaserDiagnosticsSoftware LDS, is just using the interface. A serial port can only be used by one software at a time.
2. Check whether the software opens the right port. After starting the software, the interface used can be changed in the menu **Free Communication**. Here, all interfaces available for the software are displayed (drop-down list **Com port**).

12.3 Testing the communication of multiple devices

The communication is checked via the PC by means of the PowerMonitorSoftware PMS. For this purpose, a certain command is sent to each device. If a device replies as stated in Tab. 12.1 on page 40 the communication works without any problems.

Start the PowerMonitorSoftware PMS. Select **Communication > Free communication**. In the appearing window the address of the sender (PC) has to be entered in the field **FROM**, the address of the recipient has to be entered in the field **TO** (PRIMES device) and the command is entered in the text field on the right. The command is confirmed by clicking the button **Send**. The reply of the device appears below in the bus monitor.

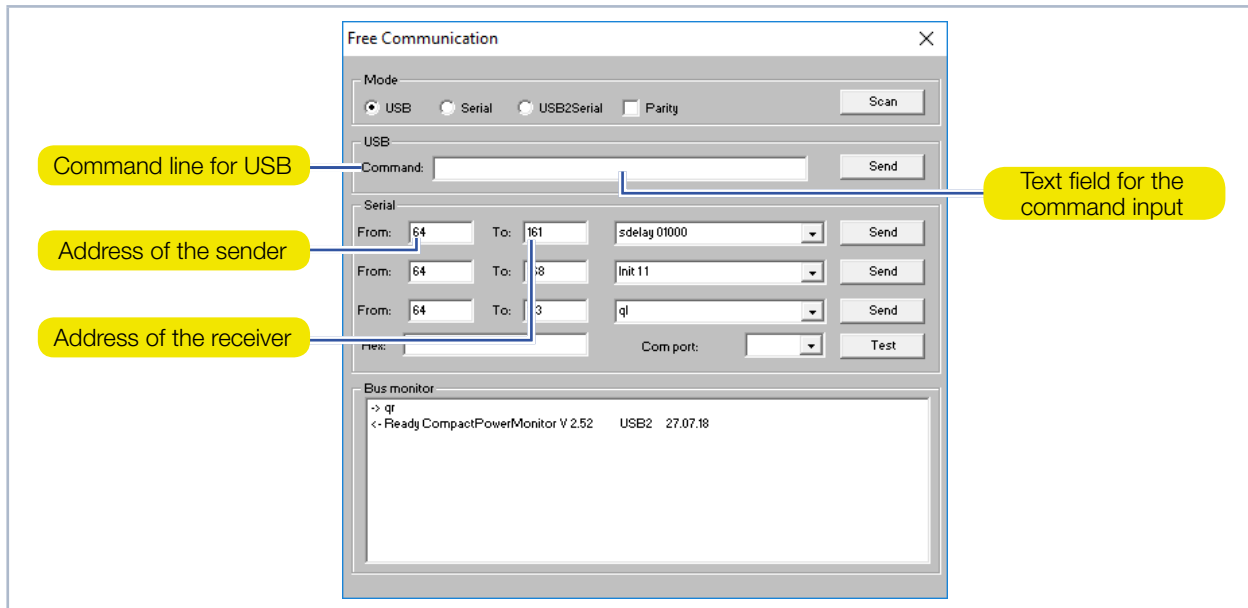


Fig. 12.4: Menu **Free Communication**

Device	FROM (PC)	TO (Device)	Command	Reply
FocusMonitor	64	161	qr	aID FocusMonitor
BeamMonitor	64	144	qr	aID BeamMonitor
CompactPowerMonitor CPM	64	113 (112)	qr	ready Power Monitor

Tab. 12.1: Table for the function control

The command for a query request is **qr** (query request).

If no reply is received from a device:

1. Turn off the voltage supply and turn it on again. Send the command again.
2. Check the cabling of the device. Are all the plugs connected?
3. A device blocks the PRIMES bus. Turn off the voltage supply and take the faulty device off the bus. Put the the system back into operation.
4. The PC blocks the PRIMES bus. This is indicated by the red LED "Send" at the interface converter which glows permanently. Start the PC again.

13 Measuring with the PowerMonitor Software PMS

13.1 Safety instructions



DANGER

Serious eye or skin injury due to laser radiation

During the measurement the laser beam is guided on the device, which causes scattered or directed reflection of the laser beam (laser class 4).

For example, with 10 kW of laser power, some 100 W of scattered radiation can occur.

The CompactPowerMonitor CPM must not be operated in any of the available configurations without taking the following precautions.

- ▶ Please wear safety goggles adapted to the power, power density, laser wave length and operating mode of the laser beam source in use.
- ▶ Wear suitable protective clothing and protective gloves.
- ▶ Protect yourself from laser radiation by separating protective devices (e.g. by using appropriate shielding).



DANGER

Serious eye or skin injury due to laser radiation

If the device is moved from its calibrated position, increased scattered or directed reflection of the laser beam occurs during measuring operation (laser class 4).

- ▶ When mounting the device, please ensure that it cannot be moved, neither due to an unintended push or a pull on the cables or hoses.



DANGER

Fire hazard; Damage/Destruction of the device due to overheating

If the safety interlock is not connected, the unit may overheat and be damaged or catch fire if there is no water or too low flow.

- ▶ Connect the laser control's safety interlock to the device. Check that the safety interlock will switch off the laser properly in case of error.



WARNING

Burn hazard; Damage of the absorber – Do not touch

Touching the hot absorber can cause severe burns.


Touching the absorber can lead to burn-in by the laser radiation at the points of contact. Burn-in lead to damage to the absorber and increase the scattered radiation.

- ▶ Do not touch the absorber.

13.2 Getting ready for operation

1. Connect the laser control's safety interlock to the device.
 - Check that the safety interlock will switch off the laser properly in case of error.
2. Turn on the voltage supply.
 - The green status display (Ready) must light up.
3. Please wait, until the measured value display is illuminated.
4. Turn on the water cooling.
 - After a few seconds the red status display (Error) must extinguish.
5. After approx. 2 minutes, the device temperature equals the temperature of the cooling water. Press the tara button to adjust the offset to zero.
 - The CompactPowerMonitor CPM is now ready for operation.

13.3 Starting the software

Start the PowerMonitorSoftware PMS by double-clicking the shortcut  on the desktop or by double-clicking the application „PMS.exe“ in the PMS directory. The graphical user interface appears, as displayed in Fig. 13.1 on page 43.

When the communication is established, different measuring values are displayed. If no communication is established, press the **Start/Stop** button in the upper right corner. If a communication is still not possible afterwards, proceed as described in chapter 12.2 on page 39.

13.4 Perform power measurement

1. Click the button **Start**.
2. Turn on the laser.
3. The measured power is updated every second on the measured value display of the device (see chapter Fig. 10.1 on page 32) or on the screen of the PC (see chapter 13.6 on page 44).
 - After about 15 seconds the display reaches about 99 % of the final value.

13.5 The graphical user interface of the PowerMonitor Software PMS

You can open different dialogue windows via the menu bar.

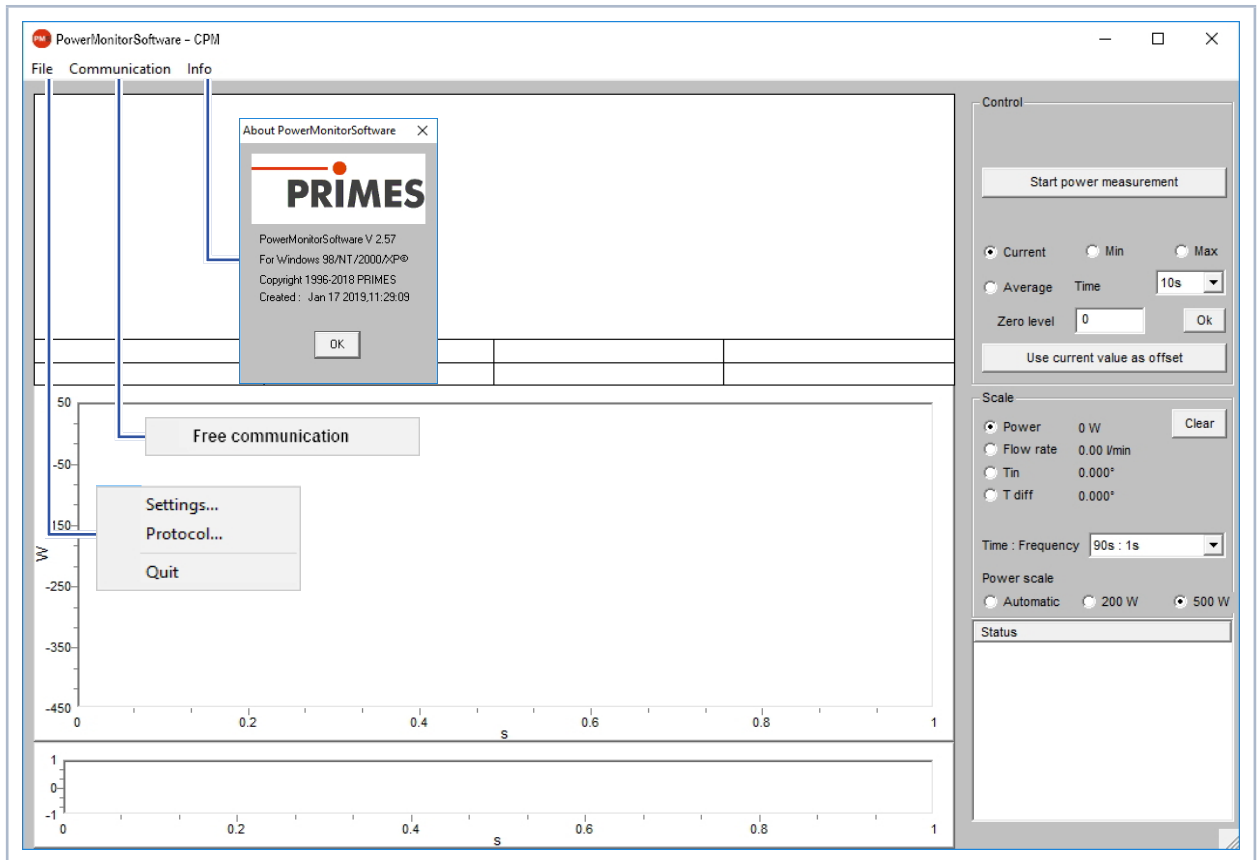


Fig. 13.1: Menu Selection in the menu bar

File > Settings

Here, a different device address can be entered.

File > Protocol

The determined measuring results can be written in a tab-separated text file. Activate the check box **Write** and type in a file name or choose a file. Click **OK**.

File > Quit

Terminates the software.

Communication > Free communication

Opens the dialogue window for the communication.

Info

Provides information regarding the software.



This operating manual describes the software version v2.57 valid at the point of printing. Due to the fact that the operating software is continuously developed further, it is possible that a different version number is printed on the attached PRIMES data medium. The correct function of the device with the software is still ensured.

13.6 Measuring value display

The graphical user interface is divided into three display parts (see Fig. 13.2 on page 44):

- The numerical display of the current measuring values (window A)
- The temporal development of the laser power or the flow rate or of the cooling water temperature (window B)
- Status window

13.6.1 Window A (Numerical display)

In window A below the large display in Fig. 13.2 on page 44: 969 W the following measured values are displayed:

- The current measuring value
- The minimum value and the maximum value
- The average value (button **Average**) of the chosen time interval (drop-down list **Time**)



With the averaging of the power measuring values (**Time** 10 s, 20 s, 30 s, 50 s, max = 90 s) a noise can be reduced, which enables very accurate measurements.

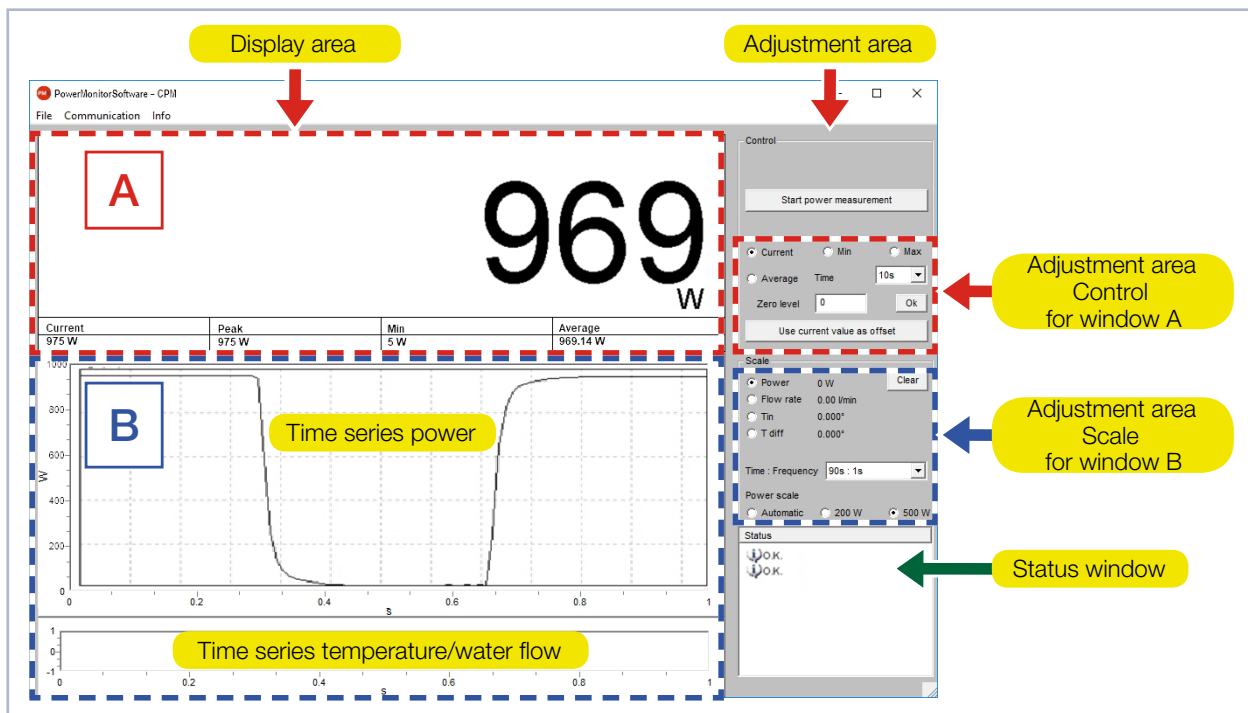


Fig. 13.2: The graphical user interface during a measurement

With option switches **Current**, **Min**, **Max**, **Average** in the configuration range **Control** set which measured value is shown in large digits (see Tab. 13.1 on page 44).

Selection	Display
Current	Display of the current power
Min	Display of the minimum power measured
Max	Display of the maximum power measured
Average	Display of the average value within the chosen measurement duration

Tab. 13.1: Selection for large display of the measured value

Settings

The maximum duration (Max) for the averaging is 90 seconds.

A possible zero offset can be compensated with the button **Use current value as offset** or numerically via the input field **Zero level**.

13.6.2 Window B (Graphical display)

In window B two time series are displayed.

Time series power

You can scale the y-axis (power) of the window automatically or with fixed values (200 W or 500 W). In the setting **Automatic** the y-axis is scaled with the difference of the measured minimum and maximum value.

Time series temperature/Flow rate

Here, the cooling water flow rate or the input temperature (T_{in}) or the difference temperature (T_{diff}) between the input and the output can be controlled. The choice can be made by means of the option switches in the adjustment area **Scale**.

- **Flow rate**
- T_{in}
- T_{diff}

Push button clear

Deletes all numerical and graphical displays in the windows.

Select list Time: Frequency

In this select list you choose the duration of the measurement as well as the measurement rate (number of measurements per time unit). Possible settings:

Measurement duration	Measurement rate	
90 s	1 s	± 1 Hz
10 min	2 s	± 0,5 Hz
30 min	2 s	± 0,5 Hz
2 h	5 s	± 0,2 Hz
10 h	5 s	± 0,2 Hz
50 h	10 s	± 0,1 Hz

Fig. 13.3: Setting Time: Frequency

13.6.3 Status window

In the bottom right window (Status) of the user interface (see Fig. 13.2 on page 44) error messages can appear in red font. These errors have to be remedied before a measurement.

14 Storage

Please note before storing:

NOTICE

Damage/destruction of the device caused by leaking or freezing cooling water

Leaking cooling water can damage the device. Storing the device at temperatures near or below freezing and without emptying the cooling circuit completely can damage the device.

- ▶ Empty the lines of the cooling circuit completely.
 - ▶ Even when the lines of the cooling circuit have been emptied, a small amount of residual water will remain in the device at all times. This may leak out and end up inside the device. Close the connector plug of the cooling circuit with the included sealing plugs.
 - ▶ Store the device in the original PRIMES transport box.
-

NOTICE

Damaging/Destruction of the flow rate meter

The flow rate meter is not designated for high rotational speed.

- ▶ Do not use compressed air for emptying the cooling circuit.
-

15 Maintenance and service

The operator is responsible for determining the maintenance intervals for the measuring device. PRIMES recommends a maintenance interval of 12 months for inspection and validation or calibration. If the device is used only sporadically, the maintenance interval can also be extended up to 24 months.

16 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.-Nr. 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 (this service does not include shipping costs):

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

17 Declaration of conformity**Original EG Declaration of Conformity**

The manufacturer: PRIMES GmbH, Max-Planck-Straße 2, 64319 Pfungstadt, Germany,
hereby declares that the device with the designation:

CompactPowerMonitor (CPM)

**Types: CPM C-9; CPM F-1; CPM F-10; CPM F-20; CPM F-30
CPM+ C-9; CPM+ F-1; CPM+ F-10; CPM+ F-20; CPM+ F-30**

is in conformity with the following relevant EC Directives:

- EMC Directive EMC 2014/30/EU
- Low voltage Directive 2014/35/EU
- Directive 2011/65/EC on the restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment
- Radio Equipment Directive 2014/53/EU

Authorized for the documentation:
PRIMES GmbH, Max-Planck-Straße 2, 64319 Pfungstadt, Germany

The manufacturer obligates himself to provide the national authority in charge with technical documents in response to a duly substantiated request within an adequate period of time.

Pfungstadt, July 19, 2021



Dr. Reinhard Kramer, CEO

UKCA Declaration of Conformity

The manufacturer: PRIMES GmbH, Max-Planck-Straße 2, 64319 Pfungstadt, Germany,
hereby declares that the device with the designation:

CompactPowerMonitor (CPM)

**Types: CPM C-9; CPM F-1; CPM F-10; CPM F-20; CPM F-30
CPM+ C-9; CPM+ F-1; CPM+ F-10; CPM+ F-20; CPM+ F-30**

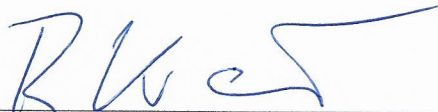
is in conformity with the following relevant UK Regulations:

- Electromagnetic Compatibility Regulations 2016
- Electrical Equipment (Safety) Regulations 2016
- Directive 2011/65/EC on the restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment
- Radio Equipment Regulations 2017

Authorized for the documentation:
PRIMES GmbH, Max-Planck-Straße 2, 64319 Pfungstadt, Germany

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Pfungstadt, July 19, 2021



Dr. Reinhard Kramer, CEO

18 Technical data

18.1 CPM C-9

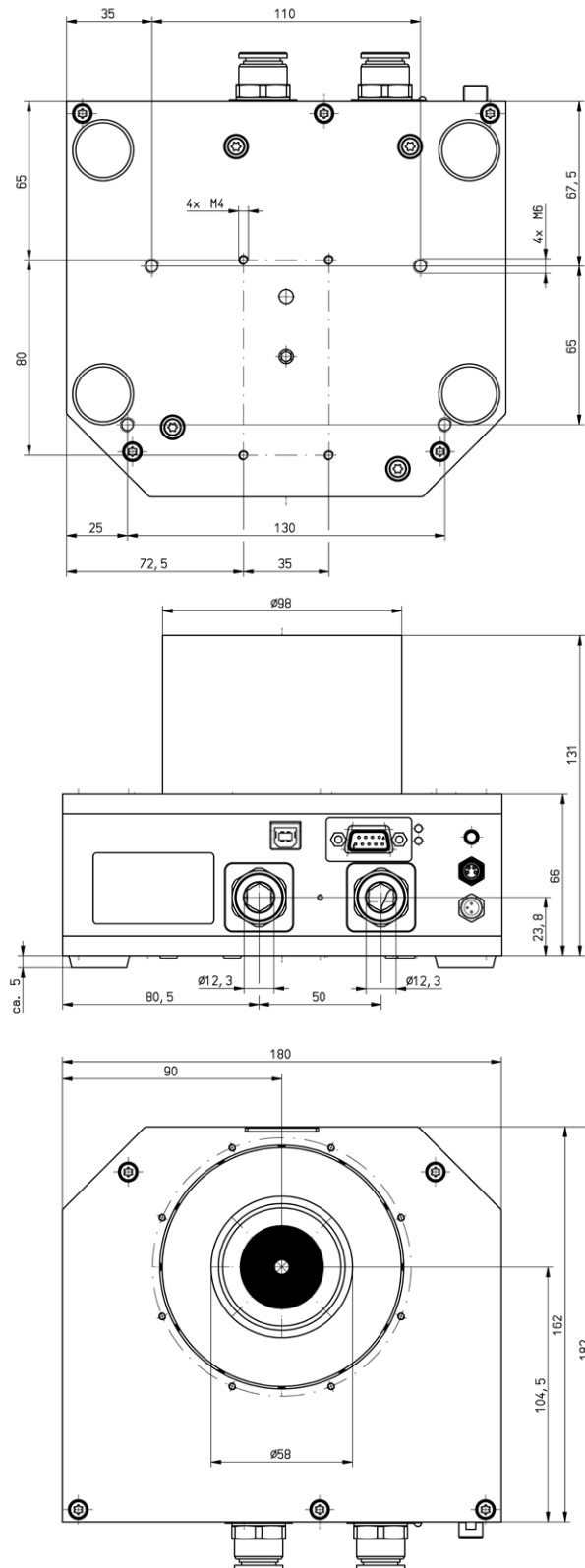
Measurement parameters	
Max. power range	0.5 – 9 kW
Irradiation time	continuous
Wavelength range	800 – 1 100 nm and 10 600 nm
Inlet aperture	55 mm
Max. power density at beam diameter ¹⁾	10 kW/cm ² (Ø < 10 mm) 5 kW/cm ² (Ø 10 – 30 mm) 0,5 kW/cm ² (Ø 30 – 55 mm)
Average power density at beam diameter ¹⁾	5 kW/cm ² (Ø < 10 mm) 5 kW/cm ² (Ø 10 – 30 mm) 0.5 kW/cm ² (Ø 30 – 55 mm)
Accuracy	± 3 %
Reproducibility	± 1.5 %
Time constant	< 10 s
¹⁾ A central beam incidence is assumed.	
Supply data	
Power supply, DC	24 V ± 5 %, max. 0.5 A
Min. cooling water pressure	2 bar
Max. cooling water pressure	4 bar
Recommended cooling water flow rate	8 – 11 l/min
Cooling water flow rate (warning level)	4 l/min
Temperature fluctuation of the cooling water	< 1 K per minute or 0.05 K per 5 seconds
Cooling water temperature T _{in} ²⁾	Dew point temperatur < T _{in} < 30 °C
²⁾ Please contact PRIMES in advance in case you intend not to work within this specification.	
Communication	
Interfaces	RS485/USB
Dimensions and Weights	
Dimensions (L x W x H)	180 × 162 × 136 mm
Weight (approx.)	5.1 kg
Environmental conditions	
Operating temperature range	15 – 40 °C
Storage temperature range	5 – 50 °C
Reference temperature	22 °C
Permissible relative humidity (non condensing)	10 – 80 %

18.2 CPM F-1, CPM F-10, CPM F-20, CPM F-30

Measurement parameters	CPM F-1	CPM F-10	CPM F-20	CPM F-30
Max. power range	0.1 – 1,4 kW	0.5 – 10 kW	1 – 20 kW	2 – 30 kW
Irradiation time	continuous			
Wavelength range	800 – 1 100 nm	800 – 1 100 nm	800 – 1 100 nm	800 – 1 100 nm
Inlet aperture	45 mm	90 mm	135 mm	180 mm
Max. power density	1 kW/cm ²	1 kW/cm ²	1 kW/cm ²	1 kW/cm ²
Average power density	0.5 kW/cm ²	0.5 kW/cm ²	0.5 kW/cm ²	0.5 kW/cm ²
Accuracy	± 3 %			
Reproducibility	± 1.5 %			
Time constant	< 10 s	< 10 s	< 10 s	< 15 s
Supply data	CPM F-1	CPM F-10	CPM F-20	CPM F-30
Power supply, DC	24 V ± 5 %, max. 0.5 A			
Min. cooling water pressure	2 bar	3 bar	3 bar	3 bar
Max. cooling water pressure	4 bar	4 bar	4 bar	4 bar
Recommended cooling water flow rate	1 – 2 l/min	8 – 11 l/min	15 – 23 l/min	25 – 30 l/min
Cooling water flow rate (warning level)	0,5 l/min	4 l/min	8 l/min	15 l/min
Temperature fluctuation of the cooling water	< 1 K per minute or 0.05 K per 5 seconds			
Cooling water temperature T _{in} ¹⁾	Dew point temperatur < T _{in} < 30 °C			
¹⁾ Please contact PRIMES in advance in case you intend not to work within this specification.				
Communication	CPM F-1	CPM F-10	CPM F-20	CPM F-30
Interfaces	RS485/USB			
Dimensions and Weights	CPM F-1	CPM F-10	CPM F-20	CPM F-30
Dimensions (L x W x H)	180 x 123 x 71 mm	180 x 162 x 71 mm	260 x 162 x 113 mm	260 x 220 x 113 mm
Weight (approx.)	2.2 kg	3.1 kg	4.7 kg	5.8 kg
Environmental conditions	CPM F-1	CPM F-10	CPM F-20	CPM F-30
Operating temperature range	15 – 40 °C			
Storage temperature range	5 – 50 °C			
Reference temperature	22 °C			
Permissible relative humidity (non condensing)	10 – 80 %			

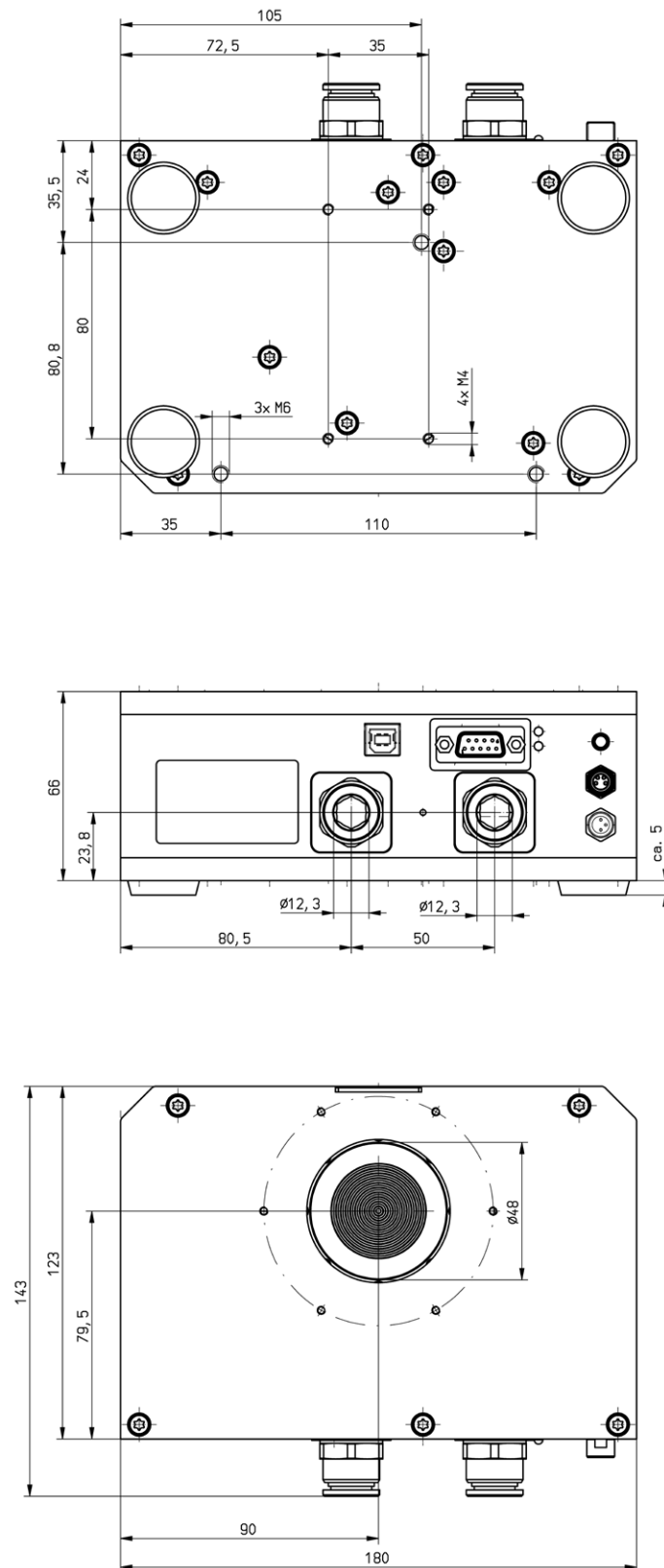
19 Dimensions

19.1 Dimensions CPM C-9



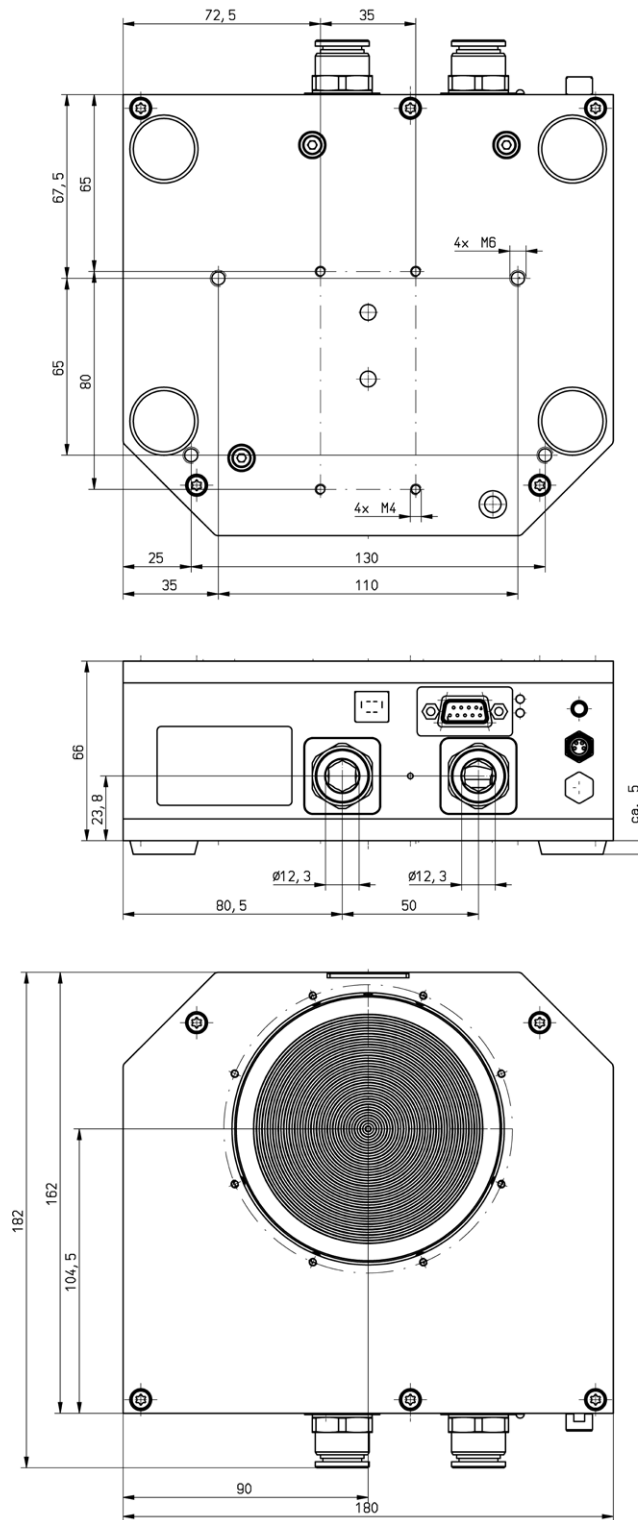
All dimensions in mm (general tolerance ISO 2768-v)

19.2 Dimensions CPM F-1



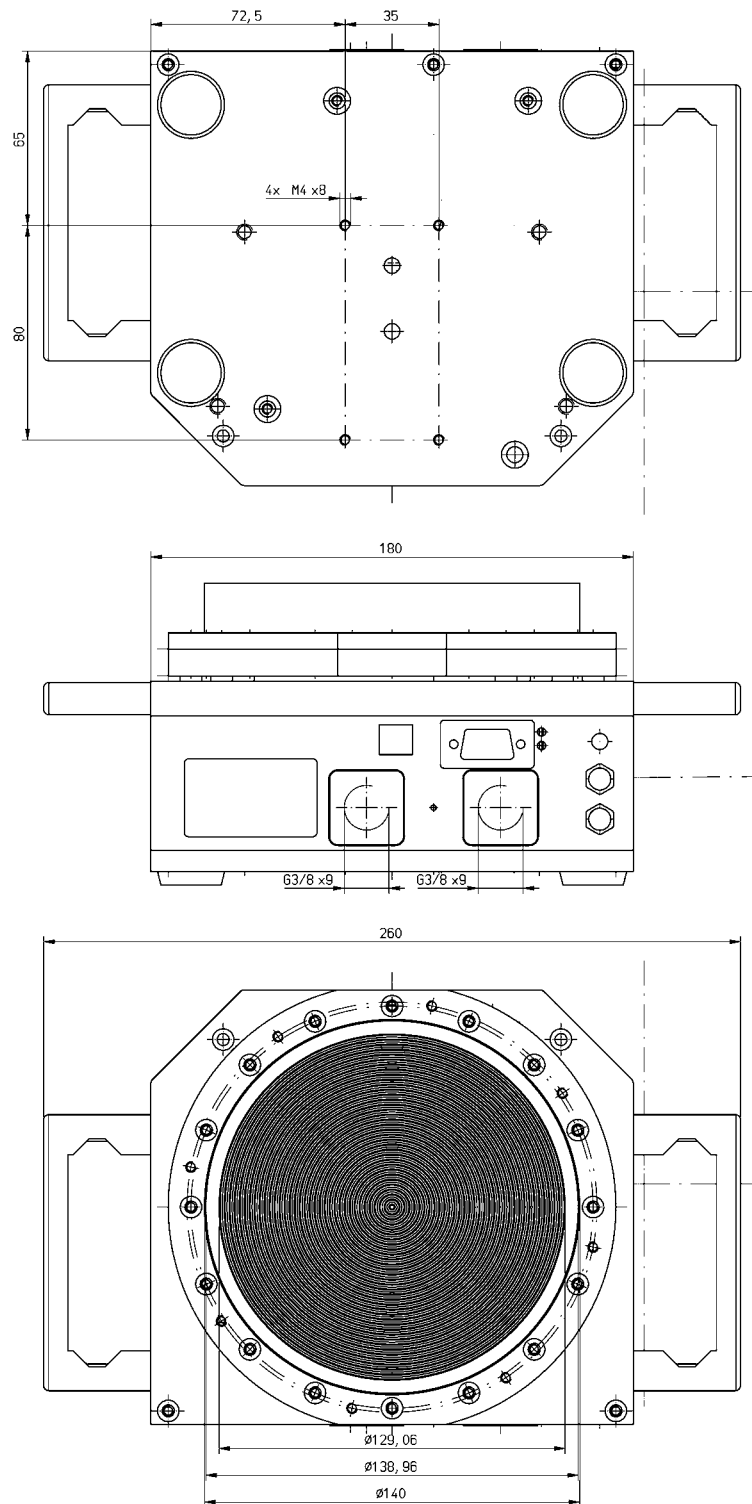
All dimensions in mm (general tolerance ISO 2768-v)

19.3 Dimensions CPM F-10



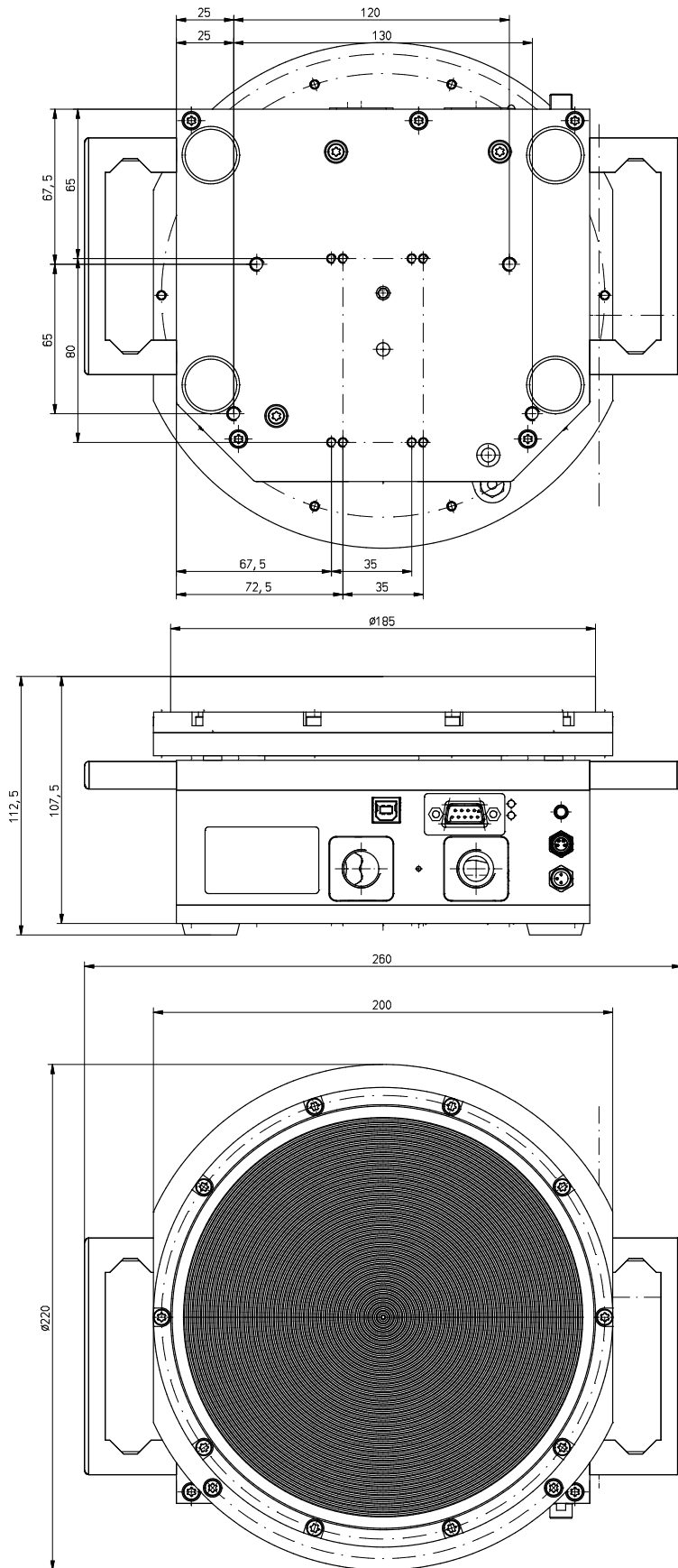
All dimensions in mm (general tolerance ISO 2768-v)

19.4 Dimensions CPM F-20



All dimensions in mm (general tolerance ISO 2768-v)

19.5 Dimensions CPM F-30



All dimensions in mm (general tolerance ISO 2768-v)

20 Appendix

20.1 Operation of the CompactPowerMonitor with PanelDisplay (without PC)

By option there is a external control display (PanelDisplay, Order-No. 130-005-003) available for the operation of the system. The display is operated via the standard PRIMES bus and therefore enables the reading from a greater distance from the measuring position without a PC.

1. Please connect the display and the CPM by the 9-pole D-Sub cable for the PRIMES RS485 bus (on the front or on the rear side).
2. Connect the power supply unit via the adapter to the 9 pin D-Sub socket (RS485) of the PanelDisplay.

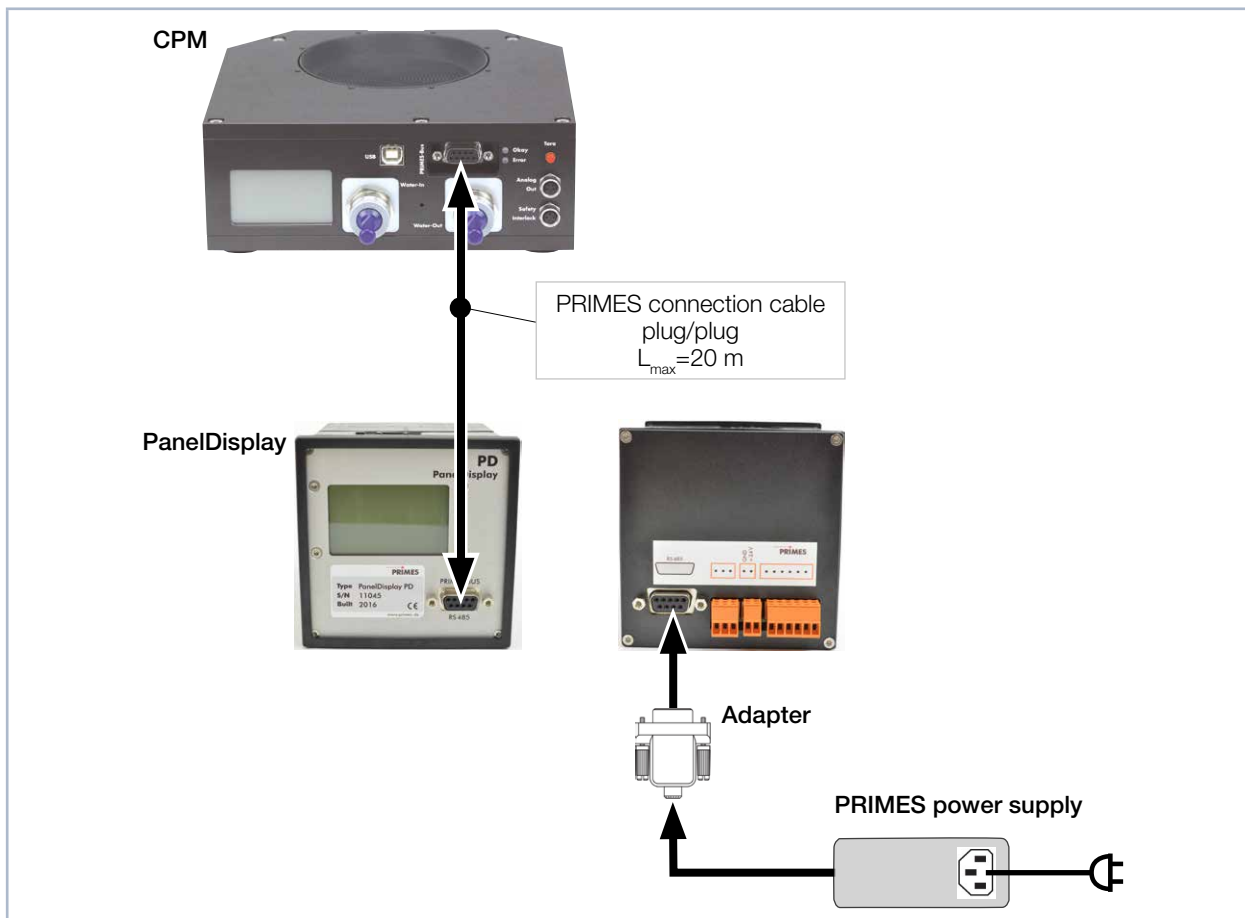
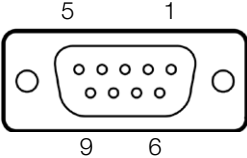


Fig. 20.1: Connecting the CompactPower Monitor CPM to the Panel Display


20.1.1 Pin assignment 9-pole D-Sub socket

D-Sub socket, 9 pin (top view, plug-in side)	Pin	Function
	1	Ground
	2	RS485 (+)
	3	+24 V
	4	Not assigned
	5	Not assigned
	6	Ground
	7	RS485 (-)
	8	+24 V
	9	Not assigned

Tab. 20.1: Pin assignment D-Sub socket on the PanelDisplay

20.1.2 Measurement display

The PanelDisplay reflects the display of the CompactPowerMonitor CPM. The PanelDisplay shows the following measurement values:

Display	Meaning	
W	Laser power in W	
Flow	Water flow rate in l/min	
Te	Water temperature at the entrance in °C	
Td	Temperature difference between water input and output in Kelvin (a temperature difference of 1 K corresponds to a temperature difference of 1 °C).	

Tab. 20.2: Meaning of the measured display




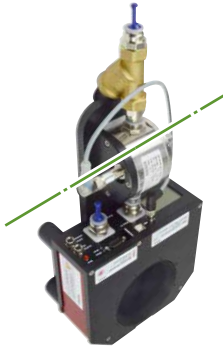

For the operation with the PowerMonitorSoftware via PC, you have to change the operating mode of the display from "Active" to "Passive". Further information can be found in the operating manual „Panel Display“, chapter „Operating Mode“.

20.2 Mounting position of a CompactPowerMonitor CPM with oval wheel meter

Please note during installation, that the axis of the oval wheel meter must always be horizontal.



Fig. 20.2: Position of the oval wheel meter axis

<p>Correct mounting position</p> <p>The device can either stand on its feet (A) or the connections and display are in an upright position (B)</p>	<p>A</p> 	<p>B</p> 
<p>Incorrect mounting position</p> <p>The flat side of the oval wheel meter must not point downwards (to the table).</p>		

Tab. 20.3: Mounting position of the CompactPowerMonitor CPM with oval wheel meter



For a continuous operation, the oval wheel meter axis has to be positioned horizontally. For a short period of time (a few hours per year) the CPM with oval wheel meter can be operated in the “incorrect” installation position without immediately causing damages to the device. Longer operation periods, however, may wear off the flow rate sensor.

20.3 Accessories fiber adapter

Example: Fiber adapter and dome for CPM F-10



For information about other fiber adapters for the CompactPowerMonitor CPM, see the PRIMES documentation "Installation fiber adapter".