Pre-Installation-Guide
RAPID, HYPER RAPID
Industrial Picosecond Laser System
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This Pre-Installation-Guide replaces all previous versions.
1 Pre-Installation Guide

Content

The package contains the following components:

- Pre-Installation-Guide: this document
- Unpacking instructions: Handling of the system on arrival
- Packing instructions: in case of future shipment
- Software simulation package (remote control via network)
- DLL specification: description of commands

Introduction

Thank you very much for your interest in our products. This document is intended for customers who decided (or are potentially about) to purchase a picosecond laser from the Rapid / Hyper Rapid series offered by Coherent Kaiserslautern GmbH. Coherent reserves the right to change this information or perform technical modifications without notice. Furthermore we cannot guarantee the accuracy of information given in this document. Coherent Kaiserslautern GmbH will not take any responsibility for inappropriate preparation due to wrong or misunderstood information.

In order to prepare the customer-site application room and get a "plug-and-play" system which just needs to be positioned, connected and turned on, we consolidated all important information in this document. Your individual needs and expectations still need to be taken into account and might necessitate further investigation or preparation. In this case contact your Coherent representative if any questions are left open.
General Information

Please consult the Operator's Manual for information beyond the scope of this guide. Furthermore we would like to point out the important document "Unpacking Instructions" due to the fact that a complex system as the one you are about to receive needs certain procedures which shall be observed and well understood. Please do not hesitate to contact us if anything is unclear.

The following table shows a set of parameters for the Rapid and Hyper Rapid systems. For more information refer to www.coherent.com. The optical wavelength of the laser output is 1064 nm (IR, infrared). An additional frequency conversion to 532 nm (SHG, green) and 355 nm (THG, UV) is optionally possible. The output for IR, SHG and THG are spatially separated and optionally switchable via software. Furthermore an optional external process shutter (EOM) can be integrated.

<table>
<thead>
<tr>
<th>Laser system</th>
<th>optical power (up to value)</th>
<th>pulse energy [µJ] (up to value)</th>
<th>repetition rate [kHz]</th>
<th>frequency conversion (optional)</th>
<th>external process-shutter, optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid</td>
<td>6 W</td>
<td>40 µJ</td>
<td>10-1000</td>
<td>IR, SHG, THG</td>
<td>EOM</td>
</tr>
<tr>
<td>Rapid 10</td>
<td>10 W</td>
<td>60 µJ</td>
<td>10-1000 optimization range: 100-500 or 400-1000</td>
<td>IR, SHG, THG</td>
<td>not required, function is integrated</td>
</tr>
<tr>
<td>Hyper Rapid 25</td>
<td>25 W</td>
<td>125 µJ</td>
<td>200-1000</td>
<td>IR, SHG, THG</td>
<td>EOM</td>
</tr>
<tr>
<td>Hyper Rapid 50</td>
<td>50 W</td>
<td>125 µJ</td>
<td>400-1000</td>
<td>IR, SHG, THG</td>
<td>EOM</td>
</tr>
<tr>
<td>Hyper Rapid 50-HE  (high energy)</td>
<td>40 W @ 200 kHz</td>
<td>200 µJ</td>
<td>200-1000</td>
<td>IR, SHG, THG</td>
<td>EOM</td>
</tr>
</tbody>
</table>
Ambient condition

The ambient conditions must be observed during storage, transport, installation and operation of the laser system. Ensure reasonable transport conditions, free of major shocks, jolt or fall. Protect the whole system against frost, gases, moisture and dust. Use original packing material for relocation.

Before unpacking the laser wait for 6 hours to allow for thermalization of all components.

<table>
<thead>
<tr>
<th>Temperature range during transportation</th>
<th>-10°C to +50°C (14°F up to 122°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative humidity during transportation</td>
<td>5% up to 90%, non-condensing</td>
</tr>
<tr>
<td>Temperature range for optimal operation</td>
<td>+15°C up to +30°C (59°F up to 86°F)</td>
</tr>
<tr>
<td>Relative humidity during operation</td>
<td>&lt;60%, non-condensing</td>
</tr>
<tr>
<td>Maximum altitude for operation</td>
<td>2000 meters above sea level (850 – 1050 hPa)</td>
</tr>
</tbody>
</table>

**NOTICE!**
In case customer components are being added to the system, consider that the environmental conditions could deviate (permitted range of ambient temperature, humidity, etc.).

Safety

The product is a class IV / class 4 laser which is defined by regulations e.g. ANSI Z136 in the US and IEC 60825 internationally. All national and local safety regulations might be dependent on the location and need to be fulfilled. This is even more important for integrators who additionally need to fulfill the regulations of the final machine destination. Persons working with the equipment as well as everybody in vicinity of the laser need to be aware and informed of possible hazards at all times.
Laser safety also includes the need to integrate, lock and seal the complete beam path. Make sure to prevent the possibility of direct or indirect exposure (especially) to eye and skin. Please be aware of the fact that IR is invisible. So the danger is invisible as well. UV light is capable of aging material. This issue also needs to be taken into account for the sealed room the laser is working in.

A laser eye protector certified for the used wavelengths has to be worn, in accordance with EN207, when working on or nearby the laser beam. Never work without the eye protection!
Please check whether appointing a certain person as a 'Laser safety officer' (LSO) might be necessary or reasonable.

**External EOM**

The optional external process shutter (EOM) is a fast optical switch which can be used to turn the laser beam on and off during processing (for example the gate signal coming from a scanner-unit). Gating the laser beam is an elaborate subject as it is important to correctly configure the input signal and timing. Each application is different, so your implementation will likely be specific to your application in mind. Another useful feature might be the "Analog-Modulation": applying an analog 0-10 V signal to the external EOM can control the power of the laser beam. Note, that the modulation frequency (from 0 to 100%) is limited to 100 Hz and the relation (between signal and optical power) is not linear. If desired, your Coherent representative will be able to provide you with more information on this feature.

**Beam polarization**

Please take into account the beam polarization when planning for beam steering and use of other optical elements in the beam delivery system.

Located at the beam exit of the frequency-conversion module (attached to the laser head front side) is a Brewster window (inclined to an angle around the horizontal axis). Due to this fact, the laser beam is linear s-polarized (E-vector vertical).

The laser beam for IR-only is typically linear p-polarized (E-vector horizontal).
All power supply devices will be delivered with the European "Schuko" connector. Please make sure to provide the appropriate connecters (to replace the "Schuko") suitable for your region (and region of end-customer in case of machine-integration). For the Hyper Rapid a transformer will be necessary if the voltage deviates from 230 V. Make sure to address this detail if necessary. In this case all "Schuko" power supply connecters can be plugged into the transformer and you need to provide an adequate connecter for the transformer (refer to section "Power transformer" on page 13.)

Please note that all electrical work (e.g. designing, configuring and connecting, etc.) should only be performed by a certified electrician.

We recommend to fuse the power supply of the laser system and the chiller separately (e.g. due to inrush-current). A multiple socket outlet is not recommended due to the fact that in total a single fuse is under-dimensional.

- Electrical connecter for the power supply (of the laser head). Rapid: The delivered cable has a C19 plug (power supply side) and a "Schuko" (CEE 7/4) plug which can be replaced by a plug provided by the customer. Alternatively as an option we offer a C19—C20 cable. Hyper Rapid: The delivered cable is permanently connected to the power supply and has a "Schuko" (CEE 7/4) plug on the free end (replaceable by a customer plug).
- Electrical connecter for the chiller. The delivered cable is C19—Schuko. Also here the "Schuko" is exchangeable.
- In case of an external process shutter – EOM: The delivered cable has a C13 and Schuko-plug.
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Refer to the following table for more details about the cables:

<table>
<thead>
<tr>
<th>Cable for device</th>
<th>article</th>
<th>device end IEC 60320</th>
<th>cable length</th>
<th>customer end</th>
<th>image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid power supply</td>
<td>23412 *</td>
<td>C19</td>
<td>4.5 m cable (14.7 feet)</td>
<td>CEE 7/4</td>
<td><img src="Cable1.png" alt="Image" /></td>
</tr>
<tr>
<td>Chiller for Rapid</td>
<td>24623 *</td>
<td>C19</td>
<td>4.5 m cable (14.7 feet)</td>
<td>CEE 7/4</td>
<td><img src="Cable2.png" alt="Image" /></td>
</tr>
<tr>
<td>Hyper Rapid power supply</td>
<td>—</td>
<td>fixed cable connection</td>
<td>4.5 m cable (14.7 feet)</td>
<td>CEE 7/4</td>
<td><img src="Cable3.png" alt="Image" /></td>
</tr>
<tr>
<td>Chiller for Hyper Rapid</td>
<td>24623</td>
<td>C19</td>
<td>4.5 m cable (14.7 feet)</td>
<td>CEE 7/4</td>
<td><img src="Cable4.png" alt="Image" /></td>
</tr>
<tr>
<td>External EOM (optional process-shutter)</td>
<td>22475</td>
<td>C13</td>
<td>2 m cable (6.5 feet)</td>
<td>CEE 7/4</td>
<td><img src="Cable5.png" alt="Image" /></td>
</tr>
</tbody>
</table>

* cable 23412 and 24623 are identical except the individual label

Alternative cables do have a C20 plug (instead of "Schuko"):

<table>
<thead>
<tr>
<th>Alternative cable for device</th>
<th>article</th>
<th>device end</th>
<th>cable length</th>
<th>customer end</th>
<th>image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid power supply</td>
<td>22848</td>
<td>C19</td>
<td>4.5 m cable (14.7 feet)</td>
<td>C20</td>
<td><img src="Cable6.png" alt="Image" /></td>
</tr>
<tr>
<td>Chiller for Rapid</td>
<td>24611</td>
<td>C19</td>
<td>4.5 m cable (14.7 feet)</td>
<td>C20</td>
<td><img src="Cable7.png" alt="Image" /></td>
</tr>
<tr>
<td>Chiller for Hyper Rapid</td>
<td>24611</td>
<td>C19</td>
<td>4.5 m cable (14.7 feet)</td>
<td>C20</td>
<td><img src="Cable8.png" alt="Image" /></td>
</tr>
</tbody>
</table>

What needs to be prepared:

- The laser head shall be positioned horizontally, flat on a ground surface made of low expansion material (ideally granite) in order to eliminate temperature and vibration issues. (A modern alternative might be cast stone). Ask for a 3D–CAD–STEP file in order to get all necessary dimensions. Refer to section "Footprint, Pedestals" on page 16 to find the fixing-procedure. Follow the chapter "Installation requirements" of the Operator's Manual.
- The room, the laser will be located in, should be relatively clean and free of condensation. For the environmental conditions please refer to section "Ambient condition" on page 6.
- Adequate table with thread holes (M6) in order to position and fix the laser head. Refer to section "Footprint, Pedestals" on page 16.
• Provide adequate electrical power plugs (if deviating from the described ones above) or contactors, which are sufficiently fused (refer to next chapter).

• Laser safety requirements must always be satisfied. Certified laser eye protection has to be worn by every person working with or in vicinity of the laser. Involved persons have to be aware of and informed about hazards associated with laser radiation.

• In case the system is being implemented into an enclosed laser-processing-area, adequate door lock devices as well as shutter control via safety element might be required and implemented into the interlock chain.

• Guidance rail or tube for laser fibers (minimum bending radius 10 cm or 4 inches). The laser fibers need to be protected and covered against mechanical forces.

• The minimum bending radius of the chiller water hoses is: 13 cm or 5.1 inches). Protect the hoses against mechanical forces and crushing.

• The laser beam path might need to be covered by an adequate housing, tubes, cabinet, etc.

• Interlock chains have to be installed; refer to section "Interlock connector Shutter" on page 23.

• In order to request the hardware-status of the diodes, shutter position or interlock condition, refer to section "Status connector" on page 25.

• In order to request the hardware-status of the emergency switch, refer to section "Emergency Stop connector" on page 26.

• The chiller cooling liquid will be included in delivery. Please provide a plastic tray for maintenance (water-exchange). The height of this container should be 10 cm (4 inches), the capacity 6 liter (1.5 US gallons).

• Additionally necessary in case of water-water chiller: An external primary water-cooled circuit. The flow rate shall provide at least:

<table>
<thead>
<tr>
<th></th>
<th>Rapid</th>
<th>Hyper Rapid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Rate</td>
<td>5.5 l/min</td>
<td>10 l/min</td>
</tr>
<tr>
<td></td>
<td>1.45 US gallons/min</td>
<td>2.65 US gallons/min</td>
</tr>
</tbody>
</table>

provide a water pressure of max. 5 bar
The water temperature has to be between 5°C and 25°C (41°F and 77°F). 2 not-transparent water hoses (in&out), inner-diameter: 1/2 inch (CPC connectors for attaching the chiller will be provided on delivery).

- Announcing a laser safety officer (LSO) might be required. He needs to be authorized by the management to conduct such duties.

- BNC signal lines (trigger and gate) in order to control the laser system. This subject is highly dependent on your application. Refer to the chapter "Operating the Laser" in the Operator's Manual or contact your Coherent representative. Refer to section "USER signals" on page 29 to find the location of the BNC-signal-plugs.

- A scanner-card (or a function-generator) might be needed to create TTL-signals (trigger, gate). This is dependent on your application as well as on the laser system.

- Power meter in order to measure the optical output

- Torque wrench (metric hex screw M6, "Allen-key") with a moment of 3.5 Nm in order to fixing the laser head to the table (section "Footprint, Pedestals" on page 16).

- Local area network connection: Ethernet cable (not included in delivery) with category CAT.5 (100 Mbit/s) minimum. Older network-controller-cards might expect a cross-link cable in case of computer-to-computer connection; an actual network-card offers this cross-link automatically.

- When using a firewall on the external PC ensure, that the specified communication port is open. This communication port is set in the ConfigN.ll2 configuration file for the server and the client application.

- In case of external software control, e.g. for a machine integration: software development (refer to the seperate document "DLL specification") and simulating the network connection (section "Software simulation" on page 29).

- For house internal transportation of the laser head (together with connected power supply), a trolley with 2 levels is recommended. This way the head can stay on the upper level and the (laser fiber-) connected power supply can stay on the lower level (consider the load of approx. 180 kg; 400 lbs).
- For the installation: A Coherent Service technician will perform measurements. Therefore the laser head should reside as a stand-alone system on a table (prior to integration). In order to position measuring devices in front of the beam output an **optical breadboard** is required. We please you to provide such equipment. There are thin optical breadboards (just an Aluminum bench plate with thread-holes) available on the market, e.g. Thorlabs: Aluminum Breadboard, 300 mm x 450 mm x 12.7 mm, M6 taps, approx. 6 kg (13 lbs) or equivalent: 12" x 18" x 1/2", 1/4" taps. It is not important if the measurements are metric or imperial. Please make sure to provide approx. 10 matching screws (M6x15 or accordant). The situation is different each time and customer-individual. Please help us to ensure the highest possible safety! Do not hesitate to contact Coherent Kaiserslautern GmbH (refer to first page) in case of any doubt about the safety of the measurement procedure, so that a solution can be found in advance. **Measurements are exclusively allowed by Coherent Service technicians if the safety is fulfilled!**

- Please also provide a stable table (200 x 70 cm or larger) in order to position the laser head as well as the optical breadboard in front. In order to secure the beam output area provide a housing, like laser safety curtains or black-anodized aluminum plates with a height of 25 cm (10 inches) which can be positioned vertically as a frame.

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**Figure 1: Alignment table, top view**
Please note that the fibers between the power supply and the laser head cannot be disconnected or extended. In case the laser head needs to be separated from the power supply for a machine integration, request a trained Coherent service engineer. Please inform us in advance.

**Power consumption values**

In the following list the power consumption of all possible devices are listed. These values need to be added together according to the requested combination. Adequate power connectors and slow-fuses are recommended.

<table>
<thead>
<tr>
<th>System name</th>
<th>Device name</th>
<th>Voltage</th>
<th>Power consumption (average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid power supply</td>
<td>P60</td>
<td>100-230V</td>
<td>700 W</td>
</tr>
<tr>
<td>Hyper Rapid 25 power supply</td>
<td>P90</td>
<td>230V *</td>
<td>1100 W</td>
</tr>
<tr>
<td>Hyper Rapid 50 power supply</td>
<td>P90</td>
<td>230V *</td>
<td>1300 W</td>
</tr>
<tr>
<td>Hyper Rapid 75 power supply</td>
<td>P90</td>
<td>230V *</td>
<td>1500 W</td>
</tr>
<tr>
<td>Hyper Rapid 100 power supply</td>
<td>P90</td>
<td>230V *</td>
<td>1600 W</td>
</tr>
<tr>
<td>External EOM (optional device)</td>
<td>EOM controller</td>
<td>100-230V</td>
<td>200 W</td>
</tr>
</tbody>
</table>

* Please communicate your mains voltage in case it deviates from 230V. In this case a transformer will be necessary and needs to be ordered. The primary current can be over 30 A (depending on the system configuration). This connection needs to be fused adequately.

**Power transformer**

The transformer will be delivered for the Hyper Rapid in case your mains voltage deviates from 230 VAC. Please inform us, if this is the case. The correct voltage-setting needs to be checked before connecting to mains.

**WARNING!**

Check the correct mains-input-voltage of the transformer before connecting to power. Therefore the casing needs to be opened by a qualified electrician.

<table>
<thead>
<tr>
<th>Product</th>
<th>used for</th>
<th>Weight</th>
<th>Dimension (WxDxH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power transformer for 100, 115, 200 or 208 V</td>
<td>Hyper Rapid, if voltage deviates from 230 V</td>
<td>30 kg / 66 lbs</td>
<td>32 x 42 x 27 cm 12.6 x 16.5 x 10.6 inches</td>
</tr>
</tbody>
</table>
The transformer cannot be placed into the Rack. The handles on top of the transformer can be removed (height without handles is 23 cm / 9 inches). All cables are being connected from the front side. Please make sure that there is enough space to guide the cables. The transformer has 4 European "Schuko"-plugs (type F, CEE 7/4).

The cable on the primary side (single phase, neutral and ground) has a length of 4.5 m (14.7 feet). The wires have a cross section of 4 mm² (0.157 inch²) for 100/110 V or have a cross section of 2.5 mm² (0.098 inch²) in case of 208 V.

In order to connect the primary side of the transformer, we recommend to use a CEE plug (refer to IEC EN 60309) (1-phase or even 3-phase), valid for 230V and the requested current. Choosing the correct connection remains in responsibility of the customer.

Note that the current can be over 30 A (depending on the system configuration and mains voltage). This connection needs to be fused adequately. The installation is exclusively allowed by a certified electrician.
**Electrical Grounding**

The laser head has a grounding connection to the power supply. Each power supply is connected to ground via mains connector. In case the local mains plug does not include the grounding, it has to be added manually. Make sure and test that all devices are correctly grounded. Also the table, where the laser head is being positioned, has to have a grounding. Do not remove, break or disconnect any grounding connections.

**Mechanical Dimensions of the laser head**

In the following table the dimensions of the laser head as well as the weight is listed. The image shows the laser head front view. All user-relevant cables as well as the water hoses are guided and combined at the rear side of the laser head (not visible in the image).

Please allow for sufficient access to the laser head in the machine for maintenance. Also, make sure a power meter can be placed into the optical beam path for diagnostic purposes. Make sure you allow for access from the top and sides in order to exchange the desiccant cartridges as well as remove the laser head cover (only done by a certified technician, if required) and from the back side to get access to the feed lines.

We recommend to leave at least 15 inches (40 cm) at the back side of the laser head for the electrical wires, water hoses and optical fibers. Also include adequate cover tubing, guiding systems or protections against mechanical forces.

Do not hesitate to contact your Coherent representative in case you need further support.

If requested we can provide a 3D CAD-STEP file of the laser head.
<table>
<thead>
<tr>
<th>Laser head</th>
<th>Dimensions (W x D x H)</th>
<th>Weight</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid, Rapid 10</td>
<td>526 x 1017 x 167 mm (20.7 x 40 x 6.6 inches)</td>
<td>70 kg / 154 lbs</td>
<td><img src="rapid_rapid_10.png" alt="Image" /></td>
</tr>
<tr>
<td>Rapid, Rapid 10 with freq.-conversion (and/or external EOM)</td>
<td>526 x 1296 x 195 mm (20.7 x 51 x 7.7 inches)</td>
<td>89 kg / 196 lbs</td>
<td><img src="rapid_rapid_10_freqConversion.png" alt="Image" /></td>
</tr>
<tr>
<td>Hyper Rapid 25, 50 IR-only, no process shutter</td>
<td>581 x 1045 x 167 mm (22.9 x 41.2 x 6.6 inches)</td>
<td>96 kg / 211 lbs</td>
<td><img src="hyper_rapid_25_50.png" alt="Image" /></td>
</tr>
<tr>
<td>Hyper Rapid 25, 50 with freq.-conversion (and/or external EOM)</td>
<td>581 x 1296 x 195 mm (22.9 x 51 x 7.7 inches)</td>
<td>115 kg / 253 lbs</td>
<td><img src="hyper_rapid_25_50_freqConversion.png" alt="Image" /></td>
</tr>
</tbody>
</table>

**Footprint, Pedestals**

We recommend to position the laser head on a horizontal, flat ground surface made of a low expansion material (ideally granite) in order to eliminate temperature and vibration issues. (A modern alternative might be cast stone).

Dimensions and locations of the 3 pedestals can be found in the CAD file (request from Coherent Kaiserslautern GmbH if required). These feet have to be fixed with 3 screw-packages and 2 alignment pins (included in delivery). The alignment pins (DIN 7979, ISO 8735, Form D, fit: m6, measure: 6x24 mm) are necessary to ensure an exact position of the laser head. One is designed as a fixed bearing (foot 1) and one as long hole (foot 2) (refer to drawings below for details).

The three M6-screws require a thread-hole in the ground-table of at least 12 mm thread-depths. Note that the mechanical connection (as included in delivery) (screw, sleeve, washers and spring-package) is designed to minimize or exclude (thermal caused) mechanical stress. Therefore observing this procedure is important and necessary. This mounting method is exclusively valid for laser-operation.
In order to transporting the laser head inside a machine, additional transport-clamps are required. These clamps have to be removed after arrival / for operation. Include additional threads into your table for this purpose.

The upper side of the feet are made of aluminum, the bottom side consist of PVC in order to achieve a thermal isolation.

Fasten the screws (M6x40) with a torque of **3.5 Nm**. This is – on purpose– a relatively low torque to avoid mechanical tension inside the laser head. The holding force is generated by the disc-springs. Additionally, temperature differences as well as vibrations have to be reduced / avoided. If one (or more) of these parameters exceeds, the consequence could be loss of optical power or even failure of the system.

CAUTION!
The fastening torque of the pedestal-screws (M6x40) is 3.5 Nm. Do not use any other screw or stronger torque. For transportation additional fixing / clamping devices are temporarily required. Temperature differences and vibrations are to be avoided.

1 cylinder head screw, M6x40
2 washer (steel)
3 disk spring package
4 plastic washer (PA)
5 spacer sleeve (aluminum)
6 cable strap (remove before using the screw package)

All necessary power supplies as well as the chiller are integrated into a 19" rack unit (on wheels).

Please discuss with your sales representative in advance if the power supplies are going to be removed from the control rack in order to be installed separately within your machine frame. This may necessitate longer control cables between the power supply units.
<table>
<thead>
<tr>
<th>Supply unit</th>
<th>Dimension (W x D x H)</th>
<th>Weight</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply P60 for Rapid 6W, Rapid 10W</td>
<td>485 x 520 x 267 mm 19 x 20.5 x 10.5 inches</td>
<td>30 kg / 66 lbs</td>
<td>6 U</td>
</tr>
<tr>
<td>Power supply P90 for Hyper Rapid 25, 50, 75, 100</td>
<td>485 x 555 x 400 mm 19 x 21.9 x 15.8 inches</td>
<td>55 kg / 121 lbs</td>
<td>9 U</td>
</tr>
<tr>
<td>Chiller P308 for Rapid 6W, Rapid 10W</td>
<td>485 x 600 x 267 mm 19 x 23.6 x 10.5 inches</td>
<td>48 kg / 106 lbs</td>
<td>6 U</td>
</tr>
<tr>
<td>Chiller P320 for Hyper Rapid 25, 50, 75, 100</td>
<td>485 x 600 x 400 mm 19 x 23.6 x 15.8 inches</td>
<td>65 kg / 143 lbs</td>
<td>9 U</td>
</tr>
<tr>
<td>External EOM controller not necessary for Rapid 10</td>
<td>485 x 420 x 132 mm 19 x 16.5 x 5.2 inches</td>
<td>9 kg / 20 lbs</td>
<td>3 U</td>
</tr>
</tbody>
</table>

$U = \text{rack unit, height of 19-inch rack, one rack unit is 1.75 inches}$

### Rack unit

Various Rack heights are available and can be chosen in case of adding or extending further supply devices or measurement tools (19-inch widths). Please let us know, if the rack is supposed to be larger than required for the present components.

<table>
<thead>
<tr>
<th>Rack unit</th>
<th>Weight (empty)</th>
<th>Height</th>
<th>Image</th>
</tr>
</thead>
</table>
| Rapid, Rapid 10 capable of containing the power supply, chiller | 29.6 kg / 65 lbs | 12 U | ![Rapid Rack](image)
| Rapid capable of containing the power supply, chiller, external EOM | 33.8 kg / 74.4 lbs | 16 U | ![Rapid Rack](image)
| Rapid capable of containing the power supply, chiller, external EOM, 5 U reserved for customer equipment | 38 kg / 84 lbs | 20 U | ![Rapid Rack](image)
| Hyper Rapid capable of containing the power supply, chiller, external EOM, 4 U reserved for customer equipment | 43.2 kg / 95 lbs | 25 U | ![Rapid Rack](image)

$U = \text{rack unit, height of 19-inch rack, one rack unit is 1.75 inches}$
We recommend to leave enough space around the rack unit for the electrical wires, water hoses, optical fibers and service access. Please ensure sufficient air ventilation is provided to allow the heat exchange from the chiller (in case of water-to-air chiller) to dissipate the thermal load.

Please keep in mind that chiller maintenance will require you to pull the chiller unit out of the control unit rack.

**Schematic design**

All control- and power supply units are located in a 19-inch rack. The connectors for cables and hoses are located at each rear side. In the following schematic all cable-connections are displayed. The configuration depends on the individual order and can deviate from the image.

For a machine integration these information might need to be taken into account:

- Laser fibers cannot be disconnected (neither from the laser head nor from the power supply).

- Connections between devices in the rack might be too short if the devices are taken out of the rack (or changed in its order). Some cables (e.g. HV cable, laser fibers) cannot be extended. Discuss this issue with your Coherent representative if necessary.

- In order to assure service and maintenance make sure that each device can be extracted out of the rack (or out of the processing-machine), that connections are long enough and can be reached for disconnecting. For example the chiller needs to be extracted to the front in order to exchange the cooling-liquid.

- The typical maximum distance between laser head and rack unit is approx.: 5.5 meters, 18 feet 3 meters, 9.8 feet.
Connecters Rapid

The connecters for the Rapid, Rapid 10 are located on the rear side of the power supply P60:

1. CPC connecter water in from laser head
2. Laser diodes with fiber coupler
3. Power connection for the monitor
4. Power connecter C20 (100-230 VAC, 50-60 Hz)
5. Mains circuit breaker
6. Mains circuit breaker
7. CPC connecter water out to chiller
8. Air outlet for fan
9 connector to S-Control
10 Circuit breaker 5 V
11 Circuit breaker 12 V
12 USB connectors of the internal computer
13 Chiller interlock connector
14 Sync A: output TTL signal approx. 0.1 μs before pulse group Asynchronized with laser pulses
15 Sync B: output TTL signal approx. 0.1 μs before pulse group Bno function
16 Monitor connector (VGA)
17 Service switch for HV power supply (remains turned on)
18 D-Sub connector – RS-232 chiller, communication interface to chiller
19 BNC-connector Gate; no function, refer to the external EOM
20 BNC-connector Trigger; The laser emits pulses according to the trigger sequence. In the software "external" must be activated
21 connector for laser head interface cable (including ground connection of the laser head)
22 D-Sub service connector. For Coherent Service only
23 Output connector for emergency exit signal for a superior machine, see section "Emergency Stop connector" on page 26
24 Circuit breaker 5 V
25 Circuit breaker 24 V
26 Circuit breaker 24 V
27 Ethernet connector
28 Output connector for shutter signal for a superior machine, see section "Interlock connector Shutter" on page 23
29 Status connector (potential-free), provides laser status signals, see section "Status connector" on page 25
30 Ground connection of the power supply
31 Timing - connector for HV switch in the laser head
32 connector for HV cable (high voltage)
Connecters Hyper Rapid

The connecters for the Hyper Rapid are located on the rear side of the power supply P90:

![Diagram of power supply P90, rear side]

**Figure 5: Power supply P90, rear side**

1. CPC connecter water in from laser head
2. Laser diodes with fiber coupler
3. Mains power cable (230 VAC, 50-60 Hz)
4. no function
5. Output connecter for emergency exit signal for a superior machine, see section "Emergency Stop connecter" on page 26
6. Mains circuit breaker
7. Mains circuit breaker
8. Circuit breaker (4 A)
9. Circuit breaker (4 A)
10. Circuit breaker +5 V
11. Circuit breaker -5 V
12. Circuit breaker 12 V
13. USB connecters of the internal computer
14 D-Sub connector – RS-232 chiller, communication interface to chiller
15 Chiller interlock connector
16 Circuit breaker 24 V
17 Ethernet connector
18 Circuit breaker 24 V
19 Sync A: output TTL signal synchronized with laser pulses
20 Sync B: no function
21 Monitor connector (VGA)
22 Ground connection of the power supply
23 Service switch for HV power supply (remains turned on)
24 Connector to S-Control
25 No function, refer to the external EOM
26 BNC-connector Trigger; The laser emits pulses according to the trigger sequence. In the software "external" must be activated.
27 Connector for laser head interface cable (including ground connection of the laser head)
28 D-Sub service connector (HV). Coherent service only
29 Power connection for the monitor
30 Output connector for shutter signal for a superior machine, see section "Interlock connector Shutter" below
31 Status connector (potential-free), provides laser status signals, see section "Status connector" on page 25
32 Timing - connector for HV switch in the laser head
33 Connector for HV cable (high voltage)
34 Desiccant cartridge
35 CPC connector water out to chiller
36 Air outlet from fans

**Interlock connector Shutter**

The IL/Shutter connector is located at the rear side of the power supply. It can be used to externally control the shutter, e.g. for monitoring a door (in case the door gets open, the shutter closes). The IL/Shutter connector is a 6-pin female circular connector (also called DIN-connector; refer to DIN EN 60130-9 / IEC 60130-9). It includes 3 different functions (refer to description below).
Pin 1 together with pin 4 can be used to realize an external interlock. Opening this chain causes the shutter to close and the laser diodes to deactivate (powering-off). The power supply and the chiller remain active. In case the Interlock is being closed again, the laser diodes remain turned off. A manual switch (off and on) is not necessary. When an active circuit is connected the polarity needs to be regarded (refer to the table). Attaching a passive switch the polarity is not relevant.

External Interlock

<table>
<thead>
<tr>
<th>Pin</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plus (+) external interlock switch</td>
</tr>
<tr>
<td>2</td>
<td>Shutter safety switch</td>
</tr>
<tr>
<td>3</td>
<td>Shutter safety switch</td>
</tr>
<tr>
<td>4</td>
<td>Minus (-) external interlock switch</td>
</tr>
<tr>
<td>5</td>
<td>Shutter push button</td>
</tr>
<tr>
<td>6</td>
<td>Shutter push button</td>
</tr>
</tbody>
</table>

NOTICE!
Take into account that the shutter is only able to be opened when the safety chain is closed. For testing purposes there is a short-cut connector (dummy) included in delivery. This one is not allowed to be used for normal operation and has to be replaced by a real safety interlock circuit.

Shutter safety switch

Pins 2 and 3: As long as these contacts are connected, the shutter can be operated. When these pins are not connected, the shutter cannot be opened or closes automatically if open. The inputs are galvanically separated.
**Shutter push button**

When Pin 5 and Pin 6 get temporary connected (e.g. with a push button) the shutter opens/closes. The signal is required to be a pulse (not a permanent signal-level). This function complies with a click of the *Shutter* in the Rapid Software. The pins are galvanically separated (potential-free).

---

**NOTICE!**

In order to implement the Interlock/Shutter circuit the adequate connector (male plug, included in delivery) can be used (alternatively: DIN 45 321 or IEC 61076-2-106). The design and implementation remains in responsibility of the customer. For further information concerning regulations of interlock chains we refer to e.g. EN11553-1 and EN60825-1. Note this as a recommendation without warranty of completeness.

---

**Status connector**

The Status connector is an interface on the back of the power supply, that can be used to output the present state of the laser system (laser diodes, shutter, interlock).

The Status connector is an 8-pin female circular connector (also called DIN-connector, refer to DIN EN 60130-9 / IEC 60130-9). The circuits are potential free (galvanically isolated). The maximum allowed electrical values at the connector are 24 V and 0.5 A.

![Figure 7: status connector (female)](image-url)
<table>
<thead>
<tr>
<th>Pin</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relay contact <strong>diodes on/off</strong>: is internally closed with pin 6, when the laser diodes are switched on (LED on power supply front side is illuminated green)</td>
</tr>
<tr>
<td>2</td>
<td>Relay contact <strong>shutter position</strong>: is internally closed with pin 4, when the shutter is open</td>
</tr>
<tr>
<td>3</td>
<td>Relay contact <strong>interlock error</strong>: is internally closed with pin 5, when an interlock error appeared (interlock circuit interrupted).</td>
</tr>
<tr>
<td>4</td>
<td>Refer to pin 2</td>
</tr>
<tr>
<td>5</td>
<td>Refer to pin 3</td>
</tr>
<tr>
<td>6</td>
<td>Refer to pin 1</td>
</tr>
<tr>
<td>7</td>
<td>No function</td>
</tr>
<tr>
<td>8</td>
<td>No function</td>
</tr>
</tbody>
</table>

**NOTICE!**
The Status connector is included in delivery. The implementation and usage of the signals remain in the responsibility of the customer.

**Emergency Stop connector**

The **Emergency Stop** connector is located at the rear side of the power supply and includes 2 coupled emergency Interlock signals (output). As soon as the Emergency Switch is pressed (power supply front side), both circuits open. This way one or two external interlock loops can be interrupted. The connection is designed for 230 V, 3 A max.

The socket is a 4 pin female circular connecter (also called DIN-connector, refer to DIN EN 60130-9 / IEC 60130-9). The circuits are potential free (galvanically isolated). The corresponding connecter belongs to the delivery.

![Figure 8: emergency stop socket (female)](image-url)
1.0.1 EOM Controller

The EOM controller is located in the laser system control-rack-unit. The rear side of the controller contains all application-relevant connectors. In order to find more information concerning the function of the EOM controller, refer to the Pre-Installation-Guide.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relay contact is internally closed with pin 2, as long as emergency switch (front side) is not activated.</td>
</tr>
<tr>
<td>2</td>
<td>refer to pin 1</td>
</tr>
<tr>
<td>3</td>
<td>Relay contact is internally closed with pin 4, as long as emergency switch (front side) is not activated.</td>
</tr>
<tr>
<td>4</td>
<td>refer to pin 3</td>
</tr>
</tbody>
</table>

Figure 9: EOM controller rear view

- **24 V DC** fuse
- **AV line** Mains connecter, 100-230 V, 50-60 Hz
  - 2 integrated fuses 230 V, 4 A, slow
- **Input** BNC connecter (input) for 5 V TTL Gate signal (internal resistance of 2 kΩ). Range: 0 - 2001000 kHz; on delivery connected to a USB port in order to constantly open the Gate. Replace the BNC cable if you want to operate the Gate.
<table>
<thead>
<tr>
<th>Modulation</th>
<th>Frontpanel Adj</th>
<th>HV level according to adjustment at front panel (max. HV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog-Mod</td>
<td>BNC (input) is activated, input signal 0 to 10 V analog, (2 kΩ terminated), external control of the output laser power (0-100%). The maximal possible switching frequency is 100 Hz. The relation between the voltage signal and the output power is not linear; residual power existing when applying 0 V signal.</td>
<td></td>
</tr>
<tr>
<td>Output connecters</td>
<td>Sync Out</td>
<td>BNC (output) monitors the electrical signal &quot;rep.-rate&quot;; pulse repetition frequency (for synchronizing external devices)</td>
</tr>
<tr>
<td></td>
<td>Pulse Monitor</td>
<td>No function</td>
</tr>
<tr>
<td></td>
<td>Overclock</td>
<td>Delivers a 5 V TTL warning signal, when the Gate switching frequency exceeds 200 kHz. Additionally the warning-lamp &quot;Overclocked&quot; (EOM controller front side) shines. No function</td>
</tr>
<tr>
<td></td>
<td>X1.0 EOM</td>
<td>Timing signal for external EOM (connected to laser head)</td>
</tr>
<tr>
<td></td>
<td>Timing</td>
<td>X4.0 To Laser head Sync signals, Gate, Trigger (connected to laser head)</td>
</tr>
<tr>
<td></td>
<td>Timing</td>
<td>X3.0 To Power Supply Timing signals (connected to &quot;Timing&quot; at the rear side of the power supply)</td>
</tr>
<tr>
<td>HV switch</td>
<td>Only for Coherent service (can remain switched on)</td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>Only for Coherent service engineers</td>
<td></td>
</tr>
<tr>
<td>X2.0 HV ext EOM</td>
<td>High voltage connector for the external HV switch (connected to laser head). <strong>Do not mismatch with the HV connector of the internal EOM (refer to cable-label).</strong></td>
<td></td>
</tr>
<tr>
<td>GND</td>
<td>ground connector</td>
<td></td>
</tr>
</tbody>
</table>

In case an external EOM is present, it must be turned on in order to operate the Laser system. Independent from the need of the high voltage, the external EOM controller has to run during laser action.

---

**Regard cable markings when connecting the electrical plugs. Do not mismatch plug connecters.**
USER signals

<table>
<thead>
<tr>
<th>Signal</th>
<th>Direction</th>
<th>Location</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GATE</td>
<td>Input</td>
<td>External EOM controller</td>
<td>TTL</td>
<td>Processing signal to turn on/off the optical laser beam</td>
</tr>
<tr>
<td>TRIGGER</td>
<td>Input</td>
<td>Power supply</td>
<td>TTL</td>
<td>Defining the optical pulse repetition rate</td>
</tr>
<tr>
<td>SYNC A,B</td>
<td>Output</td>
<td>Power supply</td>
<td>TTL</td>
<td>Signal to synchronize devices</td>
</tr>
</tbody>
</table>

Principal signal configurations

Refer to the Operator's manual (explicitly when the optional process shutter is present) for certain examples of using the application signals such as GATE, TRIGGER and SYNC.

Software simulation

In order to simulate the network connection use the test program included in this package (choose the version Rapid or Hyper Rapid). Refer to the Operator's Manual to get further descriptions. Refer to the separate document "DLL specification" for a list of software commands.

Unpacking the system on delivery

You can find instructions on how to unpack the system on top of the delivery box. The same instruction is included in this package. Please read the instructions before unpacking. Due to strongly varying weather conditions the boxes might need to acclimate before opening. Avoid condensation or frost.

Check ShockWatch and TILTWatch Indicators. Also check for any damages. Let the driver of the delivery company sign and inform Coherent Kaiserslautern GmbH.

Inspect package & product together with the transportation company. In case of any damages please report this in the shipping documents (airway bill) and inform your transportation insurance (if contracted) as well as Coherent Kaiserslautern GmbH.

The laser system might need to acclimate (over night) in ambient room temperature without opening the boxes.
Lifting the laser head

Included in the delivery are handles, which can be screwed into the laser head top in order to ensure safe transportation.

Installation

The installation is usually done by a Coherent Service engineer. We ask you to support the person by observing the information given in this document and preparing the area where the laser system is going to be located as much as possible.

Please be aware of the fact that we cannot know the on-site situation. Any information we need to have in advance in order to ensure a reliable, fast and satisfying installation are more than welcome. This could be issues like company-internal safety regulations, limited space, integration of the laser head, cable lengths, separating the power supplies, electrical plugs etc.

Check the mains voltage switch of the chiller (Rapid series). The Hyper Rapid series comes with a chiller with fixed voltage of 230V.

Warm-up time

The laser system needs a certain initialization time which can be dependent on the environment. The chiller needs 20 minutes or less in order to stabilize the system temperature.

Maintenance

- Exchanging cooling liquid, cleaning or exchanging filter (inside the chiller)
- Exchanging desiccant cartridges inside the laser head
- The laser system offers software supported maintenance to sustain the laser performance (S-Control).
- Remote access via network for the Coherent Service can be provided (if requested).

Packing the system

NOTICE!

We recommend to store the original packaging material and instructions to send the laser to other destinations or back to Coherent for service. Refer to the external document "Packing instructions" for important information concerning the preparation of shipment.