Laser Diode Collimator 48TE-SOT...

with polarization-maintaining singlemode fiber, Peltier element / thermosensor and Faraday Isolator

The 48TE-SOT... consists of three basic elements:

- Laser diode module 48TE-SOT with:
  - integrated Peltier element temperature control
  - for laser diodes with diameter 5.6 and 9 mm
  - easy to handle X/Y adjustment (see next page)
  - solderless contacts
  - optional fan 48L

- Collimation flange 48CFS
  - for system mount Ø 19.5 mm
  - collimator adjustment with indirect clamping, even with adapters

- Diode collimator 60CL...
  - focal length f’ from 2.7 mm to 8 mm
  - NA up to 0.55
  - spectral range 400 – 1800 nm

For more information, see: http://www.SuKHamburg.com/dl/ldc48te_e.pdf

Faraday Isolator (optical diode) 48FI-5...

For assembly in microbench systems, high precision through-holes for 4 parallel rod guides ensure high mechanical stability and distortion resistance of the whole system:

- isolation >30 dB
- laser beam aperture max. 5 mm
- attenuation <0.5 dB
- standard wavelengths 400 – 1080 nm

See page 57

Anamorphic Beam-shaping Optics 5AN...

Combination of cylinder lenses with integrated astigmatic correction. A focal (i.e., non-focussing) beam-shaping optics to transform the elliptical beam profile of the collimated laser diode into a nearly circular profile:

- laser beam aperture max. 6 mm
- beam-shaping factor 2, 2.5, and 3

See page 49

Mechanical Shutter 48AT...

To block the laser beam manually:

- for system mount Ø 19.5 mm
- aperture Ø 3 mm

See page 64

Laser Beam Coupler 60SMS...

Adjustable and focussable for singlemode fiber cable with FC connector:

- Inclined (8°-polish, FC-APC) or paraxial fiber-coupling axis
- focal length f’ from 2 mm to 18 mm
- NA up to 0.68
- spectral range 370 – 2300 nm

From page 9

Polarization-maintaining and Singlemode Fiber Cables PMC-... / SMC-...

- Singlemode, polarization-maintaining
- MFD 3 – 10 μm
- spectral range 400 – 1800 nm

Fiber connectors:
- FC-APC: 8°-polish of the fiber ferrule, for suppression of back-reflection into the laser source
- FC-PC: 0°-polish

From page 20

Fiber Collimators 60FC-... and Micro Focus Optics 5M...

- Fiber Collimator 60FC-... focussable, inclined or paraxial fiber coupling axis. Both beam diameter and divergence are determined by the focal length f’ of the collimating lens:
  - focal length f’ from 2.7 mm to 200 mm
  - NA up to 0.68
  - spectral range 370 – 2300 nm
  - pilot beam option
- Micro focus optics, Series 5M-... and 13M-...
  - The lens attachments for fiber collimators 60FC-... focus the collimated laser beam onto a diffraction-limited area (≤0.6 μm)

From page 33

Order Options

Laser diode beam sources are delivered fully assembled and adjusted, using laser diodes from our own stock or supplied by the client, according to customer specifications. Detailed instructions for assembly and adjustment by the user are included.

For constant laser power, the thermo-electric temperature control maintains the laser at a constant temperature and wavelength. Peltier elements establish a temperature gradient, which in magnitude and direction is regulated by the Peltier current obtained from the measured signal of the temperature sensor.
Laser Diode Collimator 48TE-SOT...

Main specifications:
- X/Y-centering of the laser diode onto the optical axis with adjustment tool 48AD
- Solderless contact using spring-contact connectors ensures laser diode is galvanically isolated from collimator module
- Integrated Peltier element and temperature sensor for thermo-electric closed-loop control of the laser diode temperature
- Peltier element provides up to 2 W of heat transfer power
- Temperature sensor: thermometer (NTC 10 kΩ)
- Separate connection cables for power supply, for the monitoring of the laser diode and temperature control
- Modular fan 48L for increased thermal transfer efficiency (12 V DC, 0.1 A power supply is not designed for use with vibration-sensitive applications)
- Compatible with microbench (30 mm pitch)
- The components are adjusted and fixed using radially located grub screws for positive locking
- An elastomere diaphragm encloses the laser diode and prevents both laser beam egress and dust ingress

Table 1: Beam parameters

<table>
<thead>
<tr>
<th>Beam parameter</th>
<th>Collimation Lens 50CL-... / 60CL-...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam-Ø 1/e² (13.5%) [mm]</td>
<td>22</td>
</tr>
<tr>
<td>Divergence [mrad]</td>
<td>0.63 0.73 0.76 0.8 0.8 0.8 0.6 0.5 0.3 0.3 0.2 0.2</td>
</tr>
<tr>
<td>Numerical aperture NA</td>
<td>0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1</td>
</tr>
<tr>
<td>Collimation lens flange</td>
<td>48CF5 48CF6</td>
</tr>
<tr>
<td>Collimation lens</td>
<td>50CL 60CL</td>
</tr>
<tr>
<td>Spectral range [nm]</td>
<td>700 - 1300 nm 1300 - 1700 nm 1300 - 1700 nm 1300 - 1700 nm 1300 - 1700 nm 1300 - 1700 nm 1300 - 1700 nm 1300 - 1700 nm 1300 - 1700 nm</td>
</tr>
<tr>
<td>Diameter [mm]</td>
<td>50 60 50 60 50 60 50 60 50</td>
</tr>
<tr>
<td>NA</td>
<td>1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0</td>
</tr>
<tr>
<td>Max. active area [mm²]</td>
<td>0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1</td>
</tr>
<tr>
<td>Lens flange Ø [mm]</td>
<td>1.9 2.7 3.4 3.9 4.3 4.8 5.2 5.7 6.2 6.7 7.2</td>
</tr>
<tr>
<td>Lens flange O [mm]</td>
<td>2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5</td>
</tr>
</tbody>
</table>

Order Codes:
- Laser Diode Module 48TE-SOT 4A
- Collimator Module 50Cl-... / 60CL-... 5A
- Adjustment Key 48AD 6A
-Faraday Isolator 48FI-5-... 7A
- Shutter 48AT-... 8A
- Fan Module Option: with or without 9A
- Internal lens focussing: a left or right turn with the eccentric key 10A
- Fiber cable length and type 11A
- Fiber collimator focus size or collimation diameter 12A
- Order Code 50AL-5.6 13A
- Assembly Key 50DL5.6 14A

Adapters for Laser Diodes Ø 5.6 mm
- Application: Laser diodes of Ø 5.6 mm size can be inserted into the slot for a Ø 9 mm laser diode without altering the active area nor position: the laser diode beam axis and the position of the emitter are unchanged.
- Adapter Order Code 50AL-5.6 1A
- Laser diode with housing Ø 5.6 mm 2A
- Retaining ring for laser diode 3A
- Adapter ring for laser diode 4A
- Collimator module 48CF5 5A
- Collimator module 48CF6 6A
- Assembly key 50DL5.6 7A

Order Options:
The 48TE-SOT laser diode collimator is supplied as a completely adjusted system consisting of laser diode module 48TE-SOT, with integrated Peltier element, diode collimator 60CL-... (50CL-...), Faraday isolator 48FI-S-... amorphous optics 5AN-..., shutter 48AT-... laser beam coupler with FC–APC connector 60SMS-... PM fiber or singlemode fiber cable PMC-.../SMD-... and fiber collimator 60FC.

On ordering, please specify:
- Laser Diode wavelength, module type and output power
- Fiber Cable length and type
- Fiber Collimator focus size or collimation diameter
- Fan module option: with or without

Please contact Schäfer+Kirchhoff for details of suitable laser diode beam sources or for laser diode collimators with other specifications.
Laser Diode Beam Source 58FCM—...
Fiber-coupled, singlemode and polarization-maintaining with FC-APC connector

- Rotational symmetric beam profile with Gaussian intensity distribution
- Singlemode fiber cable or polarization-maintaining singlemode fiber cable (polarization extinction ratio >23 dB)
- Spectral range 405 nm to 1550 nm
- Laser output power up to 70 mW
- Fiber cable with strain-relief and protective slewing (Ø 3 mm)
- FC-APC connector (B-polish) reducing power noise caused by back-reflection into the laser
- Output power adjustable using potentiometer or external voltage control input (0–2.5 V)
- AND-wired modulation inputs, analog and TTL, max. 100 kHz
- Operation mode: constant power (standard) and constant current

Laser Diode Beam Source 58FCM—...
Fiber-coupled, singlemode and polarization-maintaining with FC-APC connector

- Key switch and LED-indicator for laser operation
- Interlock connection

Electronics
- Singlemode fiber cable with FC-APC connector
- Potentiometer (reduction of laser output power)
- Cable for power supply
- Connector, ext. modulation and interlock

Accessories
- Connectors: Lumberg connector (female) according IEC 60130-9
- Type KV 60 (6-pin) for connection to interlock chain and for ext. modulation
- Order Code: BC 01 06 F
- Order Code: BC 01 03 F
- Type KV 60 (6-pin) for 5 V power supply
- Order Code: BC 01 04 F
- Type KV 40 (4-pin) for 12 V power supply

Power Supplies for 58FCM...
- Power supply for laser diode beam sources, electrically isolated, 1.5 m cable with connector (IEC60130-9 Lumberg series KV (female)).

Power Cord for Power Supplies
- 1.5 m, IEC320 female 3-pin plug, 10 A, 250 V AC IEC-connector (IEC60320) with country-specific male 3-pin plug

Table 5: Laser Diode Beam Source 58FCM...
- Laser diode beam source (see Table 6)
- Laser diode beam operation mode: constant power (standard) and constant current

Electrical Data
- Supply voltage: constant current: 5 V DC (standard) .................. C
- Max. operating current: 250 mA
- Ambient temperature range: 15–35°C
- Fiber type: 58FCM... Fiber length in cm, standard

Power Cord for Power Supplies
- DE
- US
- UK

Modulation
- The laser has two AND-wired modulation input channels, \( U_{in1} \) and \( U_{in2} \). The laser is OFF when the modulation input is open. The laser can be modulated digitally. If only one modulation input is used then the other has to be set to +5 V (see timing diagram).
- The voltage \( U_{in1} \) at all analog modulation input 1 linearly controls laser output power between 1% and 100% of the optical power set by the potentiometer.

Fiber-coupled laser sources

82 01-2017 E
Kieler Str. 212, 22525 Hamburg, Germany • Tel: +49 40 85 39 97-0 • Fax: +49 40 85 39 97-79 • info@SuKHamburg.de • www.SuKHamburg.com
**HeNe Laser with Fiber Optics**

**Singlemode and polarization-maintaining**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Power ex Fiber [mW]</td>
<td>0.7</td>
<td>0.7</td>
<td>0.35-12</td>
</tr>
<tr>
<td>Fiber-stabilized</td>
<td>-</td>
<td>-</td>
<td>yes</td>
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<tr>
<td>Price</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Universal Beam Source for Interferometry and Frequency Standards**

The Schäfter+Kirchhoff HeNe lasers and fiber optics are polarization-maintaining and provide high coupling efficiency with extremely resilient transport capabilities. A large selection of coupling lenses is provided that match the different laser beam diameters with the particular PM fiber chosen for use. Both ends of the singlemode fibers have 8°-polish (connectors Type FC-APC) in order to minimize laser back-reflection and power noise effectively.

- Coupling efficiency >75%, typically 80%
- Polarization extinction ratio >23 dB
- Fiber cable MFD = 5.8 μm, NAE = 0.07
- FC-APC type connector for coupler and fiber end (others available on request)
- Fiber-coupling solutions for HeNe lasers supplied by the customer
- Mechanical shutter or attenuator locked by a grub screw, for release by a special tool to ensure laser safety
- Electromagnetic shutter for all HeNe laser types
- Mounting brackets for stainless mounting, with shock absorbers to avoid vibration, shocks and thermal deformation: highly suitable for industrial environments
- Standard and customized power supplies

For more information and technical drawings of the laser sources, please contact Schäfter+Kirchhoff or download product information from www.SuKHamburg.com/pdf/HeNe-Laser_e.pdf

**Options**

All HeNe laser sources can be combined with following options:

- **A** Adapter flange 60A19.5-F, standard adapter
- **B** Mechanical attenuator 60A19.5-F-AT
- **C** Adapter flange with integrated shutter 60A19.5-F-S
- **D** Vibration-absorbing mounting bracket MC-MG-44.5-R
- **E** Mounting bracket with integrated flange for fiber coupling (increased long-term stability) MC-MG-44.5-F-R, standard mount
- **F** Mounting bracket with integrated flange for fiber coupling (increased long-term stability) and with steel shock absorbers MC-MG-44.5-F-S
- **G** Electromagnetic bistable shutter EMS-3-30

For more information on the shutter EMS-3-30, see page 56

- **H** Faraday Isolator 48FI-5-... , see page 57
- **I** Mechanical attenuator 48AT-A, see page 64

**Fiber-optics Accessories**

- **Page 33f**
- **Page 25**
- **Page 24**
Fiber-coupled HeNe lasers: 633, 543, 594 and 1523 nm
Output power: 0.6–28 mW ex fiber

Table 1. HeNe Laser

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
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<th>Column 7</th>
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<th>Column 9</th>
<th>Column 10</th>
<th>Column 11</th>
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<th>Column 15</th>
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<tbody>
<tr>
<td>Laser Type</td>
<td>Output Power</td>
<td>Maximum</td>
<td>Wavelength</td>
<td>Power Ex Fiber</td>
<td>Electrical</td>
<td>Laser Type</td>
<td>Power Supply</td>
<td>Power Ex Fiber</td>
<td>Power Ex Fiber</td>
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<tr>
<td>1. HeNe 633</td>
<td>3.5</td>
<td>P</td>
<td>LHP 213</td>
<td>150</td>
<td>A</td>
<td>44.5</td>
<td>310</td>
<td>3B</td>
<td>C</td>
<td>0.07</td>
<td>5.8</td>
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<td>P</td>
<td>LHP 121</td>
<td>3B</td>
<td>C</td>
<td>0.07</td>
<td>5.8</td>
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<td>P</td>
<td>LHP 213</td>
<td>35</td>
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<td>LHP 151</td>
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<td>5. HeNe 633</td>
<td>1.5</td>
<td>P</td>
<td>LHP 121</td>
<td>3B</td>
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<td>6. HeNe 633</td>
<td>0.35</td>
<td>P</td>
<td>LHP 213</td>
<td>35</td>
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<td>LHP 151</td>
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<td>C</td>
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<tr>
<td>8. HeNe 633</td>
<td>1.5</td>
<td>P</td>
<td>LHP 121</td>
<td>3B</td>
<td>C</td>
<td>0.07</td>
<td>5.8</td>
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<tr>
<td>9. HeNe 633</td>
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<td>P</td>
<td>LHP 213</td>
<td>35</td>
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</tbody>
</table>

HeNe lasers: 633 - 3.5 - P - LHP151 - 28 - A 20 - 0 - 150

Order Code 60A19.5-F-MS

Mounting Brackets and Accessories

Mounting Bracket MC-MG-44.5-R for lasers with diameter 44.5 mm / 1.75" (set of two). Elastomer shock absorbers are used for dampening of shock, vibrations and avoidance of thermal deformations. The adapter 60A19.5-F, 60A19.5-F-HT, or 60A19.5-F-S is attached to the front plate of the laser.

Mounting Bracket MC-MG-44.5-F-S for lasers with diameter 44.5 mm / 1.75" (set of two). Wire-spring shock absorbers for improved dampening of shock, vibrations and avoidance of thermal deformations in all xyz-directions. For optimum stability, the bracket MC-MG-44.5-F-S holds both laser and adapter.

Mounting Bracket MC-MG-44.5-F-R for HeNe lasers with diameter 44.5 mm/1.75" (set of two). Elastomer shock absorbers for dampening of shock, vibrations and avoidance of thermal deformations. For optimum stability, the mounting bracket MC-MG-44.5-F-R holds both laser and adapter.

Electromagnetic Shutter EMS-3-30 and shutter controller SK97120. For more information, see page 56.

Faraday Isolator 46FI-5. See page 31 for more information.

Adapters for laser beam couplers 60SMS-...

Schafter+Kirchhoff offers different adapters for attaching the laser beam couplers 60SMS-..., to a HeNe laser with a standard fitting 4x 4-40, *.

- Mounting set with screws and washers

Order Code 60A19.5-F-MS

Order Code 60A19.5-F-AT

Order Code 60A19.5-F-S

Mounting set:
Socket head screws
(similar to DIN912)
4-40 UNC x 3/8", set of 4 pcs.
with washer and hex key 3/32

Order Code 60A19.5-F-MS

Adapters and Collimators

Laser beam couplers 60SMS-...

See page 9

Fiber collimators 60FP-L...

See page 33

Fiber collimators 60FP-L...

See page 36

Mounting set:
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(similar to DIN912)
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Adapters and Collimators

Laser beam couplers 60SMS-...

See page 9

Fiber collimators 60FP-L...

See page 33

Fiber collimators 60FP-L...

See page 36

* When the laser has its own shutter, see Table 1, column 11, an external shutter is not required.

Using fiber connectors of type FC-PC with 0°-polish, even for cable output, produces back-reflections into the laser, resulting in the noisy operation of the HeNe laser.

Dimensions of Power Supplies

The HeNe lasers from Schafer+Kirchhoff are shipped with power supplies. Desktop power supplies are available for 230 V and 110 V line voltage. OEM power supplies can often be provided for HeNe lasers upon request, including 12 V DC or 230/100 V AC.

Accessories

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Socket head screws
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with washer and hex key 3/32

Order Code 60A19.5-F-MS

Adapters and Collimators

Laser beam couplers 60SMS-...

See page 9

Fiber collimators 60FP-L...

See page 33

Fiber collimators 60FP-L...

See page 36

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