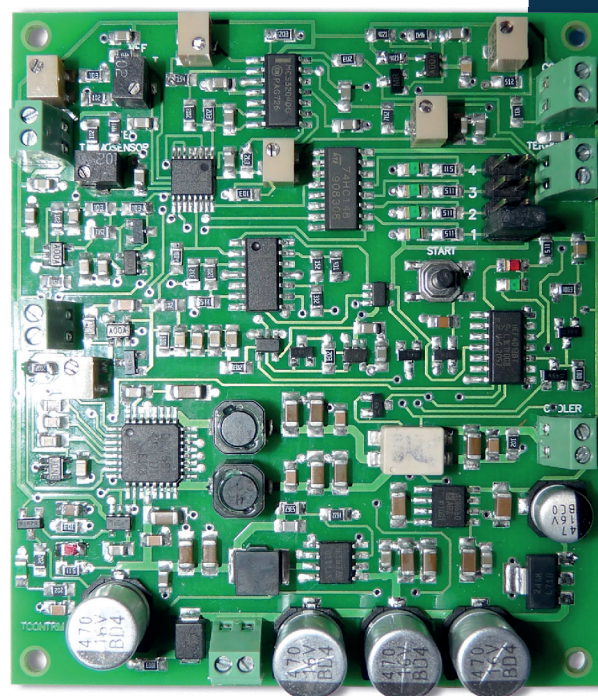


## LED Driver

Also available: unpacked LED Drivers that provide LED power supply in different pulse modes. This allows an easy set-up solution and enables quick and easy experimentation.

**LED Driver D-41** provides pulse mode operation. Using this mode it is possible to choose one of five current values (0.2, 0.6, 1.0, 1.5 and 1.9 A), select one of four frequencies (0.5, 2, 8 and 16 kHz) and choose pulse duration within four values (2, 5, 10 and 20  $\mu$ s).

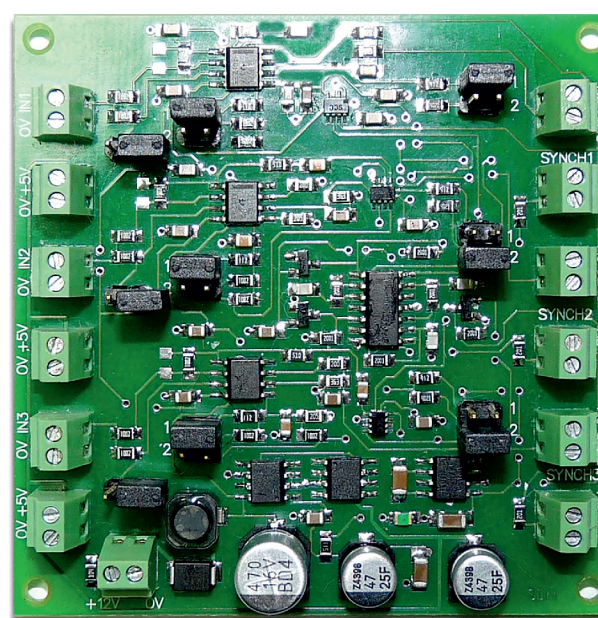
**LED Driver D-51** has the same characteristics as LED driver D-41 but features additionally temperature control. It allows to observe the intrinsic LED temperature by using the current-voltage dependency.



## SDM Synchronous Detector, NEW Thermocontroller TCM

**SDM Synchronous Detector** measures the voltage signal from the output of a photodiode preamplifier and converts it to the DC voltage signal proportional to the amplitude of voltage from the input.

**Thermocontroller TCM** is designed to control and adjust the temperature of LMSNT light-emitting diodes and photodiodes with built-in thermoelectric coolers (TEM models).



## LED Mini-Spectrometer

The **LMS-R LED Mini-Spectrometer** is ultra-compact, lightweight instrument for spectral analysis in the near-infrared range 1.3 – 2.4  $\mu$ m. It enables fast and simple measurement procedure of various samples - solids, liquids, powders.



# Frankfurt Laser Company

An den 30 Morgen 13  
61381 Friedrichsdorf  
Germany

Tel.: +49(0)6172 27978-0  
Fax: +49(0)6172 27978-10  
E-Mail: [sales@frlaserco.com](mailto:sales@frlaserco.com)  
Internet: [www.frlaserco.com](http://www.frlaserco.com)

# FRANKFURT LASER COMPANY

## Mid-IR LEDs and Photodiodes

### Frankfurt Laser Company

offers the line of MID-IR LEDs and accompanying Photodiodes. Both LEDs and PDs operate in the MID-Infrared range from 1000nm to 4500nm.

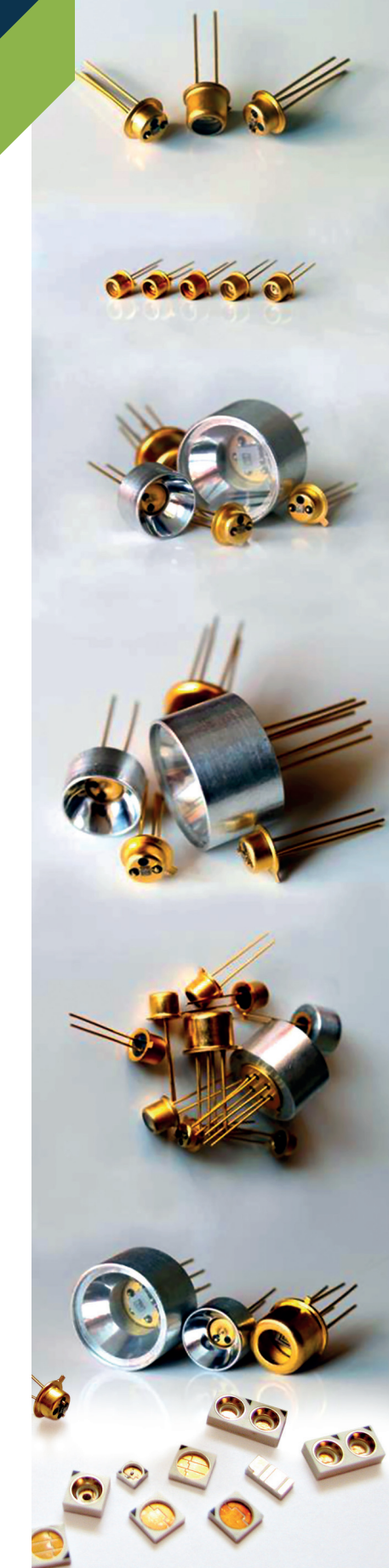
The LEDs and PDs are ideally suited for optical absorption analysis in wide temperature range from -60°C to +90°C. The main advantage of the method is virtually any sample in any state may be studied: liquid, solution, paste, powder, film, fibre, gas and surface can all be examined with the proper choice of sampling technique.

Lifetime of 80.000 hours guarantees reliable performance for many years.

LEDs can be used in qCW mode or short pulse mode to obtain either a high average or a high peak power.

### Application

- ✧ Medical Diagnostics
- ✧ Control of Technological Processes
- ✧ Thickness Measurement
- ✧ Ecological Monitoring
- ✧ Water Vapour Sensors
- ✧ Gas Sensors



[www.frlaserco.com](http://www.frlaserco.com)



Some chemical agents and their absorption bands

<b>CH<sub>4</sub></b> (Methane) 1.65 μm / 2.30 μm 3.20 - 3.45 μm	<b>CO<sub>2</sub></b> (Carbon dioxide) 2.00 μm / 2.65 μm 4.20 - 4.30 μm	<b>H<sub>2</sub>O</b> (Water) 2.65 μm / 2.85 μm 1.86 - 1.94 μm	<b>N<sub>2</sub></b> (Nitrogen) 4.00 - 4.54 μm
<b>C<sub>2</sub>H<sub>2</sub></b> (Acetylene) 2.99 - 3.09 μm	<b>HOCl</b> (Hypochlorous acid) 2.60 2.90 μm	<b>HCl</b> (Hydrogen chloride) 3.33 - 3.70 μm	<b>NH<sub>3</sub></b> (Ammonia) 2.27 μm / 2.94 μm
<b>C<sub>2</sub>H<sub>4</sub></b> (Ethylene) 3.10 - 3.40 μm	<b>HBr</b> (Hydrogen bromide) 3.70 - 4.00 μm	<b>OH</b> (Hydroxide) 2.38 - 2.63 μm	<b>NO<sup>+</sup></b> (Nitrogen oxide ion) 4.08 - 4.44 μm
<b>C<sub>2</sub>H<sub>6</sub></b> (Ethane) 3.30 μm	<b>HI</b> (Hydrogen iodide) 2.27 - 2.30 μm	<b>H<sub>2</sub>CO</b> (Formaldehyde) 3.38 - 3.70 μm	<b>HNO<sub>3</sub></b> (Nitric acid) 5.74 - 5.98 μm
<b>CH<sub>3</sub>Cl</b> (Methyl chloride) 3.22 - 3.38 μm	<b>H<sub>2</sub>S</b> (Hydrogen sulfide) 2.50 - 2.80 μm 3.70 - 4.40 μm	<b>CO</b> (Carbon monoxide) 2.24 μm 4.40 - 4.80 μm	<b>NO<sub>2</sub></b> (Nitrogen dioxide) 3.40 μm
<b>OCS</b> (Carbonyl sulfide) 3.45 μm / 4.87 μm	<b>HCN</b> (Hydrogen cyanide) 2.94 - 3.10 μm	<b>HO<sub>2</sub></b> (Hydroperoxyl) 2.73 - 3.10 μm	<b>SO<sub>2</sub></b> (Sulfur dioxide) 4.00 μm
<b>C<sub>2</sub>H<sub>2</sub>Cl<sub>2</sub></b> (Dichloroethene) 2.50 - 2.86 μm	<b>CHBr<sub>3</sub></b> (Bromoform) 2.39 μm / 3.29 μm	<b>C<sub>2</sub>H<sub>4</sub>Cl<sub>2</sub></b> (Dichloroethane) 3.23 - 3.51 μm	<b>C<sub>2</sub>H<sub>2</sub>Cl<sub>2</sub></b> (Dichloroethene) 2.50 - 2.86 μm
<b>C<sub>2</sub>HCl<sub>3</sub></b> (Trichloroethylene) 3.22 - 3.25 μm 4.20 - 4.35 μm	<b>H<sub>2</sub>O<sub>2</sub></b> (Hydrogen peroxide) 3.70 - 3.85 μm 4.17 - 4.35 μm	<b>HF</b> (Hydrogen fluoride) 2.33 - 2.78 μm 4.17 - 4.43 μm	<b>C<sub>6</sub>H<sub>6</sub></b> (Benzene) 2.44 - 2.47 μm 3.17 - 3.33 μm

#### Application

- ✧ Medical Diagnostics
- ✧ Control of Technological Processes
- ✧ Thickness Measurement
- ✧ Ecological Monitoring
- ✧ Water Vapour Sensors
- ✧ Gas Sensors

There are strong absorption bands of many chemical agents at the mid-infrared spectral range that allows their detection with sensor devices based on **LED-PD optopairs** or using **LMSNT PDs** in combination with other sources of infrared radiation. Some of these chemical agents and their absorption bands are presented here:

#### Mid-IR LEDs (LED chip with circular or ring top contact) with wavelength ranges (μm)

1.80-1.89	1.90-1.99	2.00-2.09	2.10-2.19	2.20-2.29	2.30-2.39	3.30-3.49	3.70-3.84	3.95-4.09	4.10-4.30	4.40-4.60
LED-18	LED-19	LED-20	LED-21	LED-22	LED-23	LED-34	LED-38	LED-41	LED-43	LED-46

#### Mid-IR flip-chip bonded LEDs (LED chip top surface is free of contacts) with wavelength ranges (μm)

1.60-1.69	1.70-1.79	1.80-1.89	1.90-1.99	2.00-2.09	2.10-2.19	2.20-2.29	2.30-2.37	3.30-3.49	3.65-3.79
LED-16	FCLED-17	FCLED-18	FCLED-19	FCLED-20	FCLED-21	FCLED-22	FCLED-23	FCLED-34	FCLED-37FC

### Photodiodes for detecting radiation in the Mid-IR with wavelengths ranges (μm)

The **Photodiodes** are also available with preamplifier (-PA) working in photovoltaic mode (with zero bias). The current generated by the photodiode is amplified and converted by the preamplifier into a voltage signal. There is linear correspondence between photodiode current and resulting output voltage. The signal converted by the preamplifier will have the same form, frequency and pulse duration as the photocurrent signal from photodiode. The pre-amplified photodiodes are equipped with a parabolic reflector and packaged in an aluminum tube for protection and screening.

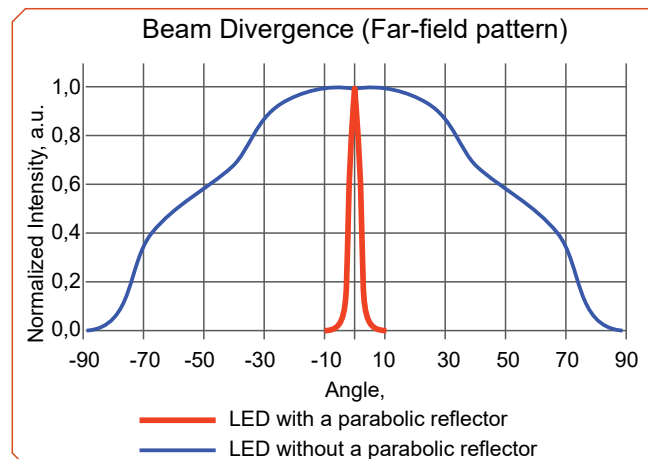


1.20 - 2.40	1.10 - 2.45	3.10 - 3.60	1.50 - 3.60	3.20 - 4.80
PD 24-03 / PD 24-03-PA	PD 24-05 / PD 24-05-PA	PD 36-03 / PD 36-03-PA	PD 36-05 / PD 36-05-PA	PD 43-03 / PD 43-03-PA

#### Available Packages

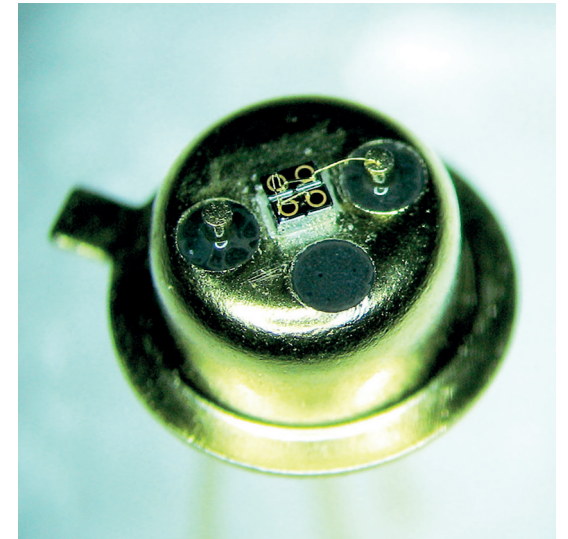
- TO-18 with cap / without glass window
- TO-18 with parabolic reflector / without glass window
- TO-18 with parabolic reflector / with glass window
- TO-5 with TEC / with cap / with glass window
- TO-5 with TEC / with parabolic reflector / with glass window

The parabolic reflector decreases the beam divergence of LEDs respectively increases the light gathering power of Photodiodes.

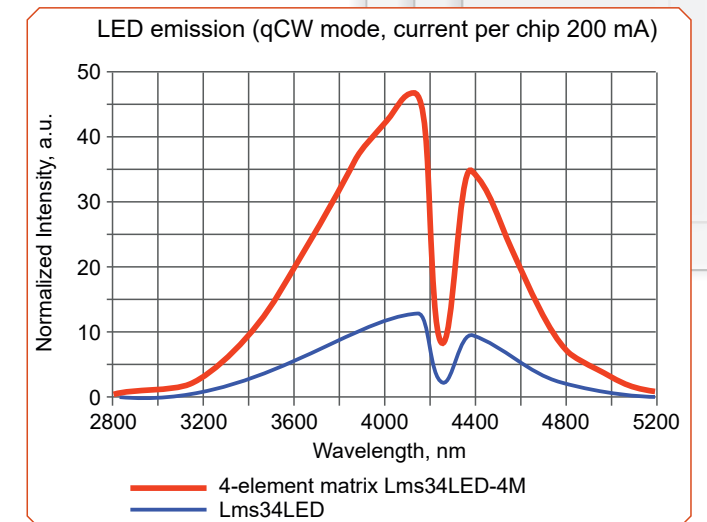
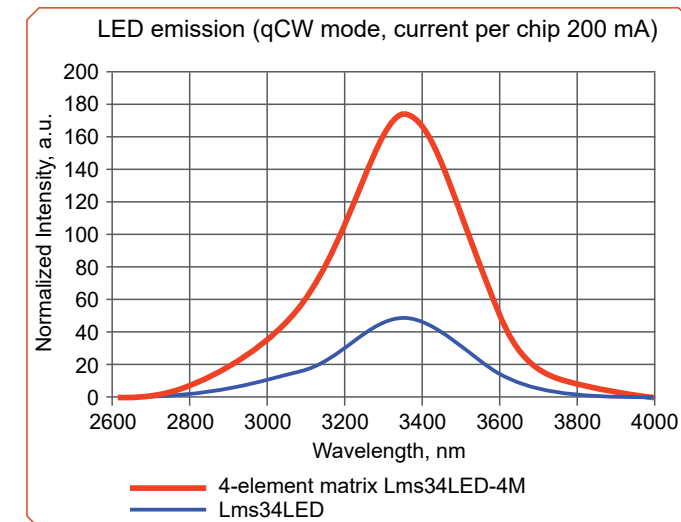


### Multi-Element LED Matrix

The **LED matrix** is a kind of an array of similar or different **LED-chips** mounted in a single compact package and driven together or individually. Matrix is a powerful radiation source for portable optical analysing systems.



Parallel connection of several LED chips that emit at the same wavelength and driving them together can provide significant increase of total optical power. FLC offers a 4-element LED matrix with one peak wavelength at 3.4 μm or 4.3 μm.



Connecting LED chips that emit at different wavelengths and driving them individually, or applying short current pulses sequentially to each chip, enables scanning of a certain spectral range with the help of a very compact radiation source. FLC offers a 6-element multi-wavelength LED matrix with peak wavelengths at 1.8, 1.9, 2.0, 2.1, 2.2 and 2.3 μm.

