

# Laboratory table-top laser drilling and micromachining system

Models LDMS-22FS / LDMS-22SM

The laser drilling / micromachining system is used for drilling / micromachining holes in gasket material and preparing samples and sample environments for Diamond Anvil Cell and other experiments. The system is based on a pulsed laser with <math><500\text{ ps}</math> pulse duration, maximum pulse energy of  $\sim 80$  microjoules up to 1,000 Hz (option to 5,000 Hz for heavier and cleaner micromachining). Short laser pulse duration allows ablating materials without thermal melting, thus leaving a clean edge after drilling (with proper post-processing). With optics designed for a tight focus (down to 7-8 micrometers), the machine can drill holes of down to  $\sim 8$  micrometers in diameter and larger (in thin gaskets). The system can be provided with either fixed magnification 10x camera or with 12x zoom Navitar microscope for better flexibility.

The system is provided with an environmental chamber allowing drilling / micromachining operations in sealed or active flow inert atmosphere. The laser drilling / micromachining system allows drilling non-conductive materials such as amorphous boron and silicon carbide gaskets, diamond, oxides and many other materials including organic materials (e.g. kapton). The machine can also be used for sample cutting and for making engineered samples. The system is easy to operate, fully remote-controlled, enclosed as a Class-I laser for safe operation, and has a precise sample alignment system with user friendly interface.

The system is available in two frame sizes – full sized LDMS-22FS (easier to upgrade) and compact LDMS-22SM (takes less desk space). In basic configuration the performance of these systems is identical.

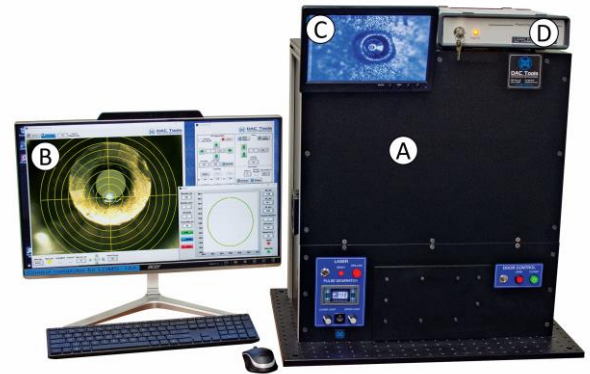


Figure 1. LDMS-22FS system components: A - laser machining system enclosure / main unit; B - control computer; C - low magnification overview monitor; D - laser power supply.

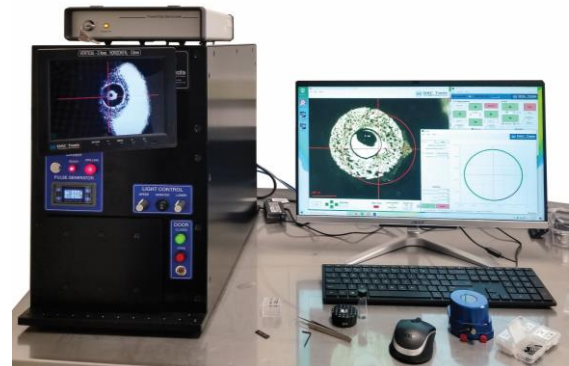


Figure 2. LDMS-22SM system in compact frame.

- User friendly Class 1 laser system
- Sturdy and low maintenance, very easy to operate
- Versatile – can micro-machine any material
- Fast – drilling of an average gasket hole typically takes about a minute or less
- Environment control chambers (sealed and active flow operations)
- Short pulse – ablates, does not melt
- Very large dynamic range of laser power and laser frequency

# Specifications of the Laser Drilling and Micro Machining system

## Models LDMS-22FS / LDMS-22SM

| Main System specifications   | Laser  |
|--|--|
| Size (W-D-H, approx.): ~61 x 46 x 60 cm (FS)<br>~31 x 61 x 48 cm (SM)                                    | Manufacturer: Teem Photonics                   |
| Weight (approx.): ~73 / 68 kg (FS/SM)  | Model: PNP-M08010-120<br>PNP-M05550-120 (opt.) |
| Frame: >25 mm anodized aluminum  | Wavelength: 1064 nm                            |
| Protective Panels: >3 mm thick black anodized aluminum   | Energy per pulse: >80 $\mu$ J                  |
| Sample compartment: Motorized  | Average power: >80 mW (>400 mW opt.)           |
| Number of cameras: 2 (10x and ~1X mag. 12x zoom optional.)   | Repetition rate: 1 - 1000 Hz (5,000 Hz opt.)   |
| Operating voltage: 110-250 V, 50-60 Hz   | Pulse length: <500 ps                          |
| Additional equipment: - Laser power supply<br>- Control computer<br>- Low-magnification overview monitor | Peak power: >160 kW (>800 kW opt.)             |
|  | Short-term stability: < 1%                     |
|  | Long-term stability: 3%                        |
|  | Beam profile: Gaussian TEM00                   |
|  | Beam divergence: $2.0 \pm 0.5$ mrad            |
|  | Beam ellipticity: <1.3                         |
|  | Beam focus: <10 $\mu$ m (7-8 typ.)             |
|  | Objective lens: Mitutoyo 10x PlanAPO NIR       |
|  | Objective WD: 30.5 mm                          |
|  | Operating temperature: 20-35 $^{\circ}$ C      |
|  | Maximum power consumption: <120 W              |
|  | Warranty: 1 year                               |
| <b>Positioning stages</b>  |  |
| X-Y-Z stages: Newport MFA stages<br>Optional PIMag and DC  |  |
| Travel range: 25x25 mm (MFA)   |  |
| Minimum step: ~300 nm (0.3 $\mu$ m)  |  |
| Driver/controller: AllMotion EZ4AXIS   |  |
| Control Software: DAC Tools in-house custom software   |  |

*Note: The exact specifications and dimensions are subject to change. Possible changes are aimed to optimize and improve the system performance.*

*WARRANTY – This product is warranted to be free of defects in material and workmanship for one (1) year from date of purchase. This warranty is limited to the correction of any such defect, or the replacement of any such defective item, provided that: (a) item was/were purchased from DAC Tools LLC; (b) we are properly notified and consent to the return of the item(s) in question; (c) the item(s) is/are returned with proof of purchase date; and (d) it is found upon inspection by us that the item(s) is/are defective as noted above. This warranty does not cover labor costs, consequential damages, nor does it apply to any item(s) that have been improperly installed, overloaded, altered, or otherwise abused by the customer, its agent(s) or employee(s).*