

1. Overview

The LDS 200M is based on the MicroJet® technology to accomplish two tasks:

- singulation of copper embedded LED devices,
dicing of copper foils on sapphire substrate
- cutting of copper layer on sapphire abstrate.
dicing of standalone copper foils

It has the advantages of both a high-power pulsed laser and a hair-thin water jet: the laser is used for ablation, and the water jet is used for guiding the laser light, cooling the edges and preventing the sample from particle contamination.

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1.1 LDS 200M System

The LDS 200M SYNOVA laser system is a high precision material working station based on the water jet guided laser technology patented by SYNOVA , described in more details in section 1.1.6. It consists in four main components (see figure 1.1) listed below, that will be described in more details in the following sections.

- **basic machine:** it consists of a two axes CNC machine mounted on a granit base accessed by a door equipped with a laser protecting window. The basic machine also contain the electrical cabinet, control panel, utility connections and exhaust. A light stack is mounted on top of the cabin for warning personnel when the laser is turned on.

- **Laser MicroJet (LMJ):** the water-jet-guided laser ablates material by thermal heating, in the form of cutting, drilling, grooving or structuring. It is driven by the optical head (section 1.2) along with a fast, automatic, high-resolution vision module, allowing the alignment of the laser on the work piece with μm precision without the operator's intervention.
- **software:** based on Windows 2000E, the HMI provides the interface between the CNC program, the operator and the machine. A touchscreen control panel is attached to the basic machine.
- **utilities:** the pump providing the pressure for the water jet is a **WANDFLUH High-Pressure Pump Microjet #3** (see appendix ??), the laser beam is produced by a **LDP-200MQG diode-pumped LEE LASER** (see appendix ??), a cleaning station (REF) and a chiller **PC69.01 KE-S** (see appendix ??).

1.1.1 X-Y axes

The LDS 200M is a 2-axis machine consisting in two linear rails mounted on a granite base for thermal and mechanical stability, controlled by a linear motor and encoder. The optical head moves along the y-axis, and the workpiece along the x-axis, as shown on figure 1.2.

1.1.2 Cutting parameters

In this section the specifications of the LDS 200M are summarized; the complete specifications can be found in chapter ??. UPDATE

type of machine	: HLS 300 (Hybrid Laser System)
precision	: $\pm \mu\text{m}$ over whole working area
working area	: 200×200 mm
nozzle	: 40 μm diamond
LASER wavelength	: green (532 nm)
model	: LDP-200MQG diode-pumped LEE LASER
average power	: used at 20W (100W rated max power)
repetition rate	: used at 40kHz (operation range 10-50kHz)
optic fiber diameter	: 150 μm
pump model	: WANDFLUH High-Pressure Pump Microjet #3
pressure	: 250 bar, max 1 L/min

1.1.3 Utilities

The LDS 200M can work with different types of pumps and laser sources depending on the application. In this section a brief presentation of the **WANDFLUH High-Pressure Pump Microjet #3** and **LDP-200MQG diode-pumped LEE LASER** is given. The operator is referred to appendices ?? and ?? for more details.