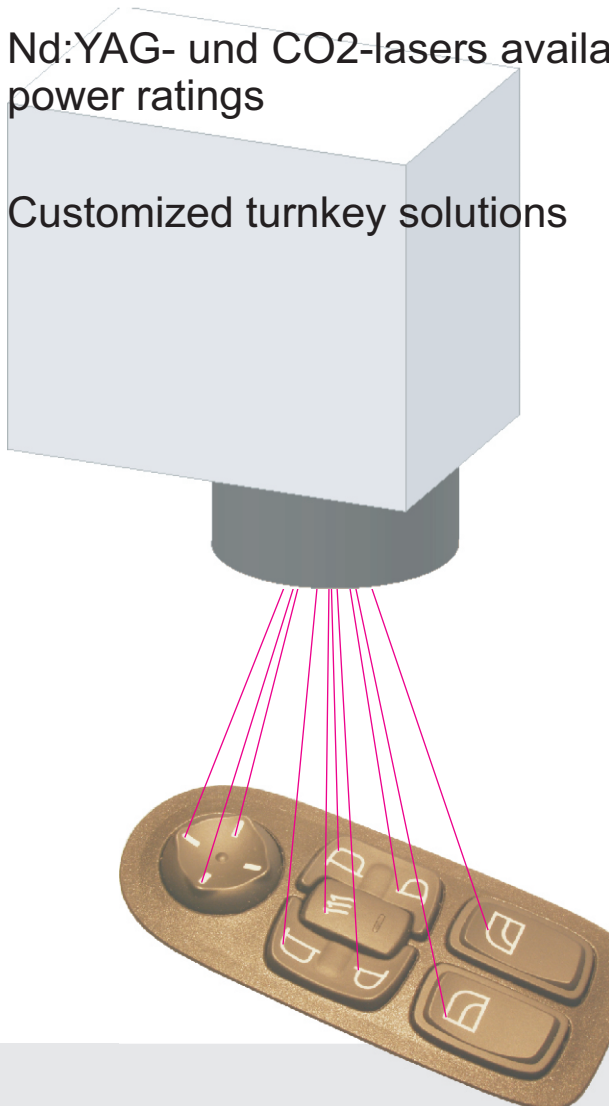


# Laser Marking

## Fast and high quality marking

- Flexible, efficient und universal
- Laser scanner with high resolution and free of distortion
- Nd:YAG- und CO<sub>2</sub>-lasers available with different power ratings
- Customized turnkey solutions



## Principle

Laser-marking is a thermal process, where a focussed laser beam with high intensity is used, in order to change the surface or the inside of a more or less transparent material. To achieve this, laser light of a certain wave length must be absorbed by the material, which thereby changes its color.

From a practical standpoint the laser can be seen as a light source which emits a sharply focussed beam with an extremely high power density.

For the marking process the high power density and the small focus point of the laser is very important.

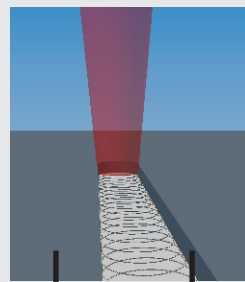
It must be differentiated between two principal methods

- Direct marking of the material of the workpiece and
- marking of a label.

To minimize cost direct marking is preferred in most cases. But the technological requirements are higher in this case than with labels, which are specially designed for laser marking.

## Process

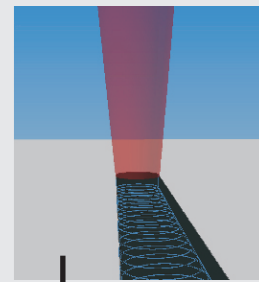
**Marking process:  
Removal of material (engraving)**



Coating (laser absorbing)  
Base material (reflecting)

Coated materials can be marked by removing the coating. When removing the coating (e.g. on anodized aluminium) or painted metals the laser beam does not interact with the base material. It is reflected by the base material. Polymers can easily be marked by removal of the thin upper layer of a multilayer coating. A typical example is the removal of the black painting on knobs, switches and other elements in day/night design. Metals, ceramics and some types of polymers can be engraved by the Laser. For this application the power density of the laser beam must be so high, that the material vaporizes within few nanoseconds.

**Marking process:  
Color change of the material**



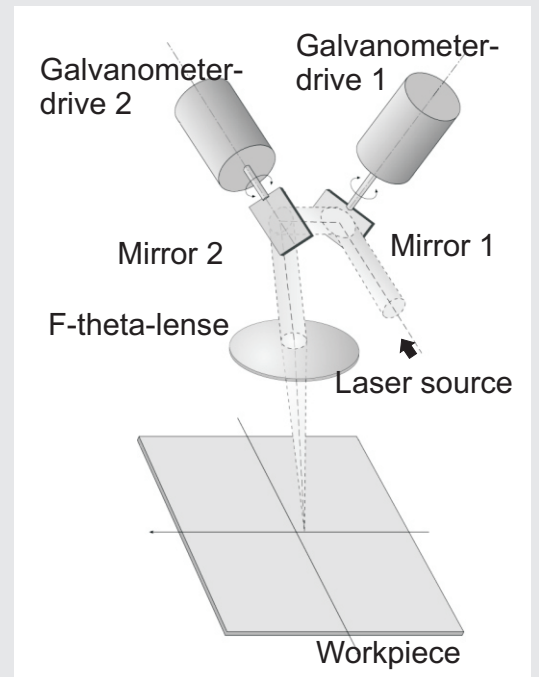
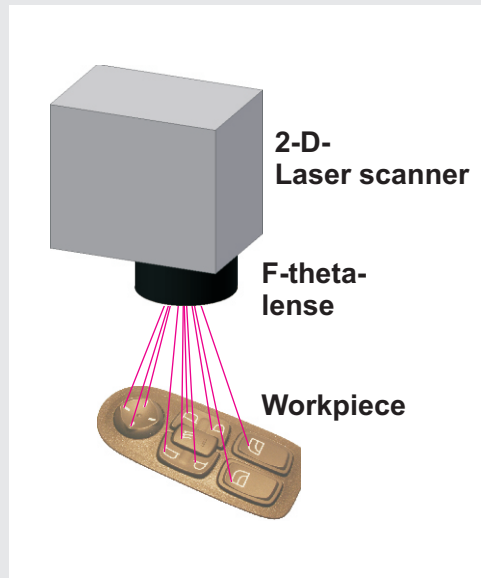
Base material (laser absorbing)  
Material changes color

On the workpiece the area where the laser is applied, material is removed and an engraving remains. In many cases there is also a change in color and/or structure of the surface. This gives additional contrast to the engraving and improves readability. Because of its beam profile the laser penetrates the surface with the shape of a cone. At the edge of the focused laser beam we see material melting which causes a rough surface. The extend of this effect depends on the material, the pulse energy and above all from the spot size of the focussed laser beam.

## Laser-application

Laser marking systems have four main components:

- Laser source,
- Laserscanner with F-Theta-Lense,
- Controller (IPC) with operating software und
- machine hardware.



The laser beam can be pointed to any position using a scanner with two galvanometer driven rotating mirrors. The laser beam keeps focused in a constant level in z-direction. The rotating mirrors have an extremely high acceleration and speed. Thus the laser beam can be moved rapidly to produce almost any kind of marking within seconds.

## Laser types

For laser marking applications two major laser types are established:

- Nd-YAG laser und
- CO<sup>2</sup>-laser.

The Nd-YAG laser has a larger application range. Modern Nd-YAG laser are diode pumped. The laser crystal has the form of a cylinder.

In Wolf laser marking systems diode pumped disc lasers are applied. The beam quality of this laser type is significantly higher. The high absorption rate of metals at a wave length of 1064 nm enables this laser type to mark metals.

The CO<sup>2</sup>-laser is not applicable for metals. The attractive pricing and very low maintenance costs make this laser still interesting for laser marking of plastics or PCB's. The absorption rate of these materials is high at the wavelength of 10640 nm.

This is even the case for acryl transparent material, which can be laser marked. Wolf laser marking systems feature CO<sup>2</sup>-Lasers from Synrad.



Jenoptik Nd-YAG disc laser



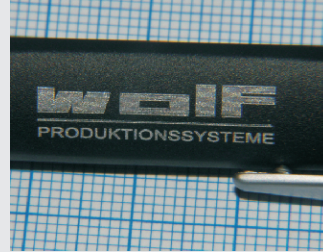
Synrad CO<sup>2</sup>-laser

## Applications

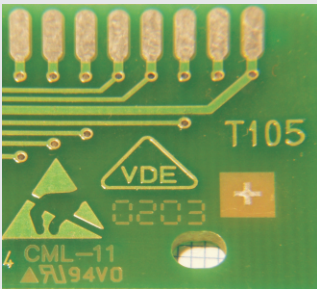
There are almost no limits to laser marking:  
It can be used for metals and polymers.



Marking of machine labels.  
Even the marking of yellow colored labels is possible.



Marking of aluminium by  
removal of the black  
painting.



Marking of printed circuit  
boards by removal of the  
solder stop coating.



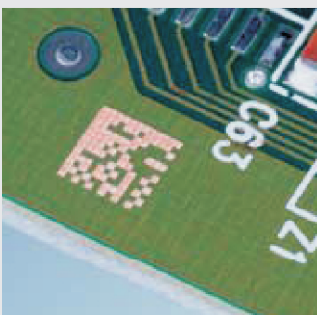
Marking of polymer by  
removal of the black  
painting (day/night design).



Marking of stainless steel.



Marking of casted and  
anodized aluminium by  
removal of the upper layer.



Marking of printed circuit  
boards by removal of the  
solder stop coating on the  
copper layer.



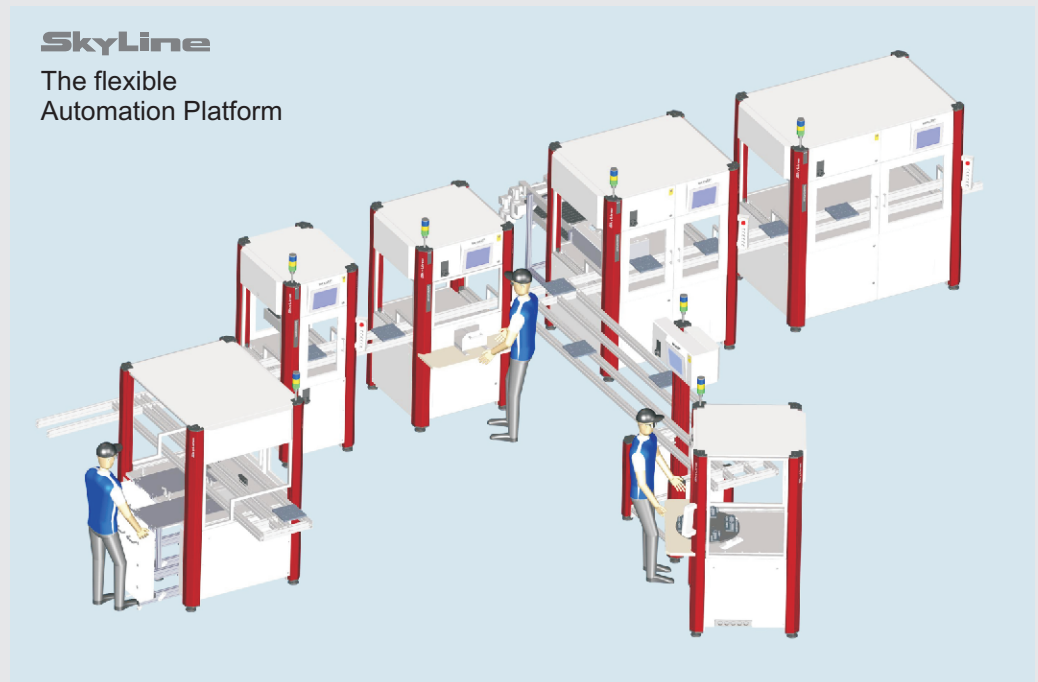
Marking of plastic by  
carbonizing the polymer to  
black color.

## Machine-solutions

Laser marking machines are part of the Wolf flexible automation platform "Skyline".

With Skyline a wide range of customized solutions are possible. Laser marking machines are available as autonomous manual workplaces with round-table as well as fully automatic in-line machines. They can be adapted to any transfer system and integrated in any existing transfer line.

With Skyline a laser marking system can be one module of a complete assembly system with various process steps before and after the laser marking process. The control system of Wolf laser marking machines can be interfaced to the Wolf machine management system (WAMS).



## Basic-Machine



The basic machine is with a width of 750 mm very compact and does not need much floor space. The footprint is optimized to be integrated in transfer lines.

The man machine interface features a TFT color screen and professional sealed keyboard with trackball.

The machine has safety features to reach laser class 1 at the outside.



Wolf laser marking machines use high quality components such as scan heads from Scanlab.

## Process- development

The successful high quality series production requires a perfect process development. We take process responsibility.

**wolf**  
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- Special Soldering
- Assembly Automation
- Laser Processing

At our works we have a large laboratory area for tests and process development. Machines for any process in the wolf program are ready to be used for test runs or small batch production of pre-series. In certain cases even job shop production is possible.

All necessary devices for test and analysis such as microscopes and automatic vision systems are present.



Laser marking tests are documented in a detailed report which can be part of the specifications for a custom made turnkey marking machine.