Which laser for plastic decoration?

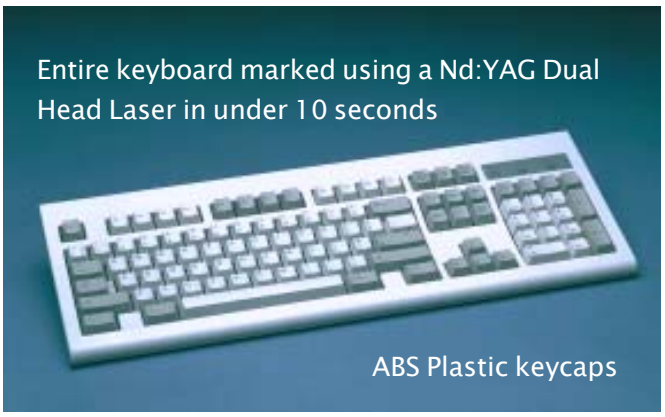
Rofin-Baasel Inc.

Today there are many reasons for choosing laser marking for decorating plastics. But choosing the right laser source for your application requires a more careful analysis.

It was in the early Eighties that some of the first laser markers were installed for marking plastics. Today, advances in laser pumping technology are combined with several concurrent trends: a society that requires ready access to information; resins and additives formulated for high-contrast laser marks; more stringent environmental regulations; and more user friendly laser systems. All these provide strong arguments for choosing laser marking for decorating plastics. But because there are so many more lasers to choose from today, selecting the right laser source for your application requires a more careful analysis.

Today, you can choose from a wide array of laser sources, power levels and beam-delivery mechanisms to decorate your plastic pars. To narrow your search, you can almost certainly assume a stroke-style beam delivery, as it is the most versatile and common delivery mechanism for laser systems used to mark both metals and non-metals. Additionally, one must decide between one deflection head versus two . With two deflection heads it is possible to split the laser beam and mark two parts simultaneously resulting in twice the throughput but with the operating cost of a single laser. If you select a single deflection head design then the laser output power needs only be one half of what is required for a dual head configuration.

PowerLine E II Air; fully air-cooled solid-state laser marker, ideal for plastic decoration

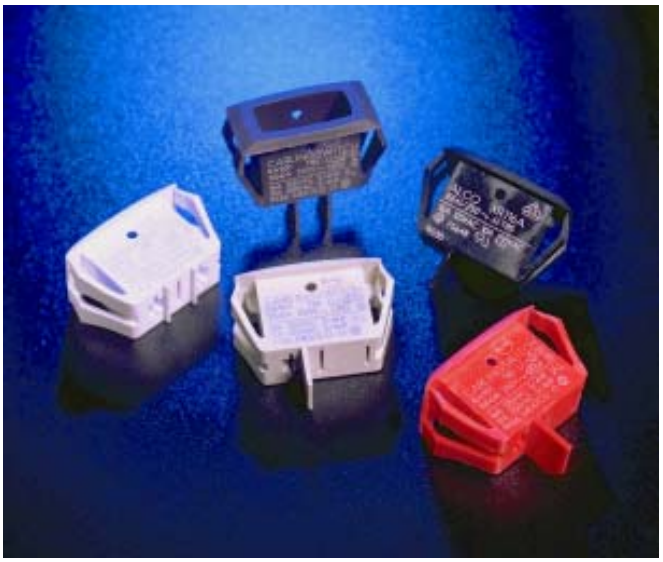


Choice of laser source

The next choice is not as easy: which laser source is best suited for marking your particular range of plastic parts? You can choose from frequency quadrupled, tripled, doubled or fundamental Nd:YAG lasers end pumped with laser diodes, short pulse Vanadate ($Nd:YVO_4$) lasers or the more conventional long-pulse, lamp-pumped Nd:YAG lasers or sealed CO_2 gas lasers. Another style that is gaining in popularity is the diode-pumped Nd:YAG where an array of laser diodes replaces the lamp to achieve higher conversion efficiency and longer intervals between maintenance.

If you want a color change mark then you should consider a laser in the UV to near Infrared spectrum. The CO_2 gas laser with a wavelength of 10640nm (mid infrared) tends to engrave with little or no color change in most thermo plastics. In considering the use of an end-pumped laser you should know what throughput is required and what additional mark requirements are mandatory. For example, if you must achieve a high contrasting mark with no measurable surface disruption and shallow penetration into the material then a frequency quadrupled or tripled laser may be well suited. This is true provided the low output power of this style of laser meets your throughput objectives.

For most thermoplastics, the choice is between the lamp-pumped and diode-pumped Nd:YAG lasers. The power range of the lamp-pump version is 65–150 watts whereas the diode-pumped configuration ranges from 3–100 watts. The lamp-pumped units all require external water-cooling, whereas, the diode-pumped units (up to 100 watts) are avaialble in air or water cooled configurations. The choice between these two types becomes primarily one of cooling preference, economics and maintainability. If scheduled maintenance every 600 to 800 hours is acceptable then you will find the lamp-pumped systems yield the highest throughput for the least amount of investment. If you can achieve the desired mark with a 3-60 watt diode-pumped unit then over a five year period the cost of ownership for the diode-pumped unit will be less than the comparable lamp-pumped unit. This is based in part on the projected volume increase in diode-pumped systems bringing down the cost for replacement diode stacks.



Agency logos and part information laser marked on nylon of various colors. Components marked in under 1 second per part using Nd:YAG Laser.

Example of lamp-pumped Nd:YAG laser system (StarMark Performance)

As the acceptance of lasers for decorating plastics increases, so does the choice of laser systems and new challenges for the manufacturers of plastic parts. The combination of the most suitable laser system and resin formulation is helping transform these challenges into exciting opportunities.

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