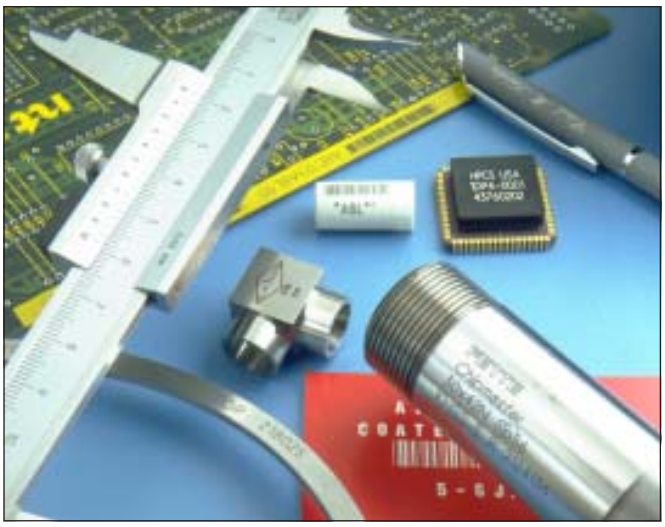
rofin
LASER MARKING

Laser Marking—Reliable, Safe, Permanent

The ability of today's manufacturer to track a component throughout its manufacturing, sales, and service cycles is of the utmost importance

Experts in the field of manufacturing and materials believe that barely 20% of the potential applications for laser technology in materials processing have been exploited to date. The arguments in favor of lasers are strong. Laser techniques are inherently non-contact, so the material being processed is not stressed by mechanical forces, or dimensionally altered. Lasers are fast, versatile, and highly reliable. Teamed up with computer control, they are extremely flexible and efficient in an automated manufacturing environment.

Laser marking is a non-contact, non-force technique, so that there is no wear and tear on the "tool", which is the laser beam itself, constantly replenished by the conversion of electrical energy into light energy. The fact that the laser tool does not deteriorate guarantees consistently high quality and lower operating costs.



Laser marking has many advantages, particularly in applying batch, type, or series markings to tools, components and subassemblies

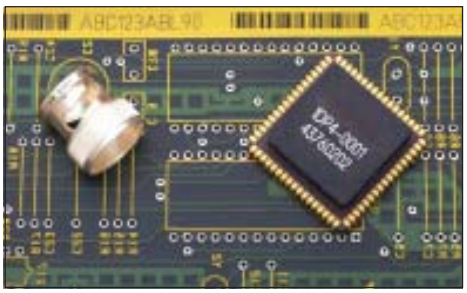
In all aspects, laser marking compares favorably with other methods used for component identification. Laser mark are virtually indestructible and cannot be falsified.

Of all the many reasons companies choose laser marking, the most compelling are:

Precision. Lasers are used for precise marking on calipers and other measuring tools. Graphics are generated by precise CAD-based tools, such as Rofin-Baasel's LaserCAD editor.

Traceability. ID marks (bar codes, 2D matrix codes, graphics) are of critical importance to industries such as auto-motive, aerospace, electronics, and medicine.

Flexibility. Lasers put consistent marks on a wide range of materials and sur-



Laser marked characters provide critical information on these electronic components—Necessary for permanent traceability

Laser marks the legends directly into the plastic on this keyboard, marked in its entirety in under 20 seconds!

Logo and text marked in a circumference with the ease of LaserCAD™ and VisualLaserMarker Graphical User Interface for Windows®

faces. Windows-based laser programs support linear, circular, angular, circumferential marking, and a variety of scalable fonts.

Readability. High-resolution, high-contrast markings can be etched into coated or uncoated plastic parts of varying colors with equal clarity, minimum tooling and no cleanup. Back-lit technology applies ultra-sharp characters to ensure fast recognition and location for viewing under any lighting condition.

Wear Resistance. A laser can mark directly into the material, eliminating the problem of wear (example: Keyboards). Manufacturers rely on lasers for deep marking of virtually all metals, such as engine parts.

Safety. Laser marking is an environmentally-benign process, requiring no solvents nor caustic chemicals.

And **Legibility, Clarity, Product Recognition, Performance, and Versatility.** These are the main reasons today's manufacturers turn to lasers for marking their products.

Rofin-Baasel designs and manufactures laser systems for a wide variety of applications in materials processing:

- marking (ceramics, plastics, glass, metal, wafers and ICs)
- drilling (ceramics, plastics, metal)
- engraving (ceramics, rubber)
- solder reflow (computer memories, multi-layer pc-boards)
- surface hardening (high-carbon steel, castings)
- perforating (plastics, paper)
- cutting (ceramics, plas-tics, metal, paper, com-posites, fabric)
- welding (metal, plastics)
- trimming (electronic components)
- 3-D structuring (poly-mers & powders)
- laser CVD (chemical vapor deposition)

The company also manufactures and supplies a range of components and assemblies like fiber optics, measuring devices, instruments, power supplies, optics, computer controller and beam delivery and directing systems.

Laser background in brief

A laser device generates an intense, directed and coherent beam of light. By contrast, normal daylight is an incoherent mixture of wavelengths at different frequencies. The word 'laser' is an acronym for light amplification by stimulated emission of radiation.

Interaction between light and material, like absorption or spontaneous emission, has interested scientists for centuries. In 1917 Albert Einstein described the theory behind stimulated emission. The idea for a laser device was developed in 1954 by Townes and Basov and in 1960 Ted Maiman built the first laser, using a ruby crystal excited by a flash lamp to produce the laser beam.

Today's laser substances are not only solid state crystals, but also include gases and liquids. All lasers work on the same basic principles. A laser consists of a laser substance (solid state) or medium (gas or liquid), an energy source (pump) and a laser resonator, in its simplest form an optical path defined by two mirrors.

An energy source pumps electrons in the lasing medium to a certain energy level, so that when they return to a lower level of excitation, photons are emitted. Different lasing media produce different wavelengths

Laser-marked fuel tank and trunk release levers molded in plastic retain their color and strength despite long-term exposure to sunlight, and bear high-contrast markings which will not wear off despite years of use.

and all produce monochromatic light. The light waves are then reflected back and forth between the two mirrors on the resonator. This has the effect of amplifying the light energy and lining it up in parallel and in phase to produce the intense and coherent light which is what makes a laser a modern tool with many uses.

Of the two resonator mirrors, the rear mirror reflects almost all the laser light, while the output mirror reflects part of the light and outputs the rest. This output is the laser beam, which can be focused, directed and controlled with great precision.

The laser marking systems used in the production of computer keyboards operate with a 65 W Nd:YAG laser as the energy source. The Nd:YAG crystal is a compound widely used in solid-state lasers and stands for neodymium: yttrium aluminum garnet, i.e., the garnet crystal is composed of the elements yttrium and aluminum. Neodymium (Nd) is a rare earth with which the YAG crystal is doped (about 1 atomic percent). The Nd atoms are the actual photon source for the laser beam; the YAG crystal acts as the carrier, or host.

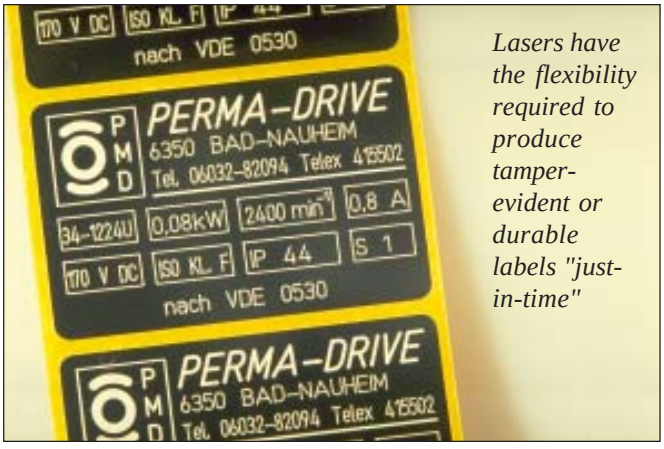
Working closely with customers – from development to service

Throughout the design, development, engineering and manufacturing process, we work closely with our customers. Typically, customers come to us with a need or an idea for a laser application, together with samples and production requirements.

Our applications specialists select the appropriate techniques and processes, and our systems engineers design the system in close consultation with the customer throughout. Before installation on customer premises, Rofin-Baasel service engineers assemble and test the system to full performance specifications at our Acton plant. We offer comprehensive training courses for operators and maintenance personnel.

Rofin-Baasel designs and manufactures complete, turnkey, standard or customized laser systems. Complete operating software to exact customer specifications is always included. Our product line includes Nd:YAG lamp pumped and diode-pumped solid-state lasers and CO_2 (carbon dioxide) gas lasers. Modular construction of the laser heads and the system hardware optimizes adaptation to each application.

After two coats of paint and laser marking, a transparent plastic shape has become a finished car radio front panel in Day and Night design. Inherently a non-contact process, the laser beam vaporizes parts of the black paint layer, exposing the white layer underneath as letters, numbers or graphics.



Lasers have the flexibility required to produce tamper-evident or durable labels "just-in-time"

Computer-programmable laser systems such as the StarMark® UW-150 Class 1 laser marking system from Rofin-Baasel, speed changes in and reduce the cost of marking parts

©ROFIN-BAASEL 2001 RB52.0

Rofin-Baasel Inc.
68 Barnum Road
Devens, MA USA 01434-3508

Devens Tel.: +(978) 635-9100
Devens Fax: +(978) 635-9199
Info@rofin-baasel.com; www.rofin.com

Rofin-Baasel Inc.
1565 West University Dr., Suite 101
Tempe, AZ USA 85281

Tempe Tel.: +(480) 777-1199
Tempe Fax: +(602) 532-7981

ROFIN-BAASEL INC