HELIUM NEON LASER APPLICATIONS

The helium neon laser is utilized in more applications than any other type of laser. The uses are diverse and depend on one or more of the unique properties of the laser to do their job. Uses range from simple pointing devices that require a basic spot of light as a visible indicator, to applications such as the sorting of blood cells in a piece of analytical instrumentation.

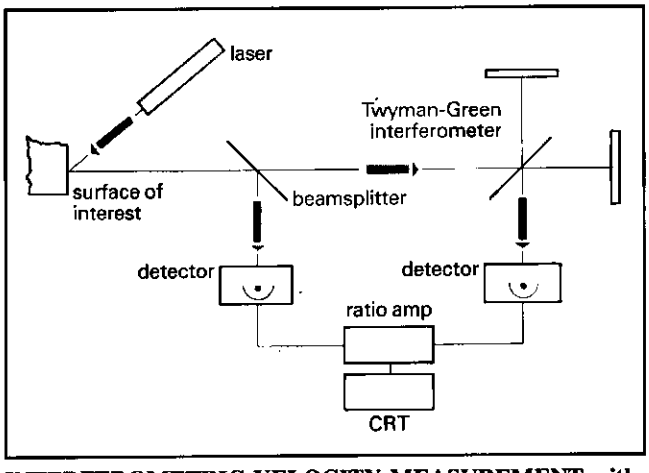
The following list of applications is provided to serve as examples of the kinds of things that helium neon lasers are being used for today. The list is not meant to be definitive; there are many, many other applications that we have not mentioned. But those that we have included indicate the broad range of uses that are available — and may help you to imagine new and exciting applications of your own.

INTERFEROMETRY

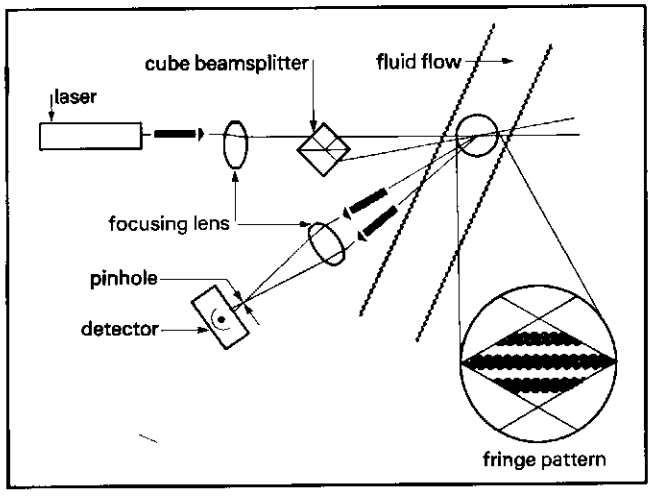
If one property were to be singled out that sets laser light apart from conventional sources, it would have to be coherence. This coherence, which can be orders of magnitude greater than from other sources, leads to many interference related applications.

Laser interferometry (usually with helium neon lasers) is used to measure the flatness and physical dimensions of objects and also distances between objects. By monitoring Doppler shifted interference patterns, velocities can be measured remotely, including fluid velocities. This technique, coupled with fiber optic technology, is used in medicine to measure blood flow rates in major vessels.

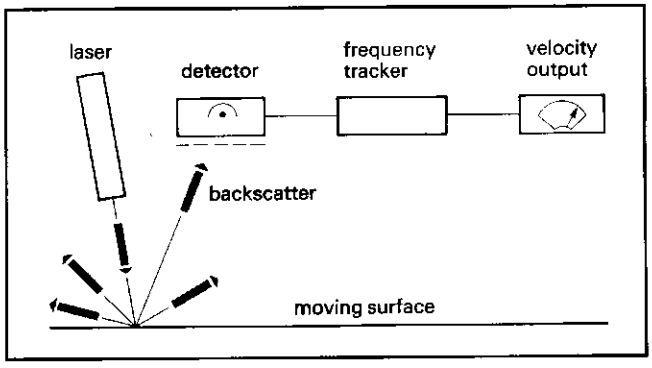
Holography, which was barely possible with the limited coherence of atomic lamps, has become one of the more spectacular uses of laser light. This is the technique in which an interference pattern is recorded in a photographic plate in such a way that a three dimensional virtual image and often an additional real image are recreated when a reference beam is incident on the plate.



INTERFEROMETRIC VELOCITY MEASUREMENT without fringe counting. Field brightness in stationary interference pattern correlates directly with constant survace velocity component in the direction of the interferometer.



DOPPLER SHIFT FLUID VELOCITY MEASUREMENT. The frequency shift of the scattered radiation is measured by heterodyne methods.

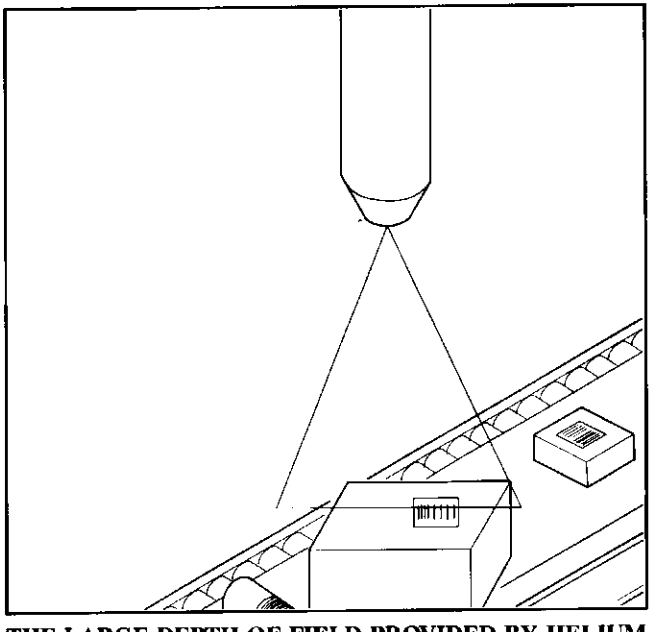


TANGETIAL VELOCITY COMPONENT MEASUREMENT for a moving surface via laser backscatter and speckle.

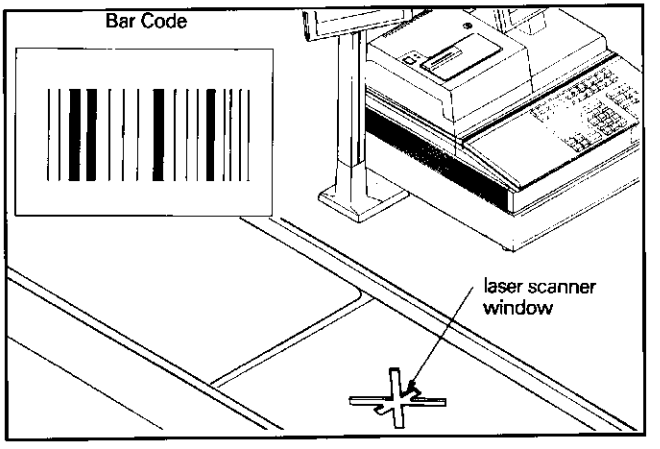
BAR CODE READING

Bar code reading applications may be broken down into two principal areas; industrial and point-of-sale. In each of these applications a helium neon laser is usually used to scan and read the printed bar code.

In industrial applications the laser bar code reader provides a low cost method of positively identifying, sorting and controlling inventories of all types of products. Food, commercial and industrial warehouses and distribution centers depend on accurate unit identification and control for efficient and cost-effective operation. In these applications the reader is positioned above or beside a conveyor system running at speeds of about 400 to 600 feet per minute. The articles to be scanned are passed by the reader, the bar codes are scanned, and the identified items are then routed to their proper destination. The helium neon readers have a large physical depth of field reading capability — which is not the case with other types of reader. As a result a single reader/conveyor system can be used to read a large variety of items of different size, shape and distance from the reader.



THE LARGE DEPTH OF FIELD PROVIDED BY HELIUM NEON BAR CODE READERS make them well suited to conveyor line and inventory applications.



THE UNIFIED PRODUCT CODE is a series of dark bars separated by space which encode numeric product identification material.

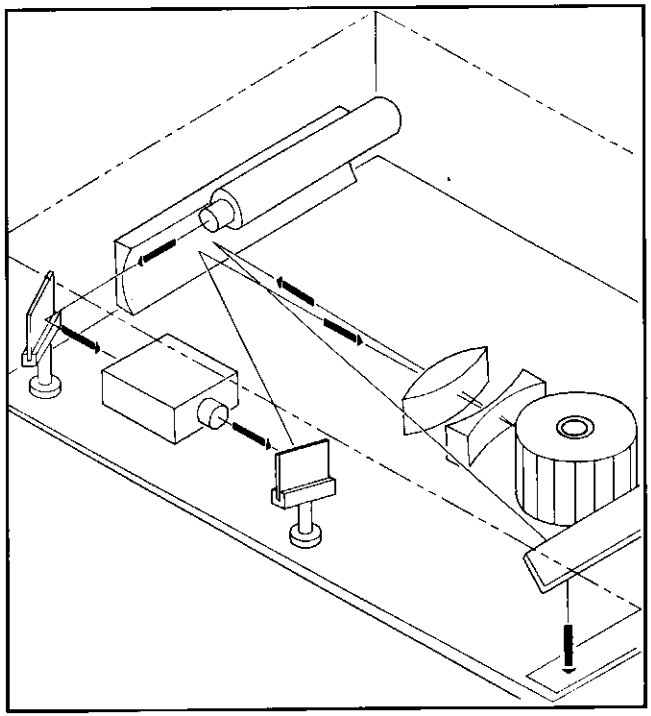
Probably the most widely known application of helium neon lasers is the check-out counter at your local supermarket. Tens of thousands of helium neon lasers are sold for this application alone. The laser scanner commonly used for this application is known as a 'slot-scanner'. The name comes from the opening in the counter, which corresponds to the outline of the pattern generated by the scanned laser beam. Much like the industrial scanner, the point-of-sale model has provided a multitude of benefits to the food marketing industry. Since the grocery business deals with immense volumes of perishable and date-stamped commodities, tightly controlled inventories are extremely important. The bar code reader provides instantaneous feedback from the check-out lane to the warehouse and allows real-time control of fast and slow moving items.

To understand how the bar code reader works, one must know more about the bar code itself. There are several different kinds of bar code presently being used throughout the world, but the best known is the Uniform Product Code (or as commonly known, the 'UPC' code). This code is basically numeric, and the data is stored as a series of black bars and spaces. The data is extracted from the label by scanning it at a known rate in a number of predetermined directions. A detector, in proximity to the laser, measures the reflected light from the label. The ratio and frequency of the returned signal is such that one of the directions falls within pre-determined logic levels built in to the detector system. This information is decoded and transmitted to the central control processor.

LASER PRINTING

The printing and computer industries have seen the development of a great variety of devices for printing in the last few years. One of the most exciting (and visually pleasing) is the laser printer. These devices now frequently use a helium neon laser as a writing device which is made permanent by a modification of the Xerographic copying technique. In this process, the graphic and text images are written on a positively charged photo-receptor with the helium neon laser beam. The laser beam is X-Y traversed over the surface of the photo-receptor while the beam is being turned on and off at a high frequency by an acousto-optical modulator, thereby tracing out the image.

Since the laser writes directly to the photo-receptor surface, the sensitivity of the receptor material is very important. Early laser printers used either blue or blue/green lasers because of the sensitivity limitations of photo-sensitive materials at that time. Because of recent advances in photo- sensitive materials a majority of the medium to high-speed laser printers presently use helium neon lasers.



LASER PRINTERS USING HELIUM NEON LASERS are fast, compact and reliable.

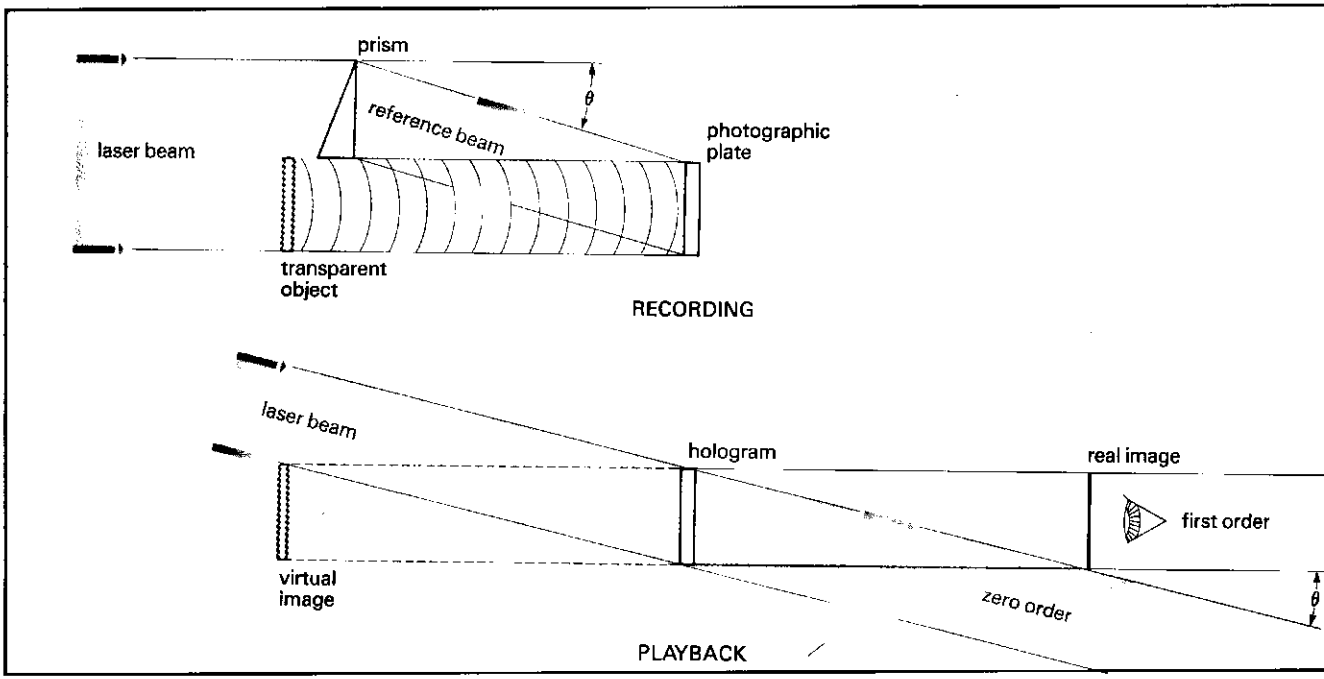
POINTING AND OTHER APPLICATIONS

Many uses of laser beams stem from the ability to point a beam at distant objects without significant loss in intensity. Although laser light is naturally divergent, it can be fairly well collimated to give a beam which is pseudo-parallel over useful distances. Helium neon lasers in particular are often used merely as pointers, and together with more powerful lasers such as krypton ion and argon ion, are now used commonly to create spectacular light displays for entertainment purposes. In various branches of engineering, helium neon lasers are used extensively to define an alignment axis by a collimated visible beam, or to define a plane when spread into a fan of light by suitable optics. Such applications include construction, civil engineering, surveying, and even machining. For precision alignment, the beam center can be located very accurately by a quadrant detector, due to the invariance of beam profile symmetry with propagation.

Over the past decade a number of applications have been developed using the helium neon laser in the processing of lumber. In the two principal applications the laser is used as a visible light source for both alignment and optical scanning. The result is a more accurate method of processing lumber resulting in both increased yield and utilization and reduced costs.

Prior to the actual cutting, each log is processed by a piece of equipment known as an optimizer. This system scans the log to be cut optically to determine the most efficient way to proceed with the cutting. The log is routed through a series of scanned laser beams. The resulting information on the size and 3-dimensional shape of the log is captured by a photo-sensitive detector array. This information is then fed to a microprocessor which determines the most effective way to cut the log.

Following the scan procedure, the log is then passed to the cutting area where it is positioned under a bank of helium neon lasers fitted with cylindrical optics. The output is a series of long, parallel, visible lines along the surface of the log. Since these lines are aligned with the direction to the saw's table motion, the log can be aligned to the system for maximum performance.

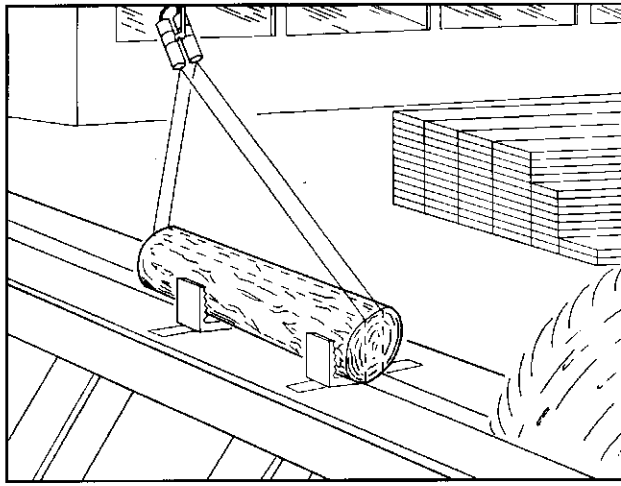


EXPERIMENTAL ARRANGEMENTS FOR HOLOGRAPHIC RECORDING AND PLAYBACK. This simple arrangement require transparent object. To reconstruct or playback the virtual image, a laser beam is directed through the hologram (in the absence of t object) at the same angle as the reference beam used in recording. The beam is reversed to obtain the real image of the object.

In this application the red helium neon laser is the preferred device because its beam may be projected over long distances without fading, and because it is highly visible under ambient lighting conditions.

Helium neon laser beams are often used as aiming devices for higher power surgical CO_2 and Nd:YAG lasers. The beams of the visible and I-R lasers are aligned so that they are coaxial and all positioning adjustments may be made prior to turning on the higher power device. When working in highly vascular areas the red HeNe beam is often hard to see. In these cases the Melles Griot green helium neon laser offers improved visibility.

Melles Griot's Applications Engineers are trained and experienced in a wide range of HeNe applications — contact them for assistance.



RED HELIUM NEON LASERS provide a bright, highly vi ble line to assist in aligning large logs in a sawmill.