

LASER PROGRAM

L.1 Miniature laser module with integrated HV power supply

A compact sealed-off nitrogen laser module measuring only 145mm x 75mm x 50mm has been developed. The module contains a sealed-off metal-ceramic N₂ laser tube, developed in-house, with pre-aligned cavity mirror and output coupler. The laser module is self-contained with all the high voltage circuitry and spark gap, also developed in-house, and integrated in the module. This laser module requires a 12V dc power supply for its operation. The photograph (fig. L.1.1) shows the laser operating from a 12Volt nickel-metal hydride rechargeable battery pack.



Fig. L.1.1 Micro N₂ Laser

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L.2 Laser aided land-leveling system

A laser beam due to its high directionality and low divergence serves as a ready reference for a straight line. If this beam is scanned in 360°, a laser plane is generated, which can be used as a reference for various leveling applications. In most leveling applications this reference plane would have to be orthogonal to the local plumb line. This is achieved by suspending the laser, so that it is plumb and a plane is swept out by a rotating penta-prism. This set-up ensures that the generated laser plane is always orthogonal to the local plumb and serves as a reference for leveling land for agriculture, civil construction, road and rail laying etc. This can also be used for leveling poured concrete in building construction. If the suspended laser is tilted from the plumb by a small angle θ , the generated plane is also tilted by an angle θ from the horizontal and can serve as a reference plane to level land to various grades.

The system consists of a laser plane generator or the scanner unit, a scale mounted sensor unit for initial surveying and a tractor mounted sensor and controller unit

for controlling the scrapper bucket to automatically level land. The control unit can be modified, appropriately to control earth movers and road and rail laying machines.

Scanner unit : The scanner unit is shown in fig. L.2.1 (a), which is mounted on a tripod. The unit is coarsely leveled using the leveling screws, a bulls-eye spirit level mounted on the tripod aids leveling. The unit consists of a flexure suspended diode laser module with a large pendulum mass. When the unit is coarsely leveled to $\pm 5^\circ$ the laser is under free suspension and is plumb. A penta-prism mounted on a precision rotating platform with the axis co-axial to the laser beam scans out a laser plane. Since the laser is plumb and the penta-prism reflects the laser by 90°, the generated plane is exactly horizontal.



Fig. L.2.1 Scanner and Scale unit

The central part of the unit is the window through which the scanned laser beam emerges. The bottom portion contains the precision rotating platform with the motor drive, the ON/OFF key and the battery socket. The portion above the window contains the pendulum suspended laser module. The laser used is a semiconductor diode laser, which is compact and consumes very little power. The scanner unit as a whole consumes 2watt and runs on a rechargeable battery pack capable of powering the unit for 10hrs of continuous operation.