## ABSTRAK

Dalam era modern ini, teknologi *Computer Numerical Control (CNC)* telah menjadi bagian penting dari berbagai industri, terutama dalam proses manufaktur yang memerlukan akurasi tinggi. Secara khusus, dalam konteks pembuatan mesin *CNC* kali ini, teknologi *CNC* digunakan untuk mengendalikan operasi pemotongan dan pengukiran dengan menggunakan sinar *laser diode*. Penelitian ini bertujuan untuk merancang dan membangun mesin *CNC Laser Diode* berukuran besar yang dapat digunakan untuk proses *cutting* dan *engraving*. Proses perancangan dimulai dengan menentukan spesifikasi teknis yang dibutuhkan, termasuk dimensi area kerja dengan ukuran 99cm x 45cm, perangkat *laser diode*, serta sistem kontrol dan mekanisme gerak. Perancangan awal melibatkan pembuatan desain 3D menggunakan *software* Autodesk Fusion 360, serta pemilihan komponen mekanik dan elektrik seperti aluminium *profile t-slot, rel linear, pulley, motor stepper*, MKS DLC32, *LCD, driver motor,* dan *power supply*. Tahap berikutnya adalah pembuatan dan perakitan fisik mesin, yang mencakup pencetakan komponen menggunakan 3D *printer*, pengukuran dan pengecekan spesifikasi, serta perakitan mekanikal dan elektrikal sesuai dengan desain awal. Setelah kontruksi mesin *laser tree diode* terbentuk, tahap selanjutnya adalah pengujian. Pada tahap ini ada beberapa pengujian yang dilakukan, seperti pengujian elektronika, pengujian posisi kerja, pengujian hasil waktu dan pengujian hasil cetak. Setelah berbagai pengujian dilakukan dapat diketahui bahwa mesin *CNC laser diode large format* mampu memotong berbagai bahan seperti akrilik hitam 5mm, triplek 5mm, dan kayu mdf 3mm dengan hasil potong yang cukup akurat. Mesin ini juga dapat melakukan *engraving* terhadap berbagai bahan tersebut sama baiknya dengan *cutting*. Namun, mesin laser ini belum dapat memotong akrilik berwarna terang atau transparan karena sinar laser diode lebih efektif diserap oleh material berwarna gelap. Hal ini disebabkan oleh interaksi sinar laser dengan material yang cenderung menyerap lebih banyak energi cahaya pada material berwarna gelap dibandingkan material berwarna terang atau transparan.



**Kata kunci:** *Computer Numeric Control, Laser Diode, Cutting, Engraving*

***ABSTRACT***

*In this modern era, technology Computer Numerical Control (CNC) has become an important part of various industries, especially in manufacturing processes that require high accuracy. Specifically, in the context of machine building CNC this time, technology CNC used to control cutting and engraving operations using light laser diode. This research aims to design and build machines CNC laser diode large size that can be used for processing cutting and engraving. This machine is expected to meet the needs of small and medium industries that require efficient, economical and flexible equipment. The design process begins by determining the required technical specifications, including working area dimensions of 99cm x 45cm, strength laser diode, as well as control systems and movement mechanisms. Initial design involves creating a 3D design using software Autodesk Fusion 360, as well as selection of mechanical and electrical components such as aluminum profile t-slot, rel linear, pulley, motor stepper, MKS DLC32, LCD, driver motor, and power supply. The next stage is the physical manufacture and assembly of the machine, which includes 3D printing of components printer, measuring and checking specifications, as well as mechanical and electrical assembly according to the initial design. After machine construction laser tree diode formed, the next stage is testing. At this stage, several tests are carried out, such as electronics testing, working position testing, time results testing and printing results testing. After various tests carried out it can be seen that the CNC machine laser diode large format capable of cutting various materials such as 5mm black acrylic, 5mm plywood, and 3mm mdf wood with fairly accurate cutting results. This machine can also do engraving against these various materials equally well cutting. However, this laser machine cannot cut light colored or transparent acrylic because diode laser light is more effectively absorbed by dark colored materials. This is caused by the interaction of the laser beam with the material which tends to absorb more light energy in dark colored materials compared to light colored or transparent materials.*

***Keywords:*** *Computer Numeric Control, Laser Diode, Cutting, Engraving*