

Abstract

This project consists of designing, building, and testing a device that measures the inner diameter of a 5-gallon bucket. This project includes a design to meet the customer needs by:

- increasing the accuracy of the measurements recorded by employing distance lasers in the design
- ensuring functionality of the device by collecting data quickly and recording data within a specified tolerance
- measuring safely with no additional PPE required and with no sharp edges or exposed wires

Customer Needs and Requirements

Accuracy

- All ID measurements must record data within a tolerance of +/- 0.010 in.

Functional Requirements

- Prototype can repeat measurement 5 times without a changed output
- Data collection must take under 30 seconds

Safety

- No extra PPE (Personal Protective Equipment) is required to run the product
- All electrical wires are secured and covered
- The prototype will have no sharp edges and proper safety guarding where necessary

Concept Selection



PLC



Frame



Electrical Panel



Stepper Motor

Accuracy

- Keyence LK-H157 laser heads
- Stepper motor & motor controller

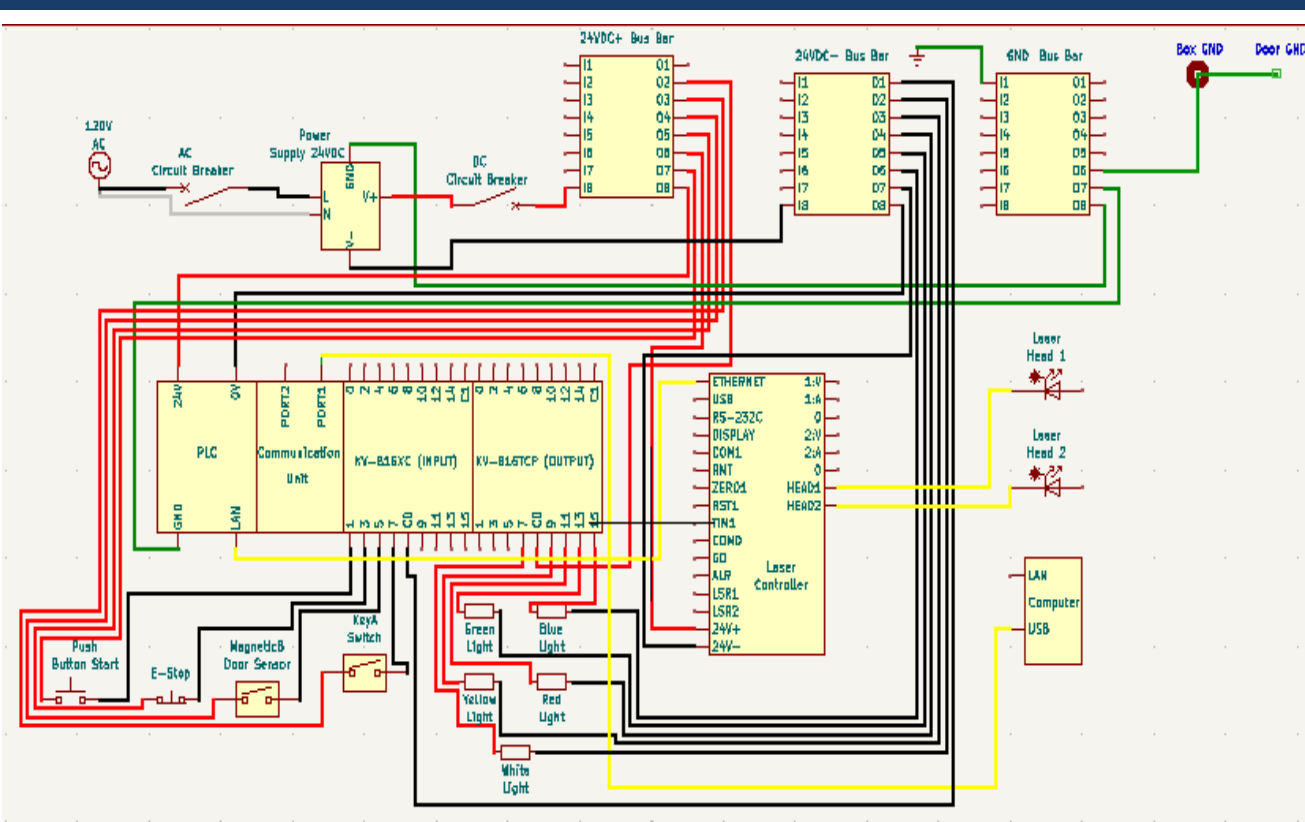
Functional

- Keyence LK-G5001P laser controller
- Keyence KV-8000A PLC

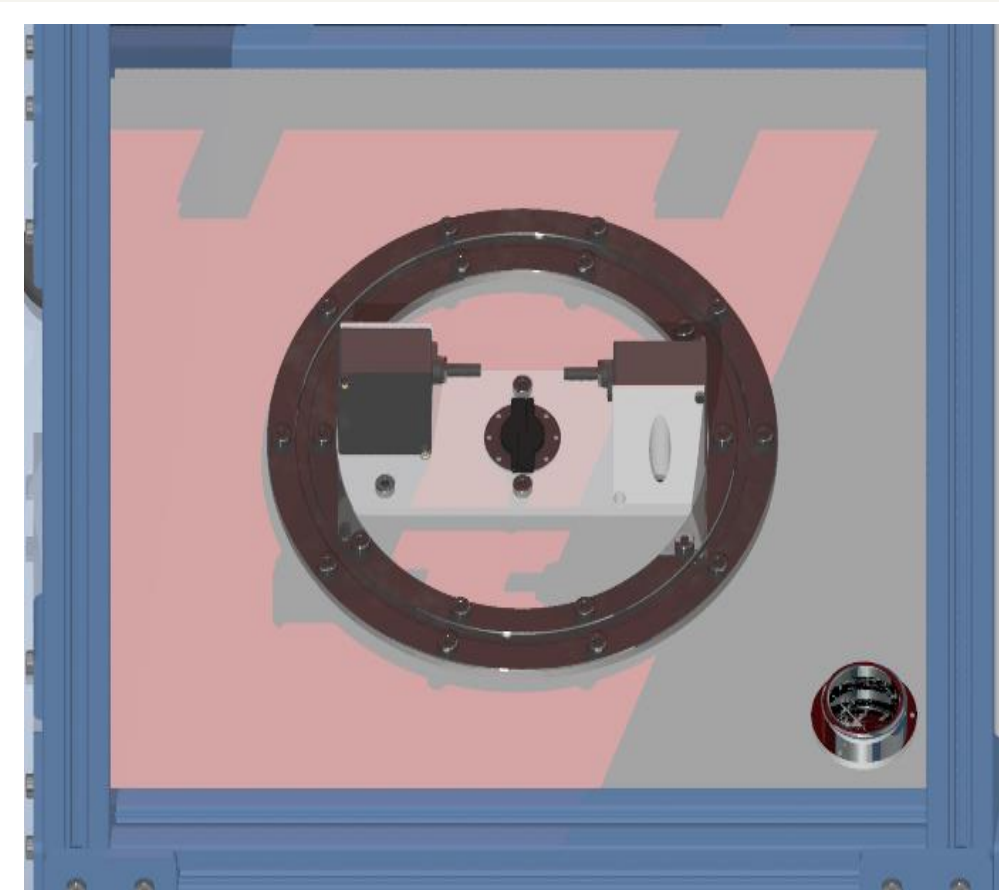
Safety

- Vention custom designed frame
- Laser Safe Industries laser safe acrylic panels
- Blackhawk Supply electrical box

Design Solution



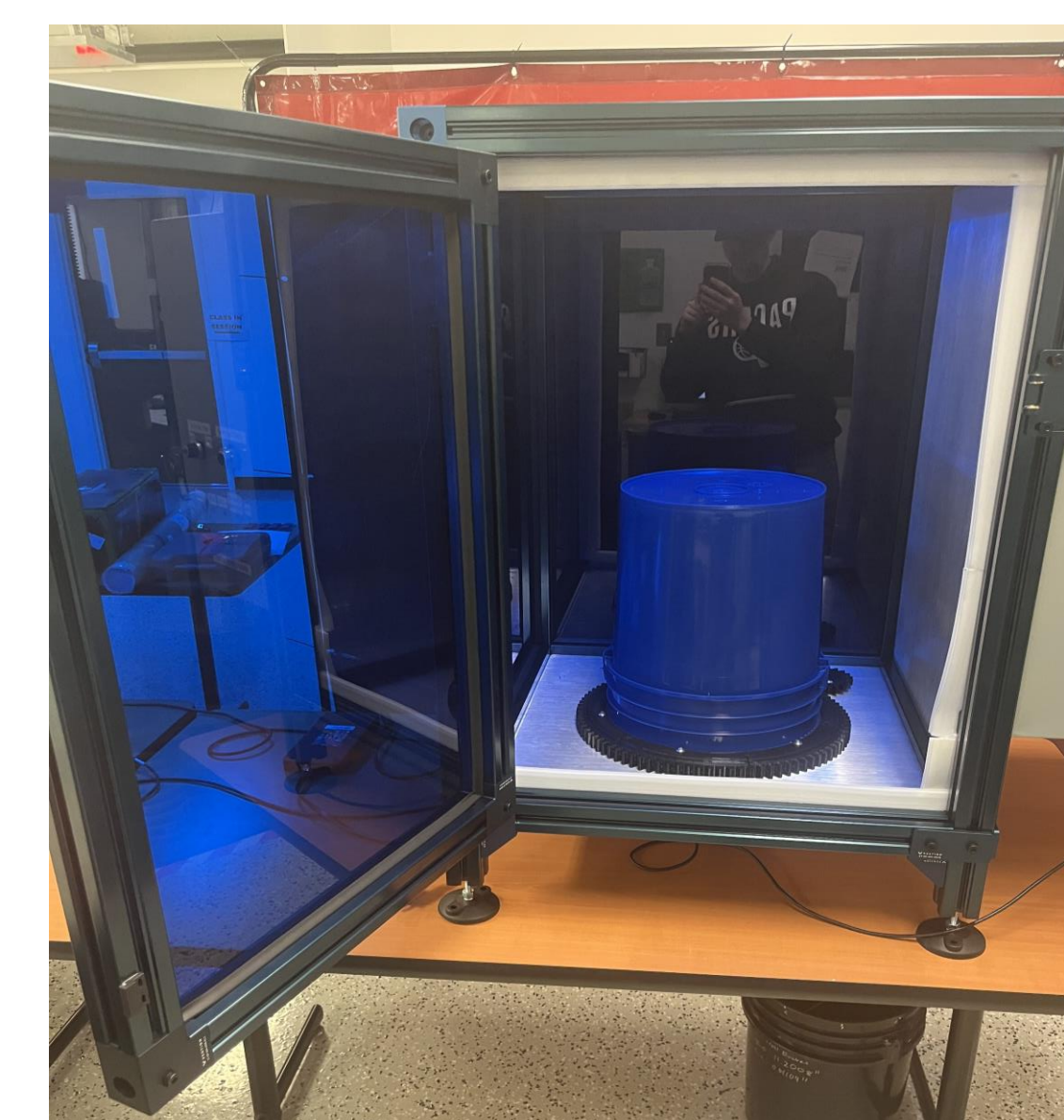
- Wiring diagram for flow of connections between components



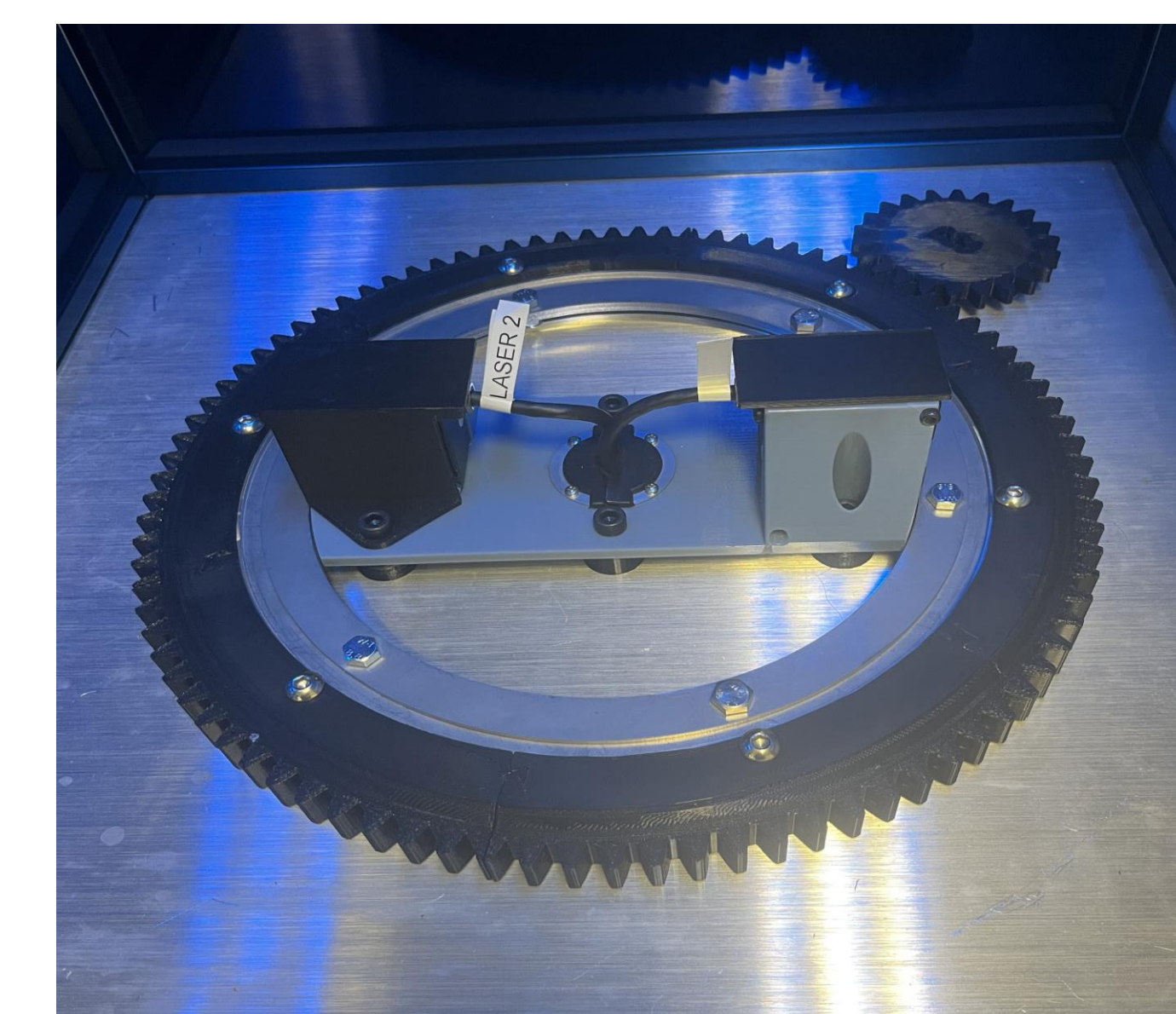
- Base plate 3D model with lasers



Manufacturing



- Vention frame
- Baseplate
- Laser safe acrylic
- Door with magnetic sensor



- 3D printed pinion gear
- 3D printed rack gear
- Resin printed laser mount



- Wiring with labels
- DIN rails
- Wire chase
- Fork terminals

Testing and Validation

CMM Measurements

- Average Diameter
- Circularity
- Bench test for comparison



Electrical Testing

- Motor Driver Control
- Laser Connection
- Cyclic Communication
- Safety Interlocks



Verification & Validation

- Average Diameter
- CMM vs Prototype



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