

The Design, Construction and Analysis of the Enhancement of an Electrical Locking System for Access Control in Eastman.

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Abstract

This poster summarises the design and implementation of an access control system for a D.C.S. Server Room at Eastman Chemical Company, an Upper Tier COMAH site in Newport. Developed to replace a key card system after a security incident, the new solution features a keypad, LED indication and a PIC microcontroller.

The project included system design and simulation in Proteus 8, PIC programming in MikroC and final construction and installation. Testing highlighted both the strengths and weaknesses of simulation in Proteus and the challenges of using uncalibrated equipment. Despite successful implementation, several challenges led to recommendations for future improvements, such as using alternative components and equipment.

Aim

To design and implement a secure, reliable, and cost-effective access control system to replace the existing key card access control system for the D.C.S. Server Room at Eastman Chemical Company, Newport.

While also addressing the identified security concerns while ensuring ease of use.

Objectives

- On successful pin entry, the system needed to switch a contact, releasing the preexisting electromagnetic lock, opening the door.
- The system should be installed within one hour to minimise disruption.
- The system must allow for the PIN to be changed.
- The system must feature battery backup (UPS) to ensure continued functionality if power is lost, lasting for over 12 hours.
- The total project cost needed to remain below £115 to meet budget constraints.

Literature Review and Background Research

- D. A. Adams et al. : PIN Access Control [1].
- F. Farahmand: Access Control Systems Security Concerns [2].
- S. Mohammed et al. :RFID and PIN Access Control [3].
- Traditional and Modern Access Control Systems.
- Security Concerns in Existing Systems.
- Microcontrollers in Access Systems.
- Power Backup Considerations.
- Existing Access Control Systems.
- Component Research and Selection.

Program Flowchart

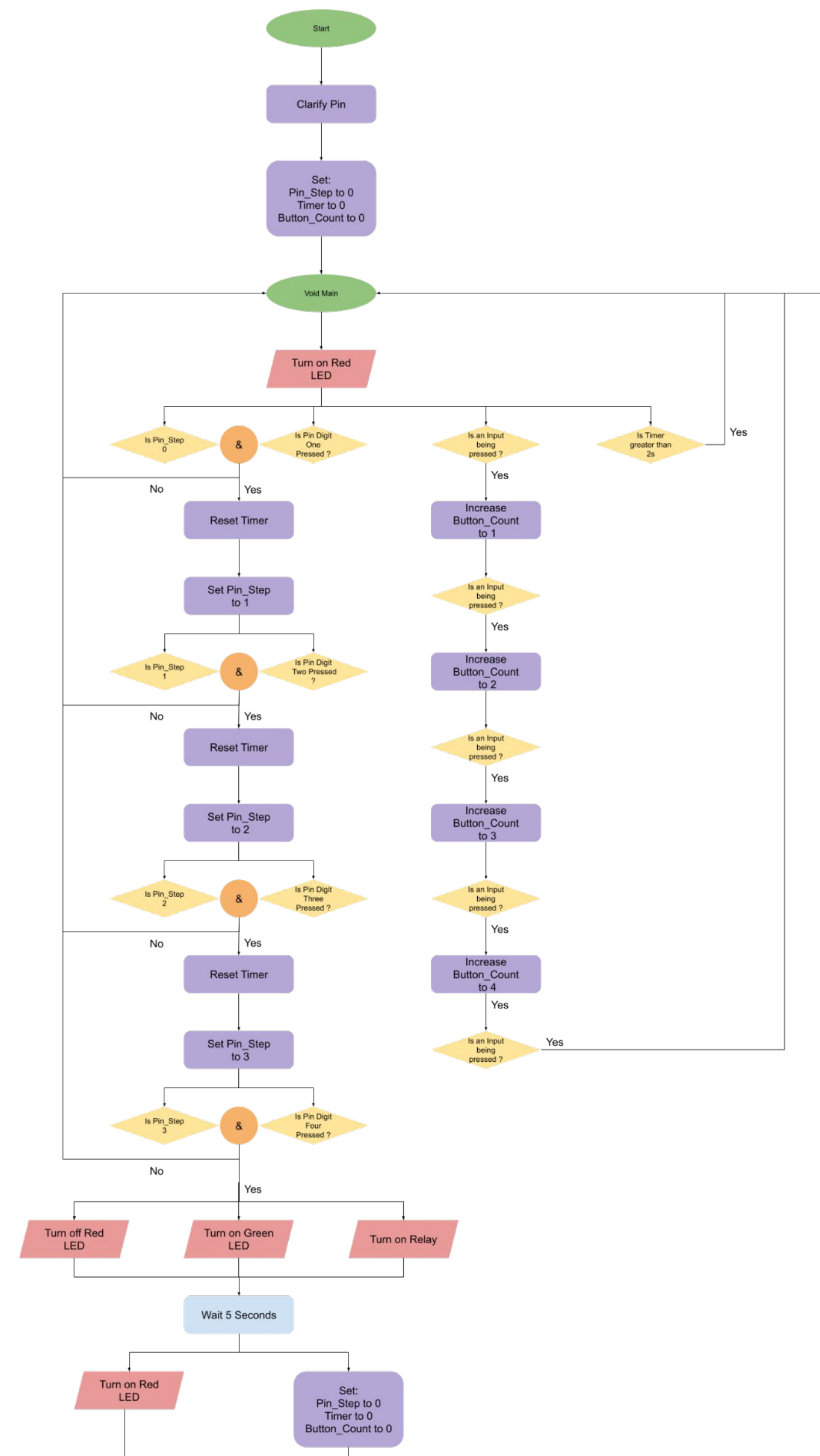


Figure 1 - Program Flow Chart

References

- [1] D. A. Adams and S. Y. Chang, "An investigation of keypad interface security," Information & Management, vol. 24, no. 2, pp. 53–59, Feb. 1993, doi: [https://doi.org/10.1016/0378-7206\(93\)90054-w](https://doi.org/10.1016/0378-7206(93)90054-w).
- [2] F. Farahmand, S. B. Navathe, G. P. Sharp, and P. H. Enslow, "A Management Perspective on Risk of Security Threats to Information Systems," Information Technology and Management, vol. 6, no. 2–3, pp. 203–225, Apr. 2005, doi: <https://doi.org/10.1007/s10799-005-5880-5>.
- [3] S. Mohammed and A. H. Alkeelani, "Locker Security System Using Keypad and RFID," 2019 International Conference of Computer Science and Renewable Energies (ICCSRE), Jul. 2019, doi: <https://doi.org/10.1109/iccsrc.2019.8807588>.
- [4] Labcentre, "PCB Design and Circuit Simulator Software - Proteus," www.labcenter.com.

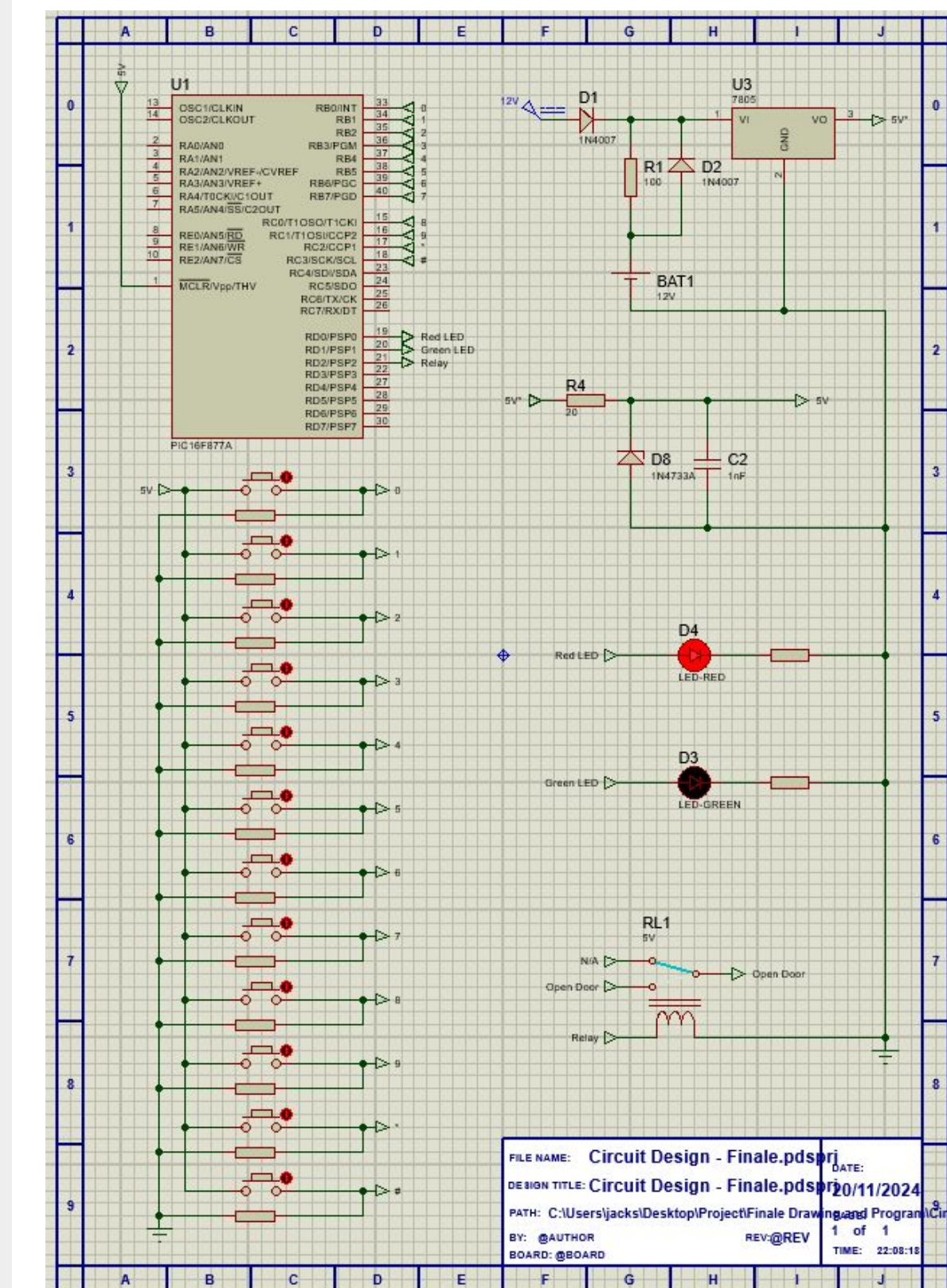


Figure 2 - Proteus Drawing

Control Board

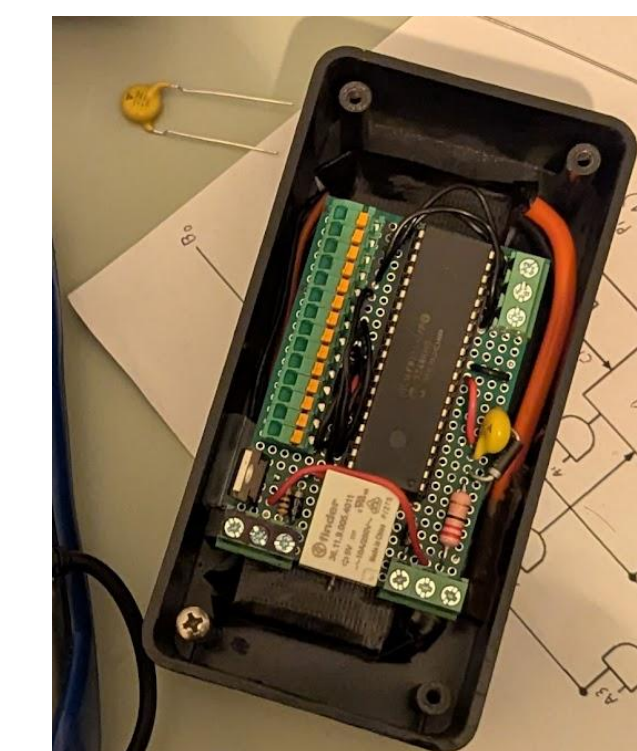


Figure 3 - Control Board/Enclosure

User Interface Board

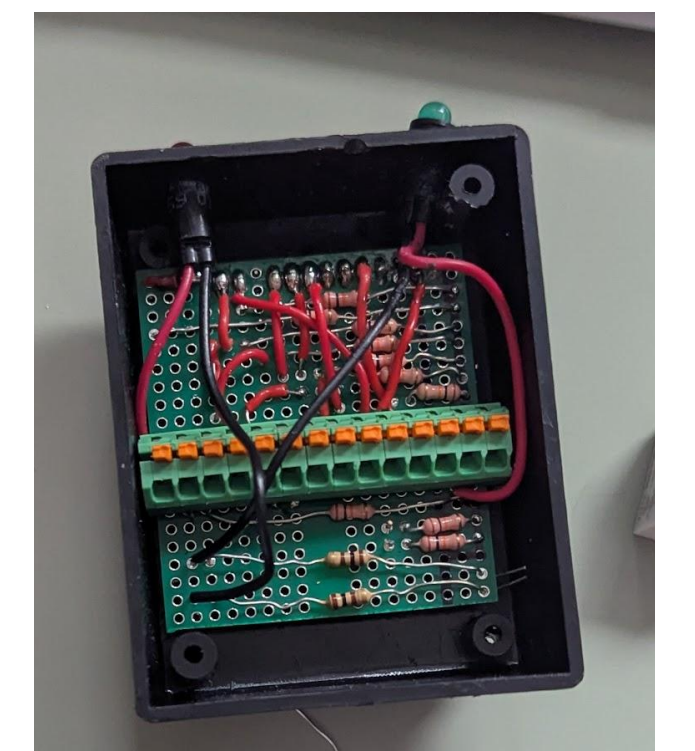


Figure 4 - User Interface Board/Enclosure

The access control system was installed at Eastman, an Upper Tier COMAH site with strict safety and permitting procedures, as a result a Management of Change (MoC) Permit was required alongside an exposure permit for the final installation. The installation was a success, meeting all safety, functional and procedural requirements.

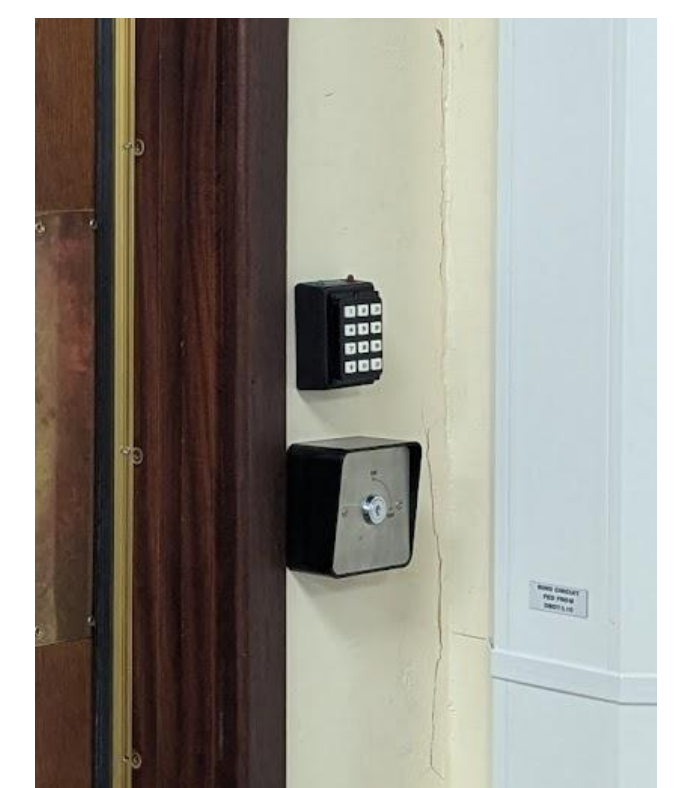


Figure 5 - Mounter User Interface Enclosure