APFC (Automatic Power Factor Compensation) for Industrial Loads to Minimize Penalty

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Abstract: *In industrial sectors, poor power factor not only leads to increased electricity bills but also results in inefficient power usage and potential penalties from utility providers. To address this challenge, this project presents a low-cost, efficient system for Automatic Power Factor Compensation using components such as optocouplers, capacitors, relays, a power board, distribution board (DB), two-line relay, Arduino UNO, 2-pin plug, and choke. The system continuously monitors the load conditions through an Arduino UNO, which processes the power factor data obtained via voltage and current sensing circuits involving optocouplers and chokes. Based on the real-time analysis, the Arduino activates or deactivates capacitor banks using relays to correct the power factor towards unity. The two-line relay and power board ensure safe and reliable switching of capacitive loads, while the distribution board organizes the wiring neatly for industrial standards. By maintaining an optimal power factor automatically, this setup helps industries minimize energy losses, avoid penalty charges, and improve overall energy efficiency, leading to significant cost savings. The design emphasizes affordability, modularity, and ease of maintenance, making it a practical solution for small to medium-sized industrial applications. The proposed system integrates modern components such as digital meters, microcontrollers, and communication interfaces to provide a reliable and automated solution for power factor correction.*

Keywords: active power, reactive power, capacitor banks, Arduino UNO