

# Integration of VFD and PLC for Motor Speed Optimization

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**Abstract:** This work explores the implementation of three-phase motor speed control using a Variable Frequency Drive (VFD) in conjunction with a Programmable Logic Controller (PLC) and a Human-Machine Interface (HMI) to enhance energy efficiency, precision, and operational adaptability in industrial environments. The VFD modulates the supply frequency to achieve variable motor speeds, enabling smoother operation and significant energy savings by aligning motor performance with load requirements. The PLC facilitates customized control logic, allowing seamless integration of sensors, automated responses, and safety interlocks. This integrated approach not only optimizes motor performance and reduces mechanical wear but also lowers maintenance demands. The HMI provides a user-friendly graphical interface for real-time monitoring, parameter adjustment, and diagnostics, thereby improving operator interaction and system transparency. This integrated approach not only optimizes motor performance and reduces mechanical wear but also lowers maintenance demands. The combined use of VFD, PLC, and HMI represents a modern, intelligent automation strategy that delivers improved reliability, flexibility, and overall system efficiency in industrial motor control applications.

**Keywords:** PLC, VFD, HMI, three phase induction motor, sensor integration, control logic.

