

V/F Speed Control Of Three Phase Induction Motor By Using Plc And Scda

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Abstract

Three phase induction motor are widely used motor in industry because of its rugged construction and negligible maintenance. To operate this kind of motor, star-Delta starters are used. But, because of its constant speed characteristics many times it is driven with the help of Drive to have reliable operation its performance must be monitored continuously. Design and Fabrication of monitoring and control system for 3 phase induction motor based on Programmable Logic Controller (PLC) technology. Also implementation of a hardware and software for protection and speed control with the result obtained from the test on three phase induction motor performance is provided. The PLC correlates the operational parameters to protect motor and monitor the system during normal operational and under trip condition. Other performance parameters of three phase induction motor can also be monitored by other control devices. AC drives (or VFD) can also use to control motor rotation direction and rotation speed of three phase induction motor. All the required control or protection and motor performance data will be taken to personal computer via PLC for further analysis. Speed control from control side and protection from performance side will be priority. The monitoring, Supervisory Control and Data Acquisition of three phase induction motor done by SCADA software.

Keywords: PLC, SCADA, Induction Motor, V/F drive, Fault diagnosis

1. Introduction

Protection of induction motor (IM) against possible problem such as overvoltage, over current, overload, over temperature, under voltage, occurring in the course of its operation is very important because of it is used intensively industry as an actuator. IMs can be protected using some components such as timers, contactors, voltage and current relay. This Method is known as classical method that is very basic and involves mechanical dynamic parts.

The implementation of a monitoring and control system for the induction motor based on programmable logic controller (PLC) technology is described. Also, the implementation of the hardware and software for speed control and protection with the results obtained from tests on induction motor performance is provided. The PLC correlates the operational parameters to the speed requested by the user and monitors the system during normal operation and under trip conditions. Tests of the induction motor system driven by inverter and controlled

by PLC prove a higher accuracy in speed regulation as compared to a conventional V/f control system. The efficiency of PLC control is increased at high speeds up to 95% of the synchronous speed. Thus, PLC proves themselves as a very versatile and effective tool in industrial control of electric drives.

2. PROGRAMMABLE LOGIC CONTROLLER

Programmable Logic Controllers (PLCs), also referred to as programmable controllers, are in the computer family. They are used in commercial and industrial applications. A PLC monitors inputs, makes decisions based on its program, and controls outputs to automate a process or machine. This course is meant to supply us with basic information on the functions and configurations of PLCs.

A PLC is user-friendly microprocessor-based specialized computer that carries out control functions of many types and levels of complexity. Its purpose is to monitor crucial process parameters and adjust process operations accordingly. It can be programmed controlled, and operated by a person unskilled in operating computers, but, who is, nonetheless, PLC-literate.

3. Drive

The drive is intended as a component for professional incorporation into complete equipment or system. If installed incorrectly, the drive may present a safety hazard. The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury.

System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this guide carefully. The STOP and START controls or electrical inputs of the drive must not be relied upon to ensure safety of personnel. They do not isolate dangerous voltages from the output of the drive or from any external option unit.

In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in

case of loss of motor braking. By using parameter setting of drive, desired function be done like for speed control of motor set it to Minimum or Maximum speed.

4. Basic Connection Diagram

In Fig. 1, the block diagram of the experimental system is illustrated. The following configurations can be obtained from this setup.

1) A closed-loop control system for constant speed operation, configured with speed feedback and load current feedback. The induction motor drives a variable load, is fed by an inverter, and the PLC controls the inverter V/f output.

2) An open-loop control system for variable speed operation. The induction motor drives a variable load and is fed by an inverter in constant V/f control mode. The PLC is inactivated.

3).The standard variable speed operation. The induction motor drives a variable load and is fed by a constant voltage-constant frequency standard three-phase supply.

The open-loop configuration 2) can be obtained from the closed-loop configuration 1) by removing the speed and load feedback. On the other hand, operation 3) results if the entire control system is bypassed.

The control system is implemented and tested for a Squirrel cage induction motor, having the technical specifications given in Table I. The three-phase power supply is connected to a three-phase main switch and then to 3 pole MCB which provides protection against current overloads. Then it is connected to variable frequency drives (VFD) which control speed of motor and we change direction of motor through PLC and this is interface on SCADA.

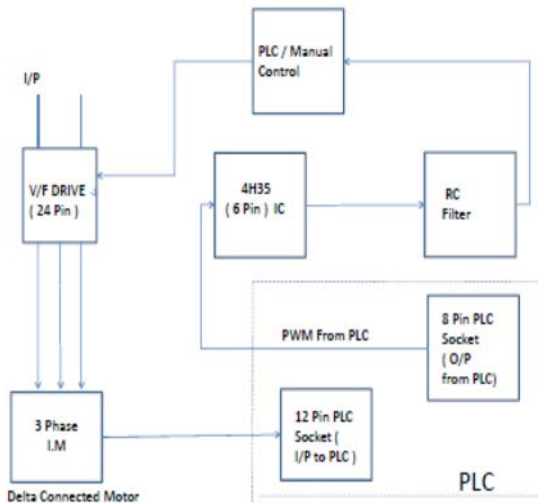


Fig. 1 Block diagram of V/F Speed Control of Induction Motor by using PLC and SCADA

5. Components

Sr. No.	Ratings & Parameters	
1	Drive Ratings	1 Ø 220 v I/P, 3Ø 220 v O/P, 0.5 HP Rating V/F Mode
2	Motor (3Ø I.M)	0.5 HP, 220 v, 1440 RPM Tachometric Control make 3Ø I.M with Loading arrangement brake Drum Type
3	RPM Indicator	Selec 5100 = 9999 RPM
4	Speed Sensor	Inductive , Proximity switch
5	Control Panel Components	1) RPM indicator 2) Drive 3) Start Switc for motor Run- SW1 4) Mode selection switch - SW2, PLC mode/ manual mode 5) Pot P1- 10K- for frequency vary 6) 18 Pin Socket for motor Connection 7) 12 Pin for I/P for PLC 8) 8 Pin for O/P from PLC 9) Internal wiring details a) Isolated Transformer 0-9 v AC b) Power Supply - +12 V DC c) Opto Isolatic Card - GH35 d) LED Indicator for Overcurrent Warning e) Full wave rectifier (0-25 V AC = + 120 v DC) f) Diode 1 HG007
6	PLC Inbuild PID Controller	Allen Bradley 1400 series (PLC = 8 Pin o/p & 12 Pin i/p)
7	SCADA	Winlog Lite = 24 tag. Software

Table 1 Components List

6. SCADA Software

As the name indicates, it is not a full control system, but rather focuses on the supervisory level. As such, it is a

purely software package that is positioned on top of hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs), or other commercial hardware modules. SCADA systems are used not only in most industrial processes. The size of such plants range from a few 1000 to several 10 thousands input/output (I/O) channels. However, SCADA systems evolve rapidly and are now penetrating the market of plants with a number of I/O channels of several 100 K: we know of two cases of near to 1 M I/O channels currently under development.

7. Conclusion

From our project “ V/F SPEED CONTROL OF THREE PHASE INDUCTION MOTOR USING PLC AND SCADA” , we conclude that automatic and manually control of variable speed of motor using PLC and SCADA. We can easily changing in hardware compare to microcontroller.

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