Abstract—Protection of an induction motor (IM) against possible problems, such as overvoltage, over current, overload, over temperature, and under voltage, occurring in the course of its operation is very important, because it is used intensively in industry as an actuator. IMs can be protected using some components, such as timers, contactors, voltage, and current relays. Computer and programmable integrated circuit (PIC) based protection methods have eliminated most of the mechanical components. However, the computer-based protection method requires an analog-to-digital conversion (ADC) card, and the PIC-based protection method does not visualize the electrical parameters measured. Moreover, the voltages, the current, the speed, and the temperature values of the motor, and the problems occurred in the system, are monitored and warning messages are shown on the computer screen. This PLC-based protection method costs less, provides higher accuracy as well as safe and visual environment compared with the classical, and the PIC-based protection systems.

Keywords—Monitoring, Distribution Transformers, PLC Automation, Relays, Sensors, Transducers, Ladder Logic.

I. INTRODUCTION

The starting, speed control and protection of Induction motor can achieved easily by using PLC. Three-phase induction motors are widely used in industrial drives because they are rugged, reliable and economical. High Starting torque is a desired feature in some special industrial applications which use 3-Ph Slip Ring Induction motor. An induction motor or asynchronous motor is a 3 phase 4pole induction motor. This is a type of alternating current motor where power is supplied to the rotor by means of electromagnetic induction. The three-phase induction motors are the most widely used electric motors in industry. They run at essentially constant speed from no-load to full-load. However, the speed is frequency dependent and consequently these motors are not easily adapted to speed control. In this study, the PLC measures the current, the voltage, the temperature, and the speed of an induction motor through analog inputs. In addition, it continuously monitors the inputs and activates the outputs according to the program. Siemens PLC S7-200 module with 14 digital input/10 digital output addresses with CPU 224 sample (14*DI 24 V dc/10*DO 24 V dc) is preferred due to its easy usefulness in experimental application. The PLC programming memory used is composed of 4096 words. STEP 7—Micro/Win 32 programmer was used as the software. Statement list editor (STL) and ladder diagram (LAD) were used as programming languages. Software of the PLC was prepared on the computer and loaded on the PLC by RS 232-RS 485. While the program prepared is being loaded on the PLC from the computer, the most important point is the baud rate between the PLC and the computer. The baud rate must be appropriate to switch setup on the bound cable in manual.

II. LITERATURE SURVEY

All the faults that occur in an AC induction motor have been analysed. The faults that are likely to happen are rotor faults, stator faults, eccentricity faults, bearing faults, load faults. Advanced Signal Processing techniques have been used to detect the faults. Stator current spectral signature analysis is mostly used to identify the faults, this method used power spectrum of the stator current. Physical parameters like vibration, noise, torque and temperature are measured using sensors, all these parameters are vital in checking the proper working of the motor. PLC is used for protection of induction motor as it can monitor more than one parameter simultaneously.
III. PROPOSED SYSTEM

The common program language of PLC is ladder diagram. There are stronger functions in PLC with the development and application requirements of electronic technology, such as position control, network and etc. Thus PLC plays an important role in the feature industry. In this study, the PLC measures the current, the voltage, the temperature, the vibrations and the speed of an induction motor through analog inputs. Moreover, it persistently screens the inputs and initiates the outputs as stated by the ladder logic program which is designed to alert the user if any faults occur during the operation of the induction motor.

Faults:
1. Over Voltage Fault:
   There may be always a chance of system over voltage due to sudden disconnection of large load. The magnitude of this voltage is higher than its normal level but frequency is same as it was in normal operating condition. Over voltage in the power system causes an increase in stress on the insulation of transformer. Core bolts which normally carry little flux may be subjected to a large component of flux diverted from saturated region of the core alongside. During this condition, the bolt may be rapidly heated up and destroys its own insulation as well as winding insulation. When the operating voltage increases to upper limit of voltage rating, the over voltage fault will occur. This fault can also detect by VFD.

2. Over current fault (Overload)
   Over current fault is mainly due to overload in secondary side of distribution transformer. Overload is current drawn by load, Current increases the hottest-spot temperature (and the oil temperature), and there by decreases the insulation life span. When the operating current increases to upper limit of current rating, the over current fault will occur.

3. Over Temperature Fault
   Not only over load current may not result in damage to the transformer but also the absolute temperature of the windings and transformer oil remains within specified limits. Due to over voltage and over current, temperature of oil increases which causes failure of insulation of transformer winding. When the temperature of transformer increases to upper limit of temperature rating, the over temperature fault will occur.

4. Phase to Phase Fault
   Faults between phases within a transformer are relative; if the fault occurs it will lead rise to a substance current compare to the earth fault currents. Phase to phase fault (L-L fault) in the transformer are very rare. When type of fault occurs, it will result rise substantial current to operate
the instant over current relay on the primary side as well as differential relay both. PLC will continuously to main current. If phase to phase fault occur then VSP trips the circuit automatically.

IV. FLOWCHART

Output:

![Alarm Screen 1](image1)

![Alarm Screen 2](image2)

![Alarm Screen 3](image3)
Advantages:
- Time saving application used in fault detection of induction motor.
- Easy to analysis fault in induction motor during working condition.
- Incresce the production.
- Accuracy.
- Less man power.

Applications:
- In various Industries such as power plant, steel plant.
- In physics laboratories.
- All PLC automation systems.

V. FUTURE SCOPE

The monitoring and controlling system of the induction motor can be implemented in the industries and the monitoring values are updated in industrial website for providing the easy maintenance. The automatic torque and efficiency of the induction motor can be calculated to improve the performance of the induction motor.

VI. CONCLUSION

In this paper we have presented a design of a system based on PLC that is used to monitor and control the voltage, current and temperature of a distribution transformer in both sides. The proposed PLC system which has been designed to monitor the transformer’s essential parameters continuously monitors the parameters throughout its operation. When the PLC recognizes any increase or decrease in the level of voltage, current or temperature values the unit has been made shutdown in order to prevent it from further damages with the help of relays in three phase system. The system not only controls the distribution transformer in the substation by shutting it down, but also displays the values throughout the process for user’s reference in SCADA system. This claims that the proposed design of the PLC system makes the distribution transformer more robust against some key power quality issues which make the voltage, current or temperature to peak. Hence the distribution is made more secure, reliable and highly efficient by means of the proposed system.

REFERENCE