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CONTROLLING & PROTECTION OF INDUCTION MOTOR BY USING PLC & VFD

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ABSTRACT:- Three-stage enlistment engines are turning over, speed control and insurance can accomplished effectively by utilizing PLC. Minimal effort and high exactness Possible to change force speed attributes of drive by programming alteration. The straightforwardness of this undertaking by changing the contribution of VFD utilizing PLC and on outer tape an other venture reinforcement is available. A Complete report on PLC has granted smart thought about modern robotization framework. In this paper, an insurance framework has been intended for protecting enlistment engines against every conceivable shortcoming. Sensors are utilized to monitor temperature, Over Current and speed. A current transformer is utilized in the framework to check the current individually. Expecting that any mistake is seen all through online activity of the engine, an alerted message appears on PC and thereafter the engine is ended. The moment that an indistinct defect occurs, the engine stops without giving any admonitions. Consequently, the defect may be depicted and found by the human administrator. The test has been fruitful in finding the inadequacies and in recovering them. PLC based assurance framework is obviously better that the other insurance frameworks which use clocks, contactors, current and voltage transfers. Microcontroller based security framework utilizes simple to computerized change card. Along these lines by utilizing a PLC all the previously mentioned parts can be disposed of and the administrator will actually want to envision the activity of the engine and its electrical boundaries.

KEYWORD:- PLC, VFD, 3 PHASE MOTOR

I. INTODUCTION

Since technology for motion control of electric drives became available, the use of programmable logic controllers (PLCs) with power electronics in electric machines applications has been introduced in the manufacturing automation. AC induction motors are used as actuators in many industrial processes. Although induction motors are reliable, they are subjected to some undesirable stresses, causing faults resulting in failure. Monitoring of an induction motor is a fast emerging technology for the detection of initial faults. It avoids unexpected failure of an industrial process. Monitoring techniques can be classified as the conventional and the digital techniques. Classical monitoring techniques for three phase induction motors are generally provided by some combination of mechanical and electrical monitoring equipment. Mechanical forms of motor sensing are also limited in ability to detect electrical faults, such as stator insulation failures. In addition, the mechanical parts of the equipment can cause problems in the

course of operation and can reduce the life and efficiency of a system. Almost any production line, machine function or process can be automated using a PLC and the speed and accuracy of the operation can be greatly enhanced using this type of control system. But the biggest benefit in using a PLC is the ability to change and replicate the operation or process while collecting and communicating vital information.

Since there were problems related to large electrical panels with a number of electrical components and extensive wiring, people felt the need for software logic controllers, so they gave birth to Programmable Logic Controller (PLC) wherein the control logic is developed in ladder diagram, a software logic control, with a number of inputs taken from the environment and generating the outputs, depending on the logic programmed, to the environment. This helped to control any machine sequence with small electrical panels, less number of electrical components and less wiring with more flexibility to change machine sequence. Induction motors are used in many industrial applications in a wide range of operating areas as they have simple and robust structure, and low production costs. Induction motors are now being used more as compared to before due to their certain advantages such as versatility, dependability and economy, good self-starting capability, offers users simple, rugged construction easy maintenance, low cost and reliability. The reliability of an induction motor is of great Importance in industrial as well as commercial, aerospace and military applications. Also the knowledge about fault mode behaviour of an induction motor drive system is extremely important from the standpoint of improved system design, protection, and fault tolerant control. There are various methods for fault detection and protection of induction motors and some of them are on line fault detection, Stator fault monitoring techniques, Programmable Logic Controller (PLC) based protection system and in this study, the method used is PLC based protection system of induction motors. With the advent of technology and availability of motion control of electric drives, the application of Programmable Logic Controllers (PLC) with power electronics in electrical machines has been introduced in the manufacturing automation systems.

OBJECTIVE:-

- Far superior repeatability.
- To reduced machine downtime.
- To reduced fault and increased accuracy
- Producing good quality product.
- To increase industrial profit.
- Operating time is reduced.
- Continuous production.
- To increasing the production rate.

PROBLEM DEFINATION

Protection of a press machine against possible problems, such as

1) Over Speed
2) Overload
3) Over Temperature
4) Over Time

- Occurring in the course of its operation is very important.
- IMs can be protected using some components, such as timers, contactors, voltage and current relay.

This method is known as the classical method i.e. very basic method and involves mechanical dynamic parts.

II. PROGRAMABLE LOGIC CONTROLLER:-

A PLC or a programmable logic controller is a small computer used for automation of real world processes, such as control of machinery on factory assembly lines. A programmable logic controller (PLC) can be programmed to sense, activate, and control industrial equipment. Therefore, a PLC incorporates a number of I/O points, which allow electrical signals to be interfaced. Input and output components of the processes are connected to the PLC; and the control program is loaded on the PLC memory. In this application, it controls through analog and digital inputs and outputs the varying load-constant speed operation of an induction motor and also, the PLC continuously monitors the inputs and activates the outputs according to the control program. This PLC system is of modular type composed of specific hardware building blocks (modules), which plug directly into a proprietary bus: a central processor unit (CPU), a power supply unit, input and output modules I/O and a program terminal. Such a modular approach has the advantage that the initial configuration can be expanded for other future applications and the basic structure of the PLC is illustrated in Fig. 1.

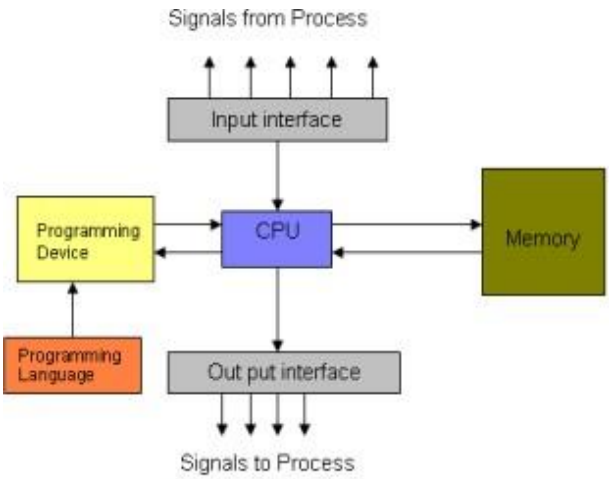

Figure 1: parts of PLC

III. MATERIAL AND METHOD

3 PHASE INDUCTION MOTOR:-A 3 phase induction motor derives its name from the fact that the rotor current is induced by the magnetic field, instead of electrical connections. The operating principle of a 3 phase induction motor is based on the production of r.m.f.

VARABLE FREQUENCY DRIVE (VFD):- VFD stands for Variable Frequency Drive. They are used for controlling the speed of an AC motor. They are also used for ramping up a motor for a smooth start-up, or to prevent a heavy load from straining the motor on start-up. This is accomplished by adjusting the frequency delivered to the motor.

PROGRAMABLE LOGIC CONTROLLER:- The PLC is also commonly used in civil applications such as in washing machines and for controlling traffic signals and elevators. They are used in many industries to monitor and control production processes and building systems.

SWITCHED MODE POWER SUPPLY:- Switch mode power supplies, SMPS provide improved efficiency & space saving over traditional linear supplies, but care has to be taken to ensure noise on the output is low. Switch mode power supplies are widely used because of the advantages they offer in terms of size, weight, cost, efficiency and overall performance.

OVER LOAD RELAY:- Overload relays cut off current to the motor when a high-current situation develops due to a ground fault, short circuit, phase failure, or mechanical jamming. They are an inexpensive way of avoiding downtime for repair or replacement of failed motors from excessive current.

LINE INDICATOR / SPEED INDICATOR:-A Vertical Speed Indicator (VSI), also known as a Rate of Climb and Descent Indicator (RCDI) is an instrument which indicates the rate of climb or an aircraft. In a simple VSI, a barometric capsule is contained in a sealed case.

TEMPERATURE CONTROLLER:-A Temperature Controller is a device that is used to control a heater or other equipment by comparing a sensor signal with a set point and performing calculations according to the deviation between those values.

SELECTOR SWITCH:- Selector switches are used when more than one control option is needed (e.g. Hand-Off- Auto). These switches are preferred when a maintained contact is needed. Contact blocks are an integral part of selector switches. The contact block can have normally open (NO) and/or normally closed (NC) configurations.

MCB (Miniature Circuit Breaker):- All fuses need to be replaced with MCB for better safety and control when they have done their job in the past. Unlike a fuse, an MCB operates as automatic switch that opens in the event of excessive current flowing through the circuit and once the circuit returns to normal, it can be reclosed without any manual replacement. MCBs are used primarily as an alternative to the fuse switch in most of the circuits. A wide variety of

MCBs have been in use nowadays with breaking capacity of 10KA to 16 KA, in all areas of domestic, commercial and industrial applications as a reliable means of protection.

RELAY CARD:-Varioface Relay Modules are specially designed to meet the application of relays in all electrical control panels in various voltage ranges like 12, 24 and 48 VDC and 24, 110 and 230 VAC commonly used in all industries.

INDUCTIVE PROXYMATIVE SENSOR:- An inductive proximity sensor is a non-contact electronic proximity sensor. It is used for positioning and detection of metal objects.Ferrous metals, such as iron and steel, allow for a longer sensing range, while nonferrous metals, such as aluminum and copper, may reduce the sensing range by up to 60 percent.

THERMOCOUPLE:-A thermocouple is an electrical device consisting of two dissimilar electrical conductors forming an electrical junction. A thermocouple produces a temperature-dependent voltage as a result of Seebeck effect, and this voltage can be interpreted to measure temperature. Thermocouples are widely used as temperature sensors.

LATCHING RELAY:-Latching relay is really a generic term that is used to describe the type of relay that maintains its position after the power is removed. The reason latching relays are used is because they allow control of a circuit by providing a single pulse to a relay control circuit.

IV. PROPOSED METHOD

In this proposed method for IMs, a new protection method based on a programmable logic controller (PLC) has been introduced In this method, all

1) Timer
2) Conversion card is eliminated

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 a visual environment compared with the classical, and the PLC- based protection systems.

CIRCUIT DIAGRAM

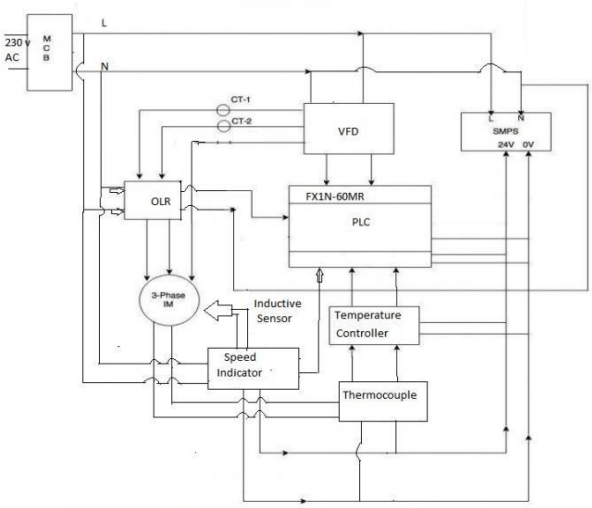

Figure : Connection diagram of Induction Motor Protection and Control

WORKING

In our paper we are using PLC (programmable logic controller) for controlling and detecting the variation of Current, Speed and Temperature of induction motor. The process of project is such as a three phase supply is given to the machine. There are 2 sensors, one Inductive sensor and one Temperature sensor. When a three phase supply is given to machine, then any of three phase the current variation like increasing in current value above the set value, then the PLC detect that type of excess current and immediately control the current. There also a Speed meter is used to check the over speed or below set Speed.

If the Speed is increased above the set value of 2000 RPM then a motor will Stop and Show Over speed Indicator.

When a heavy current flow then motor will stop and show the over load Indicator.

Similarly, It will be For Temperature and Timer Protection.

The PLC is branded PLC of MITSUBISHI Company. The Mitsubishi PLC has very simple programming for the correction of programme. We are selecting this for the industry for the less time consuming and the no special person is required for programming. The monthly consumption of industry for single motor can be possible. The data can be store by using SCADA.

APPLICATIONS

1. Increase accuracy
2. Reliability
3. Flexibility in programming and reprogramming
4. Cost effective for controlling complex system

5. Ability to communicate with the computer in running plant
6. Easy to troubleshooting
7. Provides safe and visual environment
8. Less man power required.

V. RESULT AND DISCUSSION

The software menu developed for the motor protection is given in To detect the faults and to protect the motor, the software developed was used throughout experiments. The menu of the program consists of six buttons as start, stop, alarm and reset, groups, time axis, and aspect.

1) Start is used to start the motor.
2) Stop is used to stop the motor.
3) Alarm and reset is used to stop the motor at any failure.

If the induction motor is required to be run, minimum and maximum values of the voltage, the current, the temperature The motor protection settings are based on rule-based control methodology to detect the fault and to protect the motor. The temperature sensor was used only for the stator current faults. The temperature of the rotor was neglected. In this case, the fault can be described and found by the operator. Considering all motor variables together, eliminating the conver-sion card, and providing a visual environment make the proposed protection system better than other PLC-based protection sys-tems studied. This proposed protection system can be applied to different ac motors by doing small modifications in both the hardware and the software. The only difficulty faced was the measurement of the encoder signal during the experimental study. In this article, a new protection system was designed.

Successful experimental results are obtained by hardware implementation for controlling and protection of three phase induction Motor. ON/OFF control and direction control is obtained by using `with or without timer functions. Speed is controlled in two Different speeds using PLC and VFD. For Over current protection at one particular current motor will turn off. The system was tested during operation with varying Loads including tests on induction motor speed control Performance and tests for trip situations. The PLC Monitors the motor operation and correlates the Parameters according to the software. The efficiency for different values of nsp was also Studied. As depicted in the results show that Configuration in all cases has a higher efficiency. The PLC controlled system

a) works with very Low slip values, almost zero. In all speed and load torque Conditions, the configuration a) has a smaller slip than Configuration

b) Thus the higher values of efficiency can Be justified and especially at high speeds and Frequencies. This system Presents a similar dynamic response as the closed-loop System with V/f speed control. Its transient performance Is limited due to oscillations on torque and this behavior Restricts the application of this system to processes that Only require slow speed variation. The system is tested during operation with varying loads including tests on induction motor Speed control performance. The PLC monitors the motor operation and correlates the parameters According to the software. At the beginning, for reference purposes, the performance

of Induction Motor supplied from a standard 255 V, 50-Hz network is measured. Induction motor fed by the inverter and PLC

Generator voltage =255 V Rated current=0.5 A Speed set point=2000 rpm.

VI. CONCLUSION

Three-phase enlistment engines are turning over, speed control and insurance can accomplished effectively by utilizing PLC. Minimal effort and high exactness Possible to change force speed attributes of drive by programming alteration. The straightforwardness of this undertaking by changing the contribution of VFD utilizing PLC and on outer tape an other venture reinforcement is available. A Complete report on PLC has granted smart thought about modern robotization framework. In this paper, an insurance framework has been intended for protecting enlistment engines against every conceivable shortcoming. Sensors are utilized to monitor temperature, Over Current and speed. A current transformer is utilized in the framework to check the current individually. Expecting that any mistake is seen all through online activity of the engine, an alerted message appears on PC and thereafter the engine is ended. The moment that an indistinct defect occurs, the engine stops without giving any admonitions. Consequently, the defect may be depicted and found by the human administrator. The test has been fruitful in finding the inadequacies and in recovering them. PLC based assurance framework is obviously better that the other insurance frameworks which use clocks, contactors, current and voltage transfers. Microcontroller based security framework utilizes simple to computerized change card. Along these lines by utilizing a PLC all the previously mentioned parts can be disposed of and the administrator will actually want to envision the activity of the engine and its electrical boundaries.

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