

Automatic Motor Manager for Agriculture Pump Using PLC

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Abstract— Automatic motor manager plays a important role to protect the agriculture pumps. Programmable Logical Controller (PLC) which is more attractive in present future period because they have more advance characteristics are extremely reliable. Induction motors are very sensitive to low voltage and single phasing during which they draw a heavy current and can burn out unless switched of within few seconds of occurrence of such conditions. This makes the requirement of a sensitive protective device essential to avoid burning of induction motor under such conditions. We initiate the capacitor banks for converting the two phase unit to three phase unit for uninterrupted power to motor and also this system helps to start motor automatically and at same time monitors the water level. If fault occurs in motor, they spend thousands to removal and erection of motor. To encounter the problem, we have some ideas to initiate the unmanned operations and safety features in the agriculture field. That will do more helpful to today and future Farmers.

Keywords—Programmable logic controller(PLC), Relay, Phase sensing unit, Water level sensor, Capacitor bank, Contactor, Direct online state(DOL)

I. INTRODUCTION

A programmable logic controller is unit of hardware used to control and automate the number of processes. They were initially designed to replace hardwired relay-based controls. Nowadays they can even perform PID control action. PLCs are used to solve control problems from simple to complex and over the last 20 years have been very popular in all sectors. A controls engineer's responsibilities may be designing PLC systems and troubleshooting and enhancing functionality after installation. Induction motors are popular due to their low-cost, sturdy construction, fast pick-up, low maintenance expenditure and good efficiency. Induction motors are very sensitive to low voltage and single phasing during which they draw a heavy current and can burn out unless switched of within few seconds of occurrence of such conditions. This makes the requirement of a sensitive protective device essential to avoid burning of induction motors under such conditions. The circuit of an automatic starter, incorporating the important features given below, is described here. It is meant to be used in conjunction with a DOL starter and Capacitor bank. Automatic start on

resumption of proper conditions Single phasing prevention 24-hour programmable off timer (on completion of actual runtime of the motor).Our Proposed system can be divided into three main modules- sensing, decision making and implementation. The PLC also communicates the status of the entire system through a desired supervision. Two sensing units are used to implement the system. These sensors detect the presence of water and checking all three phases. The readings of the sensors are used by the PLC to take the required decision. Finally the decision is implemented by the PLC through a relay switch. The PLC communicates the present status of the system through the Data cable to the computer. The high number of the input output port of the PLC will enable this single system to control large number of motor units single handedly.

II. SYSTEM COMPONENT DESCRIPTION

The system can be divided by following parts:-

1. PLC(Programmable Logic Controller)
2. Level Sensor
3. Phase sensing Unit
4. Capacitor Bank
5. DOL(Direct Online Starter)
6. Contactor

1. PLC (Programmable Logic Controller)

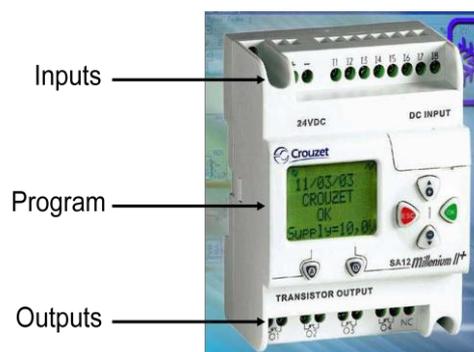


Fig a. PLC

A programmable logic controller, PLC or programmable controller is an industrial digital computer used for implementing the concept of automation in all kind of

industries, with less effort. Almost any production line, machine function, or process can be greatly enhanced using this type of control system. Before the PLC, control, sequencing, and safety interlock logic for manufacturing automobiles was mainly composed of relays, cam timers, drum sequencers, and dedicated closed-loop controllers. Since these could number in the hundreds or even thousands, the process for updating such facilities for the yearly model change-over was very time consuming and expensive, as electricians needed to individually rewire the relays to change their operational characteristics. However, the biggest benefit in using a PLC is the ability to change the entire operation of the system just by changing the program embedded in it, which is not an easy thing while using relay connections.

2. Level Sensor



Fig b. Level sensor

Level sensors detect the level of substances that flow, including liquids, slurries, granular materials, and powders. The substance to be measured can be inside a container or can be in its natural form (e.g. a river or a lake). The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. Generally the latter detect levels that are excessively high or low.

3. Phase Sensing Unit

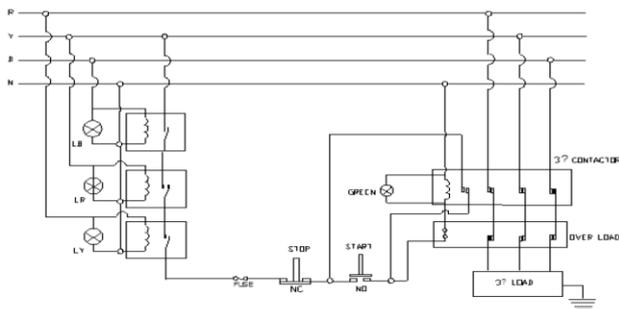


Fig c. DOL Started with Phase sensing unit.

Single phasing or phase loss is the operation of a three phase motor on only two phases to due to the loss of voltage on one phase. Phase loss is the maximum condition of voltage unbalance. This occurs when one fuse blows, when there is a mechanical failure within the equipment, a broken power line, open supply transformer winding, or a lightning strike.

4. Capacitor Bank

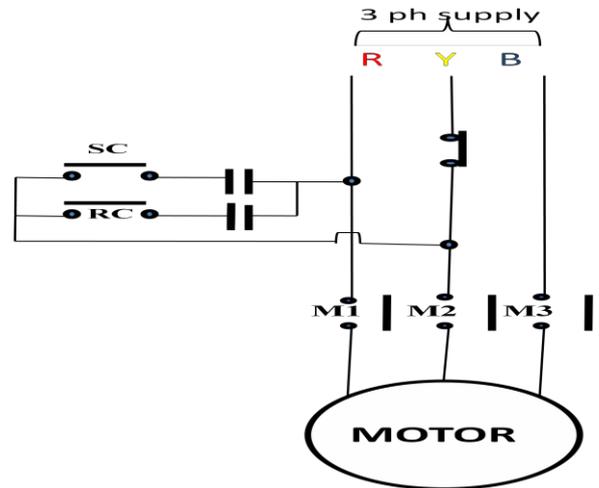


Fig d. Capacitor bank

Capacitors are used to provide the uninterrupted supply in all three Phases. In the Capacitor Bank there are two capacitors are used to initiate the power to failure phase by taken power from the healthy phase. The Starting Capacitor is used to maintain the desired rating of voltage and current at the starting period only for few seconds by timer section on PLC. The Running Capacitor is provided for maintaining the power to only one failure phase from the any one of the other two phases.

The rating of Capacitor Value for 1HP Motor =15mfd.

5. DOL (Direct Online Starter)

The DOL starter is shown on the figure a. In Which two push buttons are used, one is start which is normally open and another is stop as normally closed. An over contact is series with the stop button to avoid over load current during starting and running motor.

6. Contactor

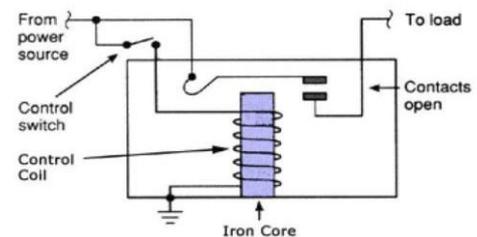


Fig e. Contactor

Contactors are designed to be directly connected to high-current load devices. Relays tend to be of lower capacity and are usually designed for both Normally Closed and Normally Open applications. Devices switching more than 15 amperes or in circuits rated more than a few kilowatts are usually called contactors. Apart from optional auxiliary low current contacts, contactors are almost exclusively fitted with Normally Open contacts. Unlike relays, contactors are designed with features to control and suppress the arc produced when interrupting heavy motor currents. When current passes through the electromagnet, a magnetic field is produced which attracts ferrous objects, in this case the moving core of the contactor is attracted to the stationary core. Since there is an air gap initially, the electromagnet coil draws more current initially until the cores meet and reduce the gap, increasing the inductive impedance of the circuit. The moving contact is propelled by the moving core; the force developed by the electromagnet holds the moving and fixed contacts together. When the contactor coil is de-energized, gravity or a spring returns the electromagnet core to its initial position and opens the contacts.

III. DESIGN AND IMPLEMENTATION

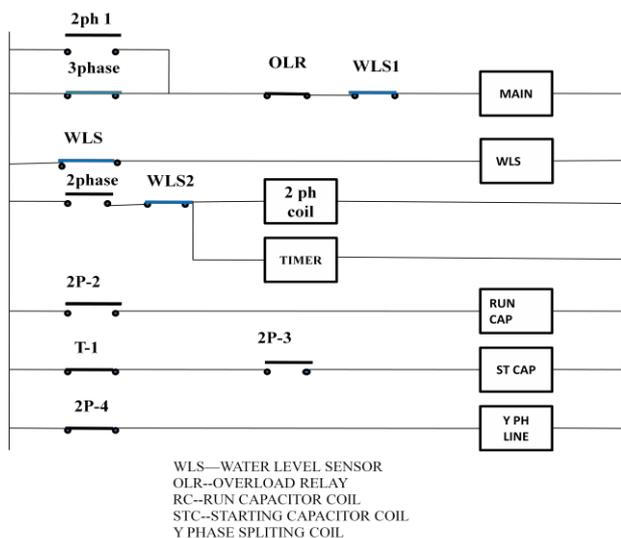


Fig.f. Circuit diagram.

In agriculture field normally three phase induction motors are used to pump the water for irrigation purposes and also. Nowadays the three phase supply is not at all time. Single phasing or phase loss is the operation of a three phase motor on only two phases to due to the loss of voltage on one phase. Phase loss is the maximum condition of voltage unbalance. This occurs when one fuse blows, when there is a mechanical failure within the equipment, a broken power line, open supply transformer winding, or a lightning strike.

The circuit diagram of our project is shown in figure f. the major parts of the circuit is phase sensing unit, level sensing unit. All sensing unit outputs are connected with PLC input ports and the output ports are connected relay and contactor units. The capacitor bank unit is also connected

across the failure phase. When the power ON, the PLC is start to reading the stored program in the memory then switch the main contactors, so the three phase supply is provided for motor for running. When the phase fault is detected by the phase sensing unit and the particular relay activate the desired contacts for the capacitor bank. On which the starting capacitor is connected in series with the timer contact. Then the starting capacitor is connected only in two seconds as desired time. But the running capacitor is also connected in all time when the phase failure occurs. At the same the water level of the bore well is monitoring as sequence. If the level of water is send below the particular value then the level sensing unit give the signal to PLC and so the desired contact is activated by the relay. That contact is series with main coil and then circuit is open, the motor is tends to off and safe.

IV. CONCLUSION

In conclusion, this presentation has shown that a good and reliable technique can be designed locally and that there is the need for unmanned and secure operation in our agriculture. Since phase failure cannot be avoided in our everyday electricity consumption, it is paramount to note that phase failure detector is a very vital protective device that must be taken seriously.

V. REFERENCE

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