International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 3, Issue 1, pp: (187-192), Month: January - March 2015, Available at: www.researchpublish.com

Contactor Testing By Using PLC

[1]Rohit Kamble, [2]Anand Ratnaparkhi, [3]Sagar Kanherkar, [4]Yogesh Wagh

KJ College of Engineering and Management Research, Pune, India

Abstract: **In the modern era for greater efficiency automation is essential for increased productivity, improved quality, reduction process inventory and increased safety of working personal etc. A product that is highly reliable quality yet cost effective only services in the competitive today. Automation takes part in every manufacturing, controlling process and testing of equipment. Now a day's contactors are useful in commercial and industrial applications, particularly for controlling large lighting loads and motors. Hence testing of contactor is prime important. The main aim of our project is to test contactor parameters using programmable logic controller. We are performing flashing and coil continuity test, coil holding test, pole continuity test, pick up time test and drop off time test. It tests the product automatically & displays result as either PASS or FAIL. In our project the whole system is carried out automatically and manually with the help of plc. Further due to benefits of automation data recording facilities can be also provided with test bench so that it will be easy to check for rejected product fault. In conclusion Plc. Contactor testing has advantages over manual testing of contactor**.

Keywords: **Automation, PLC, Contactor, Pneumatic Piston, Solenoid Valve, Limit Switch, Compressor.**

1. INTRODUCTION

A contactor is an electrically controlled switch used for switching a power circuit, similar to a relay except with higher current ratings. A contactor is controlled by a circuit which has a much lower power level than the switched circuit. It consists of two contact parts stationary and movable. Whole circuit is connected to the stationary part and the movable part consists of a coil. When the coil is energized the movable contacts are closed against the stationary contacts, and the circuit gets completed.

Day by day demand of best quality contactor product in market increases rapidly. To fulfill the requirement of market in short time maintaining same quality product and same price range is manually impossible .to overcome from this problem and meet all the condition there is need of automatic contactor testing.

Existing manual contactor testing system is electrically controlled and manually operated .it is very difficult to supervise the testing system continuously .so as to save the time and energy (money), we upgrade this system automatic by using the programmable logic controller. To convert it into automatic system, we have added some automation tools like PLC, limit switch ,solenoid valve, pneumatic piston ,compressor etc.

The whole assembly is mounted on test bench Automatic contactor test bench is developed to test MNX 9 contactor parameters automatically using PLC as controller. It eliminates human errors in testing process. The productivity or rate of testing contactor is also increased because of test bench. It takes very less time to carry out testing automatically than required for manual testing of contactor.

Results of the contactor test either pass or fail is display on the control panel. Here the contactors are tested through the plc. All input given to PLC and output of PLC given to the pilot indicator .PLC programmed in such a way that system tests contactor parameter. We are performing 1)flashing and coil continuity test 2)coil holding test3)pole continuity test 4)pick up time test 5)drop off time test.

1.1 BASIC BLOCK DIAGRAM:

Like any other equipment, our project also consists of input, process, output and the most inherent part power supply. The input section consists of limit switches, push buttons and output section consists of pilot indicators. The Power supply required to operate this system is 24V, DC and 230 V, AC.

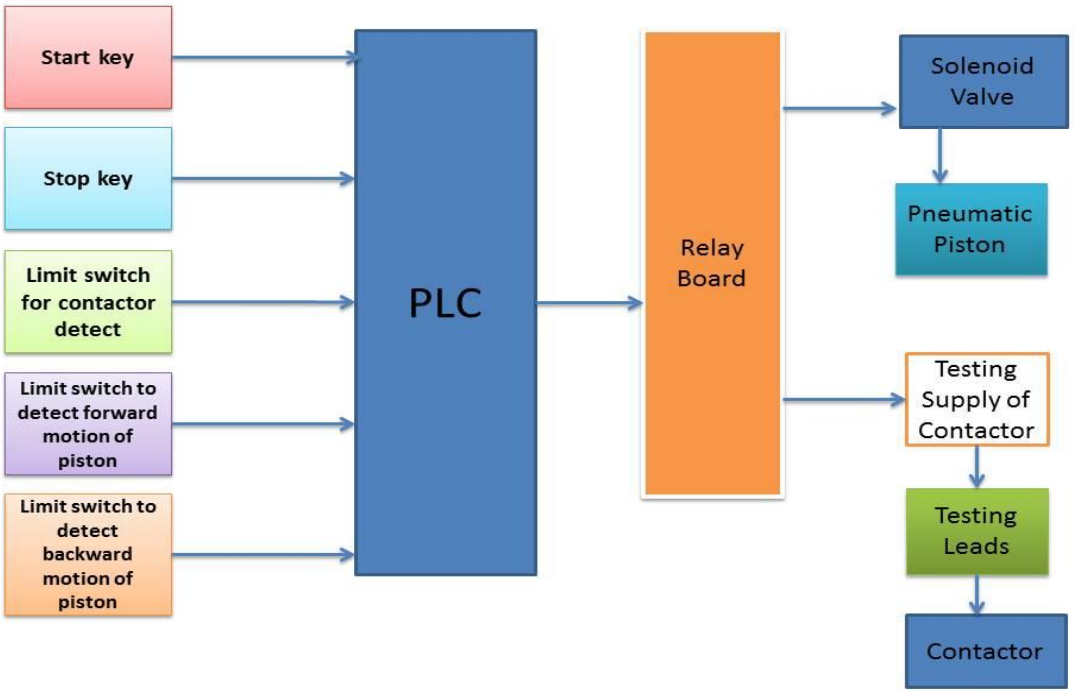

Figure.1 Basic Block Diagram

1.2 HARDWARE REQUIREMENTS:

1.2.1 PROGRAMMABLE LOGIC CONTROLLER:

Programmable logic controllers are nothing but the solid state members of the computer family, using integrated circuits instead of electromechanical devices to implement control functions. They are capable of storing instructions, such as sequencing, timing, counting, arithmetic, data manipulation and communication to control industrial machines and processes. A PLC monitors inputs, makes decisions based on its program and controls outputs to automate a process or machine.In our project we have used the PLC to test contactor parameter using its ladder logic program.

1.2.2 SWITCHED MODE POWER SUPPLY:-

A switched-mode power supply (switching-mode power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a source, like mains power, to a load, such as a personal computer, while converting voltage and current characteristics.

This higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight. In this project we use SMPS to convert the 240V AC 50Hz to 24V DC power supply to the PLC.

1.2.3 PILOT INDICATOR:

The main function of pilot indicator is to signalize when an event occurs. The source of light is LED.it is reliable and cost effective.

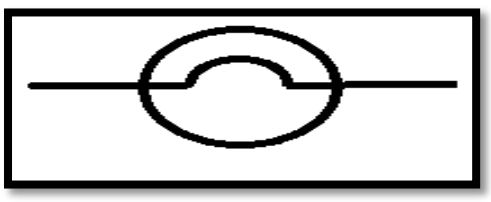

Figure 2: Symbol of Pilot Indicator

Table I: Specification of Pilot Indicator

Rating	24V DC, 2Wmax.
Terminal Capacity	Screw Connection
Rated Insulation Resistance	500M ohm at 1000V DC
Current Consumption (maximum)	20 Ma for DC circuit

1.2.4 PUSH BUTTONS: The push button is used to start the test. This is mounted on Panel and wires are connected to its NO /NC contact through terminal connectors according to the wiring diagram.

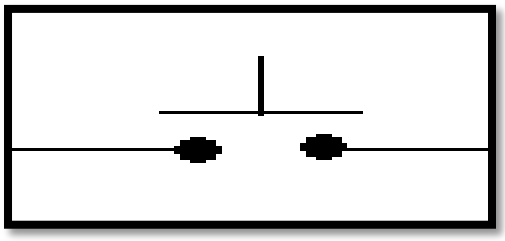

Figure3: Symbol of NO type Push Button

Figure 4: Symbol of NC type Push

1.2.5 LIMIT SWITCH: A switch that limits the activation of an electrical circuit is a limit switch. Switches can control the flow of electrical current by opening and closing. When a circuit is closed, it allows electrical current to flow to the device that is powered. When open, the electrical flow stops. A Mechanical limit switch is a mechanical device which can be used to determine the physical position of equipment. The limit switch gives ON/OFF output that corresponds to object position.

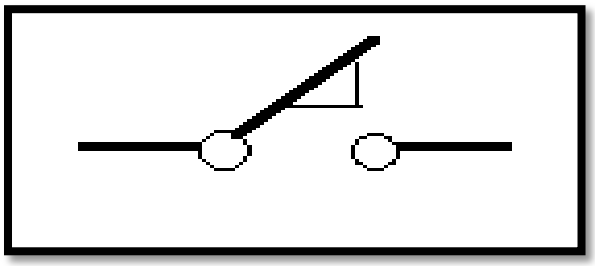

Figure 5: Symbol of Limit Switch

Table II: Specification of Limit switch

AC Ratings	0.1A to 3A, 125V AC
Electrical life	100,000 cycles per min.
Movement Differential	<0.2mm
Contact Gap	<3mm

1.2.6 CONTACTOR: A contactor is an electrically controlled switch used for switching a power circuit, similar to a relay except with higher current ratings. A contactor is controlled by a circuit which has a much lower power level than the switched circuit. It consists of two contact parts stationary and movable. Whole circuit is connected to the stationary

part and the movable part consists of a coil. When the coil is energized the movable contacts are closed against the stationary contacts, and the circuit gets completed.

Table III: Specification of contactor

Type of contactor	MNX9
AC Ratings	9A, 415V AC,50Hz.
Coil Voltage	240
Number of Poles	3 Pole
Auxillary contact	1 NO.

1.2.7 RELAY: A relay is similar to a switch; it is either open or closed. When the switch is open no current passes through the relay, the circuit is open, and the load that is connected to the relay receives no power. When a relay is closed, the circuit is completed and current passes through the relay and delivers power to the load.To open and close a reelay an electromagnet is used. When the coil controlling the electromagnet is given a voltage, the electromagnet causes the contacts in the relay to connect and transfer current through the relay. HereSPST, DPDT relay, which is used to energize contactor coil frequently via 24V DC control signal.

Figure 6: Symbol of Relay

1.2.8 SOLENOID VALVE: A solenoid valve is an electromechanical valve for use with liquid or gas. The valve is controlled by an electric current through a solenoid; in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports.

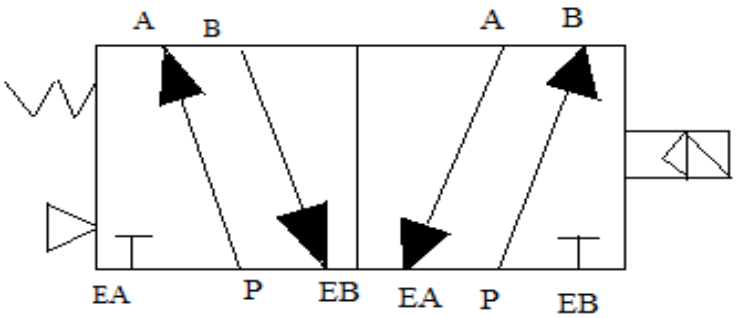

Figure 7: symbol of 5/2 valve

Table IV: Specification of 5/2 ACV

Power	Solenoid
Ports	5 ports
Joint pipe bore	1/4″
Media	Compressed air
Coil voltage	230V AC
Pressure range	0.5 ~ 10 Kgf/cm^2

1.2.9 COMPRESSOR: The air compressor is the source of compressed air that a pneumatic tool is powered by. The hosing is run from the air compressor to the equipment carrying the compressed air. The tool manipulates the work piece.

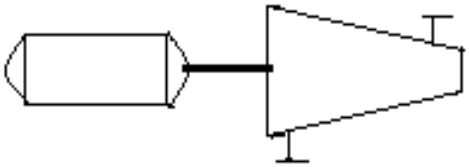

Figure 8: Symbol of compressor

2. WORKING

In this, five tests are carried which are as follows:

2.1 FLASHING AND COIL CONTINUITY TEST:

Whether the contactor is placed in the fixture is detected using a limit switch 1 & its presence or absence in indicated using indicator. If the object is present then press push button 1 then process is started. The pneumatic cylinders are extended to its full stroke length so that pins get connected to contactor contacts. When limit switch 2 senses the position of cylinder the contactor is energized through a relay & 24 V DC supply is applied to contactor coil. Continuity of coil contacts is checked using test leads. If coil is OK then product will PASS & go for next test. If coil is broken then it will show FAIL indication.

2.2 COIL HOLDING TEST:

Apply 230 V AC Voltage to coil through relay. If coil will energizing and any one particular pole contact are closed then it will indicate that product is PASSING& go for next test. If coil will not energizing and contacts are open, then it will indicate that product is FAIL.

2.3 POLE CONTINUITY TEST:

Apply 230V AC voltage to contactor coil and 24 V DC Voltage to contactor pole through relay. If contactors particular poles are closed then it will indicate that product is PASS & go for next test. If contactors particular poles are not closed then it will indicate that product is FAIL.

2.4 PICK-UP TIME TEST:

Apply 230V AC voltage to contactor coil and 24 V DC Voltage to contactor pole through relay. Record the time between energizing the coil and contacts are closed. Check that this time is within specified limit. If it is within limit then product will PASS & go for next test indication. If it is not within limit then it will show FAIL.

2.5 DROP OFF TIME TEST:

Apply 230V AC voltage to contactor coil and 24 V DC Voltage to contactor pole through relay. De-energized the coil after some time and record the time between de-energizing the coil and contacts are open. Check that this time is within specified limit. If it is within limit then indicate that product is PASSING. If it is not within limit then indicate that product is FAIL.

3. ADVANTAGES, DISADVANTAGES AND APPLICATIONS

ADVANTAGES:

1) This process is automatic which reduces human error.

2) Accurate tests can be done.

3) Testing of contactor is achieved in less time.

4) It increases productivity.

5) Reducing running cost.

6) Improved performance of existing testing system.

DISADVANTAGES:

1) High capital cost.

2) Special skilled and maintenance staff required.

APPLICATION:

This project can be used in switch gear and protection industry.

4. CONCLUSION

This project proves that MNX9 contactor is tested for its parameters with the help of PLC. By using automaton tools time required to test contactor is less. Indication of pass/fail helps to sort contactor accordingly. It is easy to test the product automatically rather than testing it manually. Thus with proper interfacing of software with hardware can improve this test bench to test many contactor products at a time. To accommodate such systems more efficient PLCs with more number of input/output, testing leads, has to be used which invariably will increase the cost of the system also. Further HMI can be provided with interfacing PLC to PC and using SCADA. Visual Basic will also provide facility of data recording if bar coding is provided with the product. In future pick and place assembly can be added to this test bench to take product into fixture automatically and take out product after test is over. So we conclude that contactor testing can be automated with proper PLC and HMI, making use of PLC can make testing more advanced.

REFERENCES

[1] Webb J. W, “Programmable Controllers”, Merrill Publishing Company, 1988

[2] John W. Webb, Ronald A. Reis, “Programmable Logic Controllers: Principles andApplication”, 5th Edition

[3] Sunil S. Rao, “Switchgear and Protections”, Khanna Publication

[4] Badri Ram, D. N.Vishwakarma,“Power System Protection and Switchgear”, Tata McGraHill Publishing Co. Ltd.