ISSN (ONLINE): 2395-695X
ISSN (PRINT): 2395-695X

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3, Special Issue.24, March 2017

CYCLIC LOAD ENERGY SAVER FOR STAR DELTA INDUCTION MOTOR USING PLC

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ABSTRACT

In the present scenario power demand has increased in drastic manner. Power is the basic necessity for the economic development of a country. To overcome the power demand the power wastage should be reduced. Basically the Induction motor starts in star connection and it changed to delta connection while running. At low load operation in delta condition leads to wastage of power. So it is better to operate both star and delta connection induction motor. In our project we change the delta connection as star connection at low load but during high load the star connection is not suitable. At the time, connection is changed from Star to delta. For this programmable logic controller (PLC) is used to change the connection by the contactor. By this we can save the power according to the loads.

KEYWORDS: PLC, energy saving, maximum demand reduction.

INTRODUC TION

Induction motor in the industries plays a major role for the operation of machines. Though the power consumption is much for their operation. In order to reduce these problems we have proposed this idea. This project proposes about the power wastage occur in star delta induction motor. In order to reduce the power voltage the PLC used. According to the load requirement the star delta connection is changed. The power wastage is reduced. The current transformer is to monitoring the current. The proposed system will help in energy saving and increases the life span of induction motor. When the load on the motor is less than 50% of full load, it switches the motor to operate in star to save energy. When the load increases beyond 50%, it automatically switches the motor to operate in delta. Since the power consumption in Delta is 3 times greater than Star, this will directly leads to power saving.

DESCRIPTION

Cyclic load energy saver for star delta induction motor is equipment developed to save power on variable load machines especially for which are running in no-load or partial load for long time. Using delta to star change over during no-load or partial load, the power can save up to 30 to 40% of the no-load power. It can save up to 2 units per day. Changeover from Star to Delta based on current instead of time. It is likely that the Motor is started with different loads at different times and the timing set in the timer may not be always suitable for these differing loads.

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BLOCK DIAGRAM:

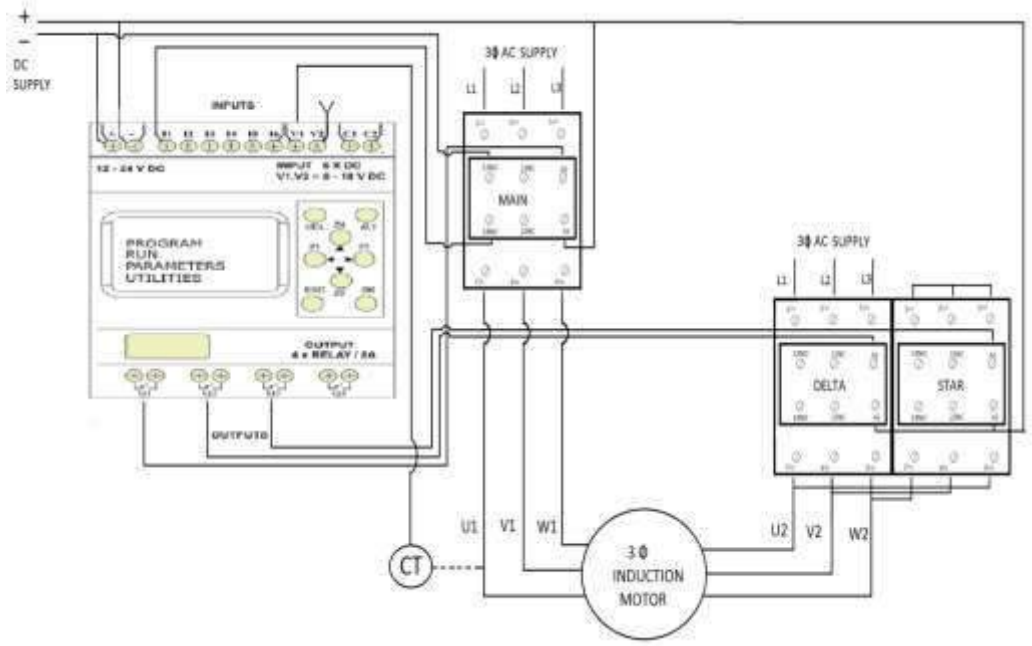

Fig. No. 1 Block Diagram of the Proposed System.

During partial load or no-load period motor is supplied with 400/440v as that much power can be saved. Based on the feedback from current sensor the Delta Star module performs as a Energy saver to avoid the frequent unwanted switching‘s the output from the sensor will monitor by using a additional timer and this period can be varied manually as per the requirement. The control circuit of the proposed system is shown above.

PLC

A PLC is a microprocessor-based control system, designed for automation processes in industrial environments. It uses a programmable memory for the internal storage of user orientated instructions for implementing specific functions such as arithmetic, counting, logic, sequencing, and timing. A PLC can be programmed to sense, activate, and control industrial equipment and therefore, incorporates a number of I/O points, which allow electrical signals to be interfaced. Input de- vices and output devices of the process are connected to the PLC and the control program is entered into the PLC memory.

INDUCTION MOTOR

An electric motor is such an electromechanical device which converts electrical energy into a mechanical energy. In case of three phase AC operation, most widely used motor is three phase induction motor as this type of motor does not require any starting device or it can be say that they are self starting induction motor.

Stator: Stator of three phase induction motor is made up of numbers of slots to construct a 3 phase winding circuit which is connected to 3 phase AC source. The three phase winding are arranged in such a manner in the slots that they produce a rotating magnetic field after 3Ph. AC supply is given to them.

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Rotor: Rotor of three phase induction motor consists of cylindrical laminated core with parallel slots that can carry conductors. Conductors are heavy copper or aluminum bars which fits in each slots & they are short circuited by the end rings. The slots are not exactly made parallel to the axis of the shaft but are slotted a little skewed because this arrangement reduces magnetic humming noise & can avoid stalling of motor.

CONTACTORS

A contactor is an electrically controlled switch used for switching an electrical 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.

Contactors come in many forms with varying capacities and features. Unlike a circuit breaker, a contactor is not intended to interrupt a short circuit current. Contactors range from those having a breaking current of several amperes to thousands of amperes and 24 V DC to many kilovolts. The physical size of contactors ranges from a device small enough to pick up with one hand, to large devices approximately a meter on a side.

METHODOLOGY

During partial load or no-load period motor is supplied with 400/440v as that much power can be saved. Normally motors run in delta mode. 1 .e. full voltage is applied to the motor. So by making the motor to run in start mode during these no- load only $1/\sqrt{3}$ times the line voltage is applied to the each phase winding of the motor which reduces the power input to the motor. Current sensor continuously monitors the current variations & provides the necessary feedback as per the design. Based on the feedback from current sensor the PLC module performs as a Energy saver.

Table1: energy saving in different loads

Load	Savings (%)		
	1 to 15HP	16 to 40HP	41 to 150HP
No load	76%	60%	45%
10%	40%	30%	22%
20%	26%	22%	20%
30%	15%	13%	12%
40%	9%	8%	7%
50%	6%	5%	4%

POWER RELATIONSHIP IN STAR AND DELTA CONNECTION

Let‘s suppose Vs be the supply voltage per phase.
So the line voltage of the supply will be $\sqrt{3}$Vs.
For Delta connected load: Power per phase,

PD= I^2R I = $\sqrt{3}$Vs/R {as line voltage of the supply is directly applied to the phase of the delta load}

Pd = ($\sqrt{3}$VsVs/R)2R = 3Vs2/R watts per phase.

For 3 phases:

$P_{3d}=3P_d=3*3Vs2/R=9Vs2/R$ watts.

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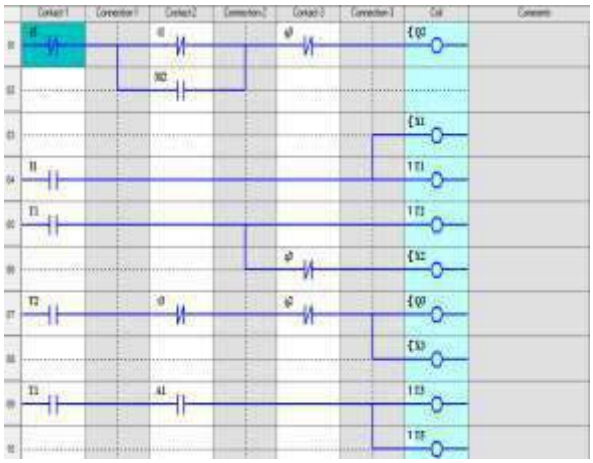
For Star connected load:

P_S= I2R =(Vs/R)2R = Vs2/R watts For 3 phases:

P_{3S} = 3PS = 3 Vs2/R watts

So we can see that the power in the delta connection is 3 times greater than that of the star connection.

SIMULATION



CONCLUSION

This paper is giving a method to improve the total efficiency of the induction motors used in industries. The life span of the machines also is increased by this implementation.

REFERENCES

1. International Journal of Science, Engineering and Technology Research (IJSETR), Volume 4, Issue 5, May 2015 -CYCLIC LOAD ENERGY SAVER BY USING DELTA STAR CONVERTER Shalet P. Abraham, A.Sakthivel.
2. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 12, December 2013 FAULT DIAGNOSIS OF INDUCTION MOTOR USING PLC Ravi Masand, Deepika Jadwani, Prof. S.P Shukla
3. International Journal of Engineering Research and General Science Volume 3, Issue 2,March-April, 2015 PLC BASED INDUCTION MOTOR STARTING AND PROTECTION Chetan Borse, Akshay Pandhare and Randhir kumar.
4. International Journal of Emerging Technology and Advanced Engineering, Volume 6, Issue 5, May 2016 PROTECTION OF INDUCTION MOTOR USING MICROCONTROLLER Shweta hugar, Basavaraj Amarapur.