PLC BASED AUTOMATION

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***Abstract--* SIMATIC is a unique, integrated system designed for deployment with all manufacturing applications.There are SIMATIC controllers for smaller automation tasks as well as for highly complex system solutions. SIMATIC S7 is synonymous with innovation and quality in the modular PLCfield,because of this the products are future-compatible, modularly expandable, vibration-resistant, maintenance-free and scalable.The aim of this paper is to to reduce this high inrush current and increase efficiency of the product.**

Index terms—PLC,auxiliary contact block,capacitor duty contactors,HMI

I.INTRODUCTION

As a response to the increasing competitive pressure,it is more important than ever today to make full use of all optimization opportunities-over the entire life cycle of a machine or plant starting with planning and engineering,continuing into operation and maintainance right through to expansion and modernization.With totally integrated automation,the requirements(added value) of efficient configuration,faster integration and commissioning,greater flexibility in production and higher availability and energy savings can be implemented efficiently. The basisfor this is modern and innovative products from a comprehensive and balanced range of automation products.Clearly defined system characteristics ensure the optimum interplay of the products and provide the system advantages of totally integrated automation.

Our automation systems are synonymous with excellence because of our commitment to superior engineering and technology.For more than 50 years,Siemens has consistently advanced technologies progress in automation.Our systems cover all industry requirements and set the standards in their respective fields.Siemens SIMATIC delivers first-class efficiency because of the numerous option packages for PLC programming and design and our advanced drive technologies. Siemens programming software, an extensive range of useful tools, and numerous sophisticated functions will support you throughout your automation project — and greatly reduce the complexity of PLC programming.

II.PLC(Programmable Logic Controller)

Early PLCs were designed to replace relay logic systems. These PLCs were programmed in "ladder logic", which strongly resembles a schematic diagram of relay logic[1], Modern PLCs can be programmed in a variety of ways, from the relay-derived ladder logic to programming languages such as specially adapted dialects of BASIC and C. As programming terminals evolved, it became more common for ladder logic to be used, for the aforementioned reasons and because it was a familiar format used for electromechanical control panels.

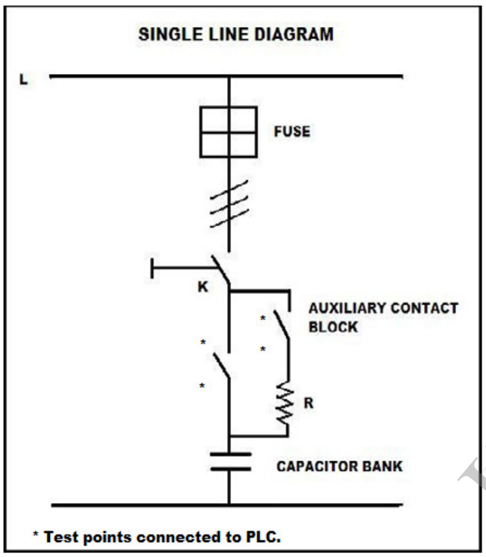
PLCs are programmed using application software on personal computers, which now represent the logic in graphic form instead of character symbols. The computer is connected to the PLC through Ethernet, RS-232, RS-485 or RS-422 cabling. The programming software allows entry and editing of the ladder-style logic. Generally the software provides functions for debugging and troubleshooting the PLC software. The functionality of the PLC has evolved over the years to include sequential relay control, motion control, process control, distributed control systems and networking. The data handling, storage, processing power and communication. Early PLCs, up to the mid-1980s, were programmed using proprietary programming panels or special-purpose programming terminals, which often had dedicated function keys representing the various logical elements of PLC programs.[2] PLC-like programming combined with remote I/O hardware, allow a general-purpose desktop computer to overlap some PLCs in certain applications PLCs are armored for severe conditions (such as dust, moisture, heat, cold) and have the facility for extensive input/output (I/O) arrangements. These connect the PLC to sensors and actuators. PLCs read limit switches, analog process variables (such as temperature and pressure), and the positions of complex positioning systems. Some use machine vision.[3]

III.PROBLEM IDENTIFICATION

In many industries inductive loads are used due to which power factor issue occurs.The power factor reduces thus reducing system efficiently and increase in power loss.To avoid this we use power capacitor load banks,but it results in high inrush current.Due to high inrush current resistors get burnt in short span of time,reducing its life span.Because of this we need to keep changing the resistors everytime when it gets burnt.Due to high inrush current even the contactor size increases.This leads to increase in ths size of setup and also its overall cost increases.

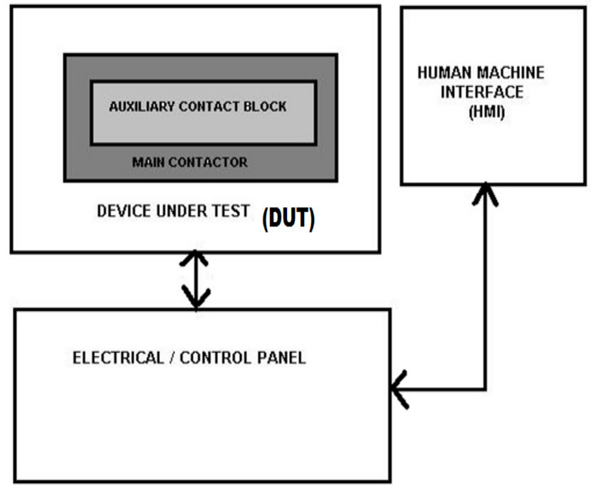
Our project is basically to reduce this high inrush current and increase efficiency of the product.this is achieved by placing an auxiliary contact block in parallel with input further in series with resistor and thus capacitor is charged due to which inrush current is reduced and efficiency of the system increases.

IV.METHODOLOGY



Auxiliary contact is placed on Main Contactor parallel with input supply. In this Auxiliary contact starts before Main Contactor is switched ON. The capacitor will charge through this auxiliary contact. This Auxiliary contact is further connected in series with resistor, which drops the current and thus inrush current is reduced to large extent, thus reducing high current rating contactor. Thus electrical panel size is reduced and cost is also reduced. Once the Main contractor is on it disconnects the auxiliary contact and thus capacitor is charge through Main contractor. Our set up will check whether these auxiliary contacts are working properly or not.The feedback of auxiliary contact switching and Main contact switching is taken to PLC input and we check weather auxiliary contact is switched before the Main contactor within the set time period.This process is repeated number of times. For different voltage levels rated contactors are tested. If the Auxiliary Contacts are ok then it is send for packing, if not then the product is rejected

V.BLOCK DIAGRAM



VI.HARDWARE SUBSYSTEM DESCRIPTION

A. DUT(Device under test)—

It consists of main contactor and auxiliary contact block. Auxiliary contact block is placed on main contactor. It also consist of connectors which are used to transfer signals from PLC to the Auxiliary block and main contactor and vice versa. Here an Assembly is made to check the condition of auxiliary contact block. It checks the time period between the auxiliary block and the main contactor and thus pass the signal to PLC for further processing.

A1.Contactor

Contactor is basically same as relay.The major difference between relay and contactor is contact comes with high current ratings.There are different range of Siemens contactor one of it is 3TS series of contactor relays specially designed for capacitor load bank.Another range of contactors are of 3TH and 3RH SIRIUS range of contactor relay which are suited for all applications. These relays are installed both in India and world market having number of satisfied customers globally.

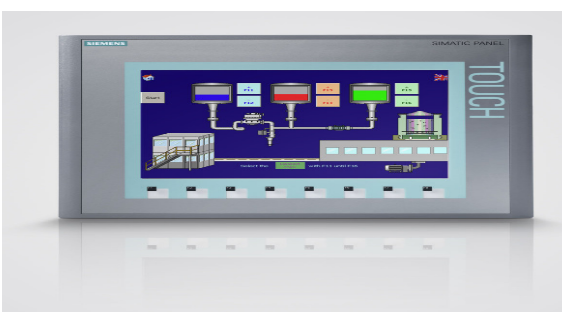
A2. Auxiliary Contact Block

are physically linked to the main switching mechanism and activate at the same time it does. They are commonly used as interlocks or retainers on the primary device's control circuit and often used to give indication of its state of operati Auxiliary contacts are secondary switching devices that work in conjunction with primary switching equipment such as circuit breakers, relays, and contactors. These contacts on. Many contactors and circuit breakers feature sets of auxiliary contacts as integral parts or they may be modular snap on units which can be added or removed as required.

B. Electrical/ control panel

It consist of PLC i.e Programmable logic controller, MCB i.e Miniature circuit breaker, ELCB i.e Earth leakage circuit breaker, Relays, Contactors, Autotransformer. It’s the heart of the system where all controlling and sequence of action is performed and monitored. The signals coming from connectors are given to PLC and further processing.After processing it will display whether test of auxiliary contact block is OK or FAULTY signal which will be displayed on HMI(Human Machine interface).

C. Human Machine Interface(HMI)



This is used to set the voltage which is required according to the rated contactor coil.After selecting proper voltage and contactor we can start the process.If the coil selected is not proper or faulty it will generate fault error on the screen. It is used to display the result, if the result is OK then it will display TEST OK on HMI and if the test is faulty it will display TEST FAULTY on HMI. If the test is faulty we have to acknowledge it by pressing acknowledge button on HMI.It will also show in which step the fault has occurred.

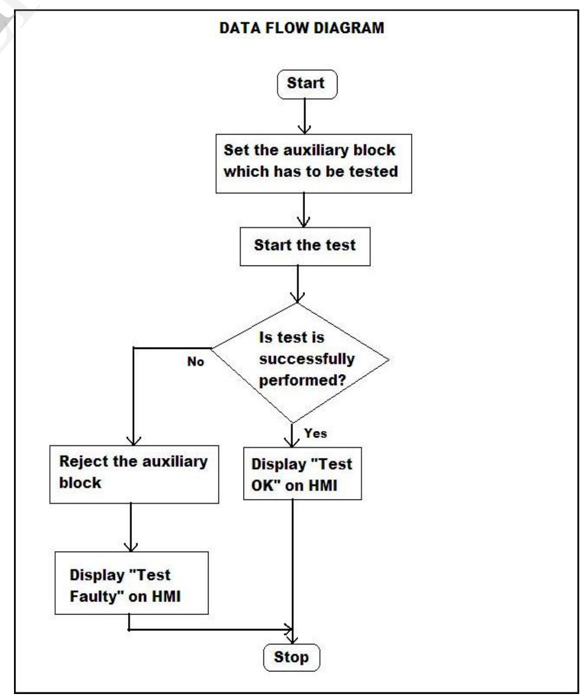
D. Capacitor Load bank

Cap. Bank are used to improve the power factor.While using inductive load in industries it develops poor power factor. Poor power factor can be corrected, paradoxically, by adding another load to the circuit drawing an equal and opposite amount of reactive power, to cancel out the effects of the load's inductive reactance. Inductive reactance can only be cancelled by capacitive reactance, so we have to add a capacitor in parallel.But while using Cap Bank it develops high inrush current.

VII.SOFTWARE SPECIFICATION

SIMATIC S7-200: The SIMATIC S7-200 Micro PLC is fast, communication-capable and highly productive in real-time mode. The consistently modular design facilitates the creation of tailor-made, expandable solutions in the low-end performance range. The S7-200 Micro PLC from Siemens can be used as either a stand-alone Micro PLC solution or in conjunction with other controllers.

VIII. DATA FLOW DIAGRAM



IX.ADVANTAGES

- System efficiency increases.

- Power losses decreases.
- Life span of resistor increases.
- Size of contactor reduces.
- Low cost of contactor due to its small size.

X.CONCLUSION

The high inrush current which is produced due to the capacitor load bank would have cost the customer to pay huge amount for the main contactor and the size of the contactor would also increase.This will make the set up huge,which will require more amount of area.Not only this but even the resistors get burned quickly due to heavy flow of current thus reducing its life span.to avoid this we need to keep changing the resistors frequentlywhich will again cause problem thus reducing the efficiency.All this will ultimately lead to high consumption of power.Basically power factor should be near to unity which is practical is not possible due to high consumption of power.Usually power factor should be above 0.8 for satisfactory results.

Thus by using auxiliary contact block we have not only reduced the cost and size of the main contactor but also innovated new idea for the development in the field of capacitor load bank and power factor correction technique.

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