



ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

250 Ton C Column Type Hydraulic Piercing Press with Interfacing of Programmable Logic Controller

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ABSTRACT: This paper describes how the present automation system comes in to existence through its several stages. The PLC which is equipped in control panel. Siemens S7 1200 PLC is used in many automation applications. This PLC is Standard, Failsafe version and it can easily detect the fault by providing the flexibility and scalability. S7 1200 is equipped with integrated IOs, Interface for programming, HMI connections. Totally Integrated Automation (TIA) Software is used for ladder logic program with Siemens S7 1200 to control the electrical wiring and mechanical assembly movements. The Piercing tool is used to pierce the rim of heavy load vehicle. In order to reduce the human work Servo motor is used to pierce the rim of heavy load vehicle. Which is controlled by Siemens S7 1200 PLC.

KEYWORDS- Siemens S7 1200 PLC (Programmable Logic Controller), Totally Integrated Automation (TIA), HMI, Piercing tool, Servo motor, Automation.

I. INTRODUCTION

Currently, All Industries are run under entirely automation. In sixties and seventies there were a huge electrical board for system controls and the entire wall cannot be covered frequently. The design logic for a system and the schematic of logic in receiver have been implement with relays.

Ladder will display all the switches, sensors, motors, valves, relays etc. found in the system. The main drawback of this type of control happens by the mechanical relays. If one relay stops working, then the entire system have to be analyzed and it would be out until a cause of the problem was found and corrected. To make even a small change, it would turn out to be a major expenditure and a loss of manufacture time until a system was serviceable again.

PLC has been extensively used in automation process to reduce the production cost and to improve quality and reliability. This paper adopted PLC control, which has strong and anti- interference ability, high reliability, good adaptability, could improve the lack of a relay controller. It's possible to programmable and controls the process of machinery. The goal of automation is integration of various features of manufacturing operations to reduce human intervention. In proposed system increase the capacity up to 250T compared to the existing system by using servo motor. Also increase system accuracy. An ability to change a process quickly become very important in order to satisfy consumer needs.

Siemens S7 1200:

The compact design, flexible configuration, and powerful instruction set combine to make the S7-1200 a perfect solution for controlling a wide variety of applications. The CPU combines a microprocessor, an integrated power supply, input and output circuits, built-in PROFINET, high-speed motion control I/O, and on-board analog inputs in a compact housing to create a

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powerful controller. After you download your program, the CPU contains the logic required to monitor and control the devices in your application. The CPU monitors the inputs and changes the outputs according to the logic of your user program, which can include Boolean logic, counting, timing, complex math operations, and communications with other intelligent devices. A 25 mm thermal zone must be provided above and below the unit for free air circulation. The S7-1200 equipment is designed to be easy to install. You can install an S7-1200 either on a panel or on a standard rail, and you can orient the S7-1200 either horizontally or vertically. The small size of the S7-1200 allows you to make efficient use of space.

Conductive contamination due to dust, moisture, and airborne pollution can cause operational and electrical faults in the PLC. If you locate the PLC in an area where conductive contamination may be present, the PLC must be protected by an enclosure with appropriate protection rating. IP54 is one rating that is generally used for electronic equipment enclosures in dirty environments and may be appropriate for your application.

Several security features help protect access to both the CPU and the control program:

Every CPU provides password protection that allows you to configure access to the CPU functions.

1. You can use "know-how protection" to hide the code within a specific block.
2. You can use copy protection to bind your program to a specific memory card or CPU.

The S7-1200 fail-safe CPUs do not support PROFIBUS or PROFINET distributed fail-safe I/O. Electrical equipment standards classify the SIMATIC S7-1200 system as Open Equipment. You must install the S7-1200 in a housing, cabinet, or electric control room. You should limit entry to the housing, cabinet, or electric control room to authorized personnel. The installation should provide a dry environment for the S7-1200. SELV/PELV circuits are considered to provide protection against electric shock in dry locations. The installation should provide mechanical and environmental protection that is

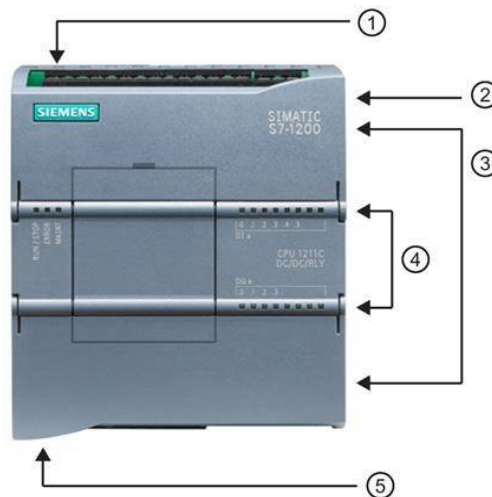


Fig 1 PLC

1. Power connector approved for open equipment in your particular location category according to applicable electrical and building codes.
2. Memory card slot under top door
3. Removable user wiring connectors (behind the doors)
4. Status LEDs for the onboard I/O
5. PROFINET connector (on the bottom of the CPU)

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II. RELAY

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. When a relay contactor is normally open (NO), there is an open contact when the relay is not energized. When a relay contact is normally closed (NC), there is a closed contact when the relay is not energized. In either case applying electrical current to the contacts will change their state.

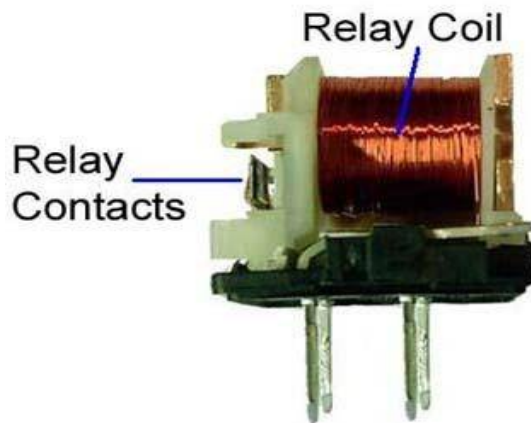


Fig 2 Relay

Relays are generally used to switch smaller currents in a control circuit and do not usually control power consuming devices except for small motors and solenoids that draw low amps. Relay can control large voltages and amperes by having an amplifying effect because a small voltage applied to a relay coil can result in large voltage being switched by the contacts. Protective relays can prevent equipment damage by detecting electrical abnormalities, including overcurrent, undercurrent, over loads and reverse currents. In addition relays are widely used to switch starting coils.

Relay Applications:

Relays are used whenever it is necessary to control a high power or high voltage circuit with a low power circuit, especially when galvanic isolation is desirable. In an automobile, a starter relay allows the high current of the cranking motor to be controlled with small wiring and contacts in the ignition key.

Relay Advantages:

Totally silent operation increased life time, even if it is activated many times, as there are no moving parts to wear and no contacts to pit or output resistance remains constant regardless of amount of use. No sparking, allows it to be used in explosive environments, where it is critical that no spark is generated during switching. Much less sensitive to storage and operating environment factors such as mechanical shock, vibration, humidity and external magnetic fields.

Switched Mode Power Supply:

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched 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 DC or AC source (often mains power), to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power

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supply, the pass transistor of a switching-mode supply continually switches between low- dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Switched mode power supply (SMPS) in domestic products such as personal computers often have universal inputs, meaning that they can accept power from mains supplies throughout the world, although a manual voltage range switch



Fig.3 SMPS

may be required. Short for SMPS is a power supply that uses a switching regulator to control and stabilize the output voltage by switching the load current on and off. These power supplies offer a greater power conversion and reduce the overall power loss.

D.C. to D.C. converters and D.C. to A.C. converters belong to the category of switched mode power supplies. The various types of voltage regulators, used in linear power supplies (LPS), fall in the category of dissipative regulator. As they have a voltage control element usually transistor or zener diode which dissipates power equal to the voltage difference between an unregulated input voltage and a fixed supply voltage multiplied by the current flowing through the device. The switching regulator acts as a continuously variable power convertor and hence the efficiency is negligibly affected by the voltage difference. Hence the switching regulator is also known as 'non-dissipative regulator'. In a SMPS, the active device that provides regulation is always operated in cut-off or in saturation mode. The input D.C. supply is chopped at a higher frequency around 15-50 kHz using an active device like the BJT, power MOSFET or SCR and the converter transformer.

III. MINIATURE CIRCUIT BREAKER (MCB)

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current, typically resulting from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected. The thermal operation of miniature circuit breaker is achieved with a bimetallic strip whenever continuous over current flows through MCB, the bimetallic strip is heated and deflects by bending. It is the medium voltage and the current amps 45-63 amps. MCBs are manufactured in different pole versions such as single, double, triple and four pole structures with different fault current levels. This feature will be helpful in case of single phase in three phase motor protection.

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Fig 4 MCB

This provides mechanically strong and insulated housing. The switching system consists of a fixed and a moving contact to which incoming and outgoing wires are connected. The metal or current carrying parts are made up of electrolytic copper or silver alloy depending on the rate of the circuit breaker. The over current, in an electrical circuit, may result from short circuit, overload or faulty design. An MCB is a better alternative to a fuse since they do not require replacement once an overload is detected. Unlike fuse, an MCB can be easily reset and thus offers improved operational safety and greater convenience without incurring large operating costs and shown in fig. Operation of MCB: The principle of operation of MCB is simple. An MCB functions by interrupting the continuity of electrical flow through the circuit once a fault is detected. In simple terms MCB is a switch which automatically turns off when the current flowing through the device passes the maximum allowable limit. Generally MCB are designed to protect against over current and over temperature faults. There are two contacts one is fixed and the other moveable. when the current exceeds the predefined limit a solenoid forces the moveable contact to open.

Advantages of MCB Smaller in size

The size of an MCB is smaller than fuse. Hence this is very compact.

Easier for end user to reset

As there are no touching live parts, this is easy to reset. No waiting to reset

Resetting is easy as with fuses-spare must be found. Low cost

As no resetting is needed, cost is less.

MOULDED CASE CIRCUIT BREAKER

A molded case circuit breaker, abbreviated MCCB, is a type of electrical protection device that can be used for a wide range of voltages, and frequencies of both 50 Hz and 60 Hz. The main distinctions between molded-case and miniature circuit breaker are that the MCCB can have current ratings of up to 2,500 amperes, and its trip settings are normally adjustable. An additional difference is that MCCBs tend to be much larger than MCBs.

The wide range of current ratings available from molded-case circuit breakers allows them to be used in a wide variety of applications. MCCBs are available with current ratings that range from low values such as 15 amperes, to industrial ratings such as 2,500 amperes. This allows them to be used in both low- power and high-power applications.

A **motor controller** is a device or group of devices that serves to govern in some predetermined manner the performance of an electric motor.

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Fig.5 MPCB

A motor controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and faults.

Motor protection Circuit Breaker:

In **STAR connection**, the starting or finishing ends (Similar ends) of three phases (coils) are connected together to form the neutral point. A common wire is taken out from the neutral point which is called Neutral. There is no such connection in Delta network. The Line voltage is root three times the phase voltage. It is provided with a number of tapings. The starter is connected to one particular tapping to obtain the most suitable starting voltage. A double throw switch S is used to connect the auto transformer in the circuit for starting. When the handle H of the switch S in the **START** position. The primary of the auto transformer is connected to the supply line, and the motor is connected to the secondary of the auto transformer.

SERVO MOTOR:

A **servomotor** is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

SOFTWARE DETAILS

Piercing tool



Fig.6 MPCB

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Ladder logic is a programming language that represents a program by a graphical diagram based on the circuit diagrams of relay based logic hardware. A ladder diagram features as excellent graphical representation based on well understood Piercing involves cutting of clean holes with a resulting scrap slug. The operation is called die cutting and can also produce flat components where the die, the shaped tool, is pressed into a sheet material employing a shearing action to cut holes. This method can be used to cut parts of different sizes and shapes in sheet metal, leather and many other materials.

HUMAN MACHINE INTERFACE (HMI)

A human-machine interface (HMI) is typically local to one machine or piece of equipment, and is the interface method between the human and the equipment/machine in the far field. An operator interface is the interface method by which multiple equipment that are linked by a host control system is accessed or controlled.

ADVANTAGES OF HMI

- *Eliminates the need for component parts such as buttons on cell phones
- *Makes possible a greater range of computer functions thereby adding value
- *Reduces the need for labor within various service industries.

circuit design concepts. Ladder logic programming languages are used primarily to develop software for PLCs used in industrial control system. Also, they may be used to replace old hardwired relay circuits.

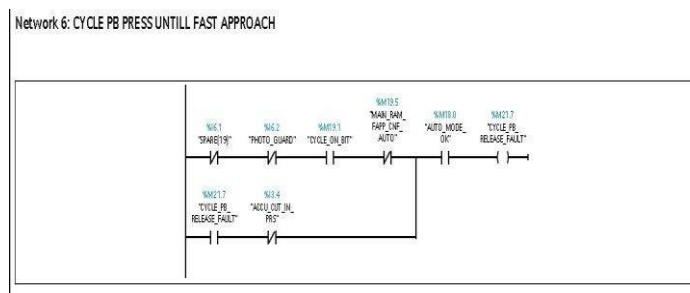


Fig 7 cycle start

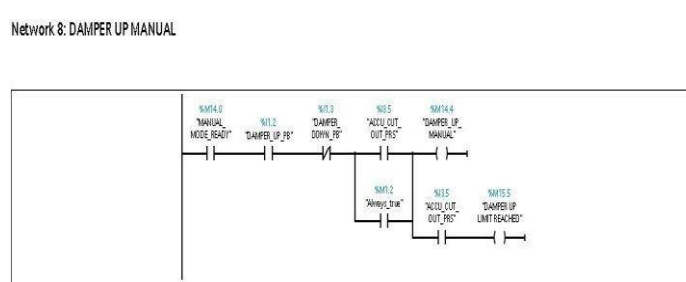


Fig 8 damper up

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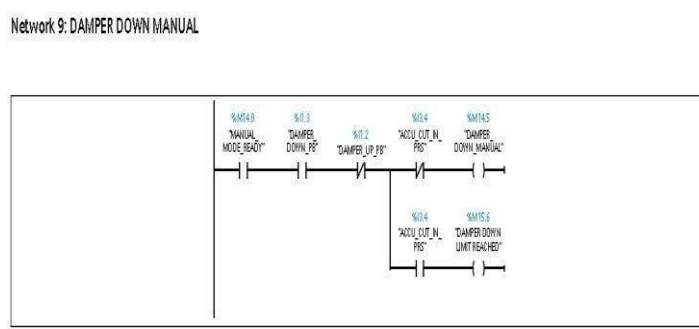


Fig 9 Damper down

IV. CONCLUSION

The proposed system of our project is very simple as PLC ladder logic programming is used. In all industries run under the manual operation and many fault occurring for the operators. The PLC provide an efficient control tool in industrial application. It is used to improve security and efficiency of the system and avoid the manual errors. The automation reduces the manual operations and error occurring to the device can be avoided. Hence heat produced in the device is also less. The system hardware is made less complex, the capacity used in proposed system is increased upto 250 tons. The concept of HMI, load cell and LVDT is introduced in the proposed system of our project, HMI is easy to operate from a farfield, the loadcell is used to determine the exact position of bolt in the component. The LVDT used to determine the exact position of the cushion. Thereby the drawbacks of existing system is overcome. Hence the and the capacity of the system is improved.

Future scope

In future implementations the Siemens S7 1200 PLC's can be replaced with Pilz controller. It allows to implement safety and automation applications of any size easily and flexibility. Nowadays the pilz is used in foreign countries. In the proposed system of our project, PLC controls main Ram. But bottom bearing cylinders and not controlled by PLC. The mechanical switching used in the proposed system can be overcome by electrical switching in the near future. Controller used in the load cell is very costly, in the future controller will be replaced and cost will be less.

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