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PLC Based Timer Controller for Multiple Machines

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Abstract – This paper describes the design and development of a feedback control system that maintains the time of a process at a desired set point. The system consists of a PLC-based timer controller unit that provides input and output interfaces between the PLC and the man machine interface and computer system. The main difference from other computers is that PLCs are armoured for severe conditions such as dust, moisture, heat, cold etc., and have the facility for extensive input/output (I/O) arrangements. The paper will provide details about the timer control unit, shows the implementation of the controller unit, and present test results.

Index Terms – PLC, Ladder Language, Functional Block Diagram (FBD), Automation.

1. INTRODUCTION

Nowadays computer control and information system technology is applied widely in most of the process industry, because it may produce significant technical and economic benefits. Process control information systems assist operating personnel in producing the required output of products with minimum quality variations, least consumption of the raw material and energy, and maximum efficiency. Centralization process control combined with increased mechanization has resulted in improved productivity. Now a day's advanced control systems like PLCs are extensively used in the industries.

Different control techniques have been proposed for timer controller during required variations. It is common to use relays to make simple logical control decisions. The relays allow power to be switched on and off without a mechanical switch. The development of low cost computer has brought the most recent revolution, the Programmable Logic Controller (PLC).With the advent of the PLC, it has become the most common choice for manufacturing controls. A PLC is a digital operating electronic apparatus which uses a programmable memory for internal storage of instruction for implementing specific function such as logic, sequencing, timing, counting and arithmetic to control through Analog or digital input/output modules various types of machines or process. There are different types of PLC'S used for various applications.

2. PROGRAMMABLE LOGIC CONTROLLER

The Programmable Logic Controller (PLC) is a relatively new technology that uses a computer to process the information. The control task is incorporated into a graphical program called the Ladder Logic Diagram. Any control task modifications are done by changing the program. Today, *PLC*s are used in many "real world" applications such as machining, packaging, material handling, automated assembly or countless other industrial processes.

Basic PLCs are available on a single printed circuit board .They are sometimes called single board PLCs or open frame PLCs. These are totally self-contained (with the exception of a power supply) and, when installed in a system, they are simply mounted inside a controls cabinet on threaded standoffs. Screw terminals on the printed circuit board allow for the connection of the input, output, and power supply wires.

In this paper aims to control time for multiple machine with specified time. In most of industries these machines running in one unit when other unit machines were not running. PLC is used for specified time of runs the machines.

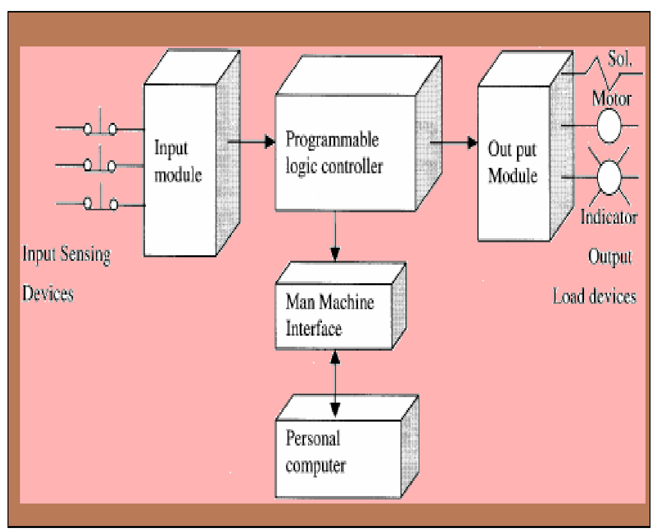


Fig.1 Program Logic Controller Hardware

Fig.2 Block diagram of PLC system

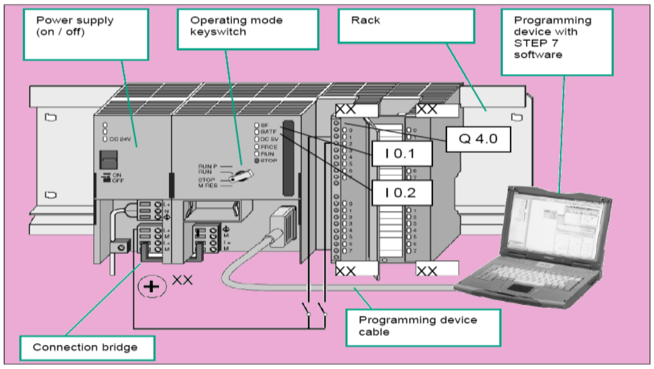


Fig.2 Block diagram of PLC system

3. TIMERS & COUNTERS

The types of timers used on PLC. There are ON delay timers, OFF delay timers and retentive timers. The figures 3, 4, 5 shows the timer instruction.

TIMER ON DELAY	
Timer	**T4:0**
Timer Base	**0.01**
Pre-set	**120**
Accum	**0**

Fig.3 ON delay timer

TIMER OFF DELAY	
Timer	**T4:1**
Timer Base	**0.01**
Pre-set	**120**
Accum	**0**

Fig.4 OFF delay timer

RETENTIVE TIMER ON	
Timer	**T4:2**
Timer Base	**0.01**
Pre-set	**120**
Accum	**0**

Fig.5 RETENTIVE timer instruction

When programming a timer instruction, the programmer must specify the Timer address, the Time base and the pre-set value, which are listed in the instruction. The format of Timer address is T4: N, Where N is a positive integer. Each timer instruction should have a unique number that distinguishes its timer instruction from other timer instructions. The time base value is an interval that the timer is going to use. This value can be set to 1 second, 0.01 second, or 0.001 second. The Pre-set value specifies how many intervals a timer should count before the timing is complete, also known as "done". A timer's setting time equals its Pre-set value timing is complete, also known as "done". A timer's setting time equals its Pre-set value timer's setting time is 500 x 0.01 second = 5 seconds. That means this timer will be done 5 seconds after the timer instruction is enabled.

Each timer instruction has three very useful status bits. These bits are Timer Enable (TE), Timer Timing (TT) and Timer Done (TN). Each of these bits has one bit of memory and the memory is affected by the corresponding bit status.

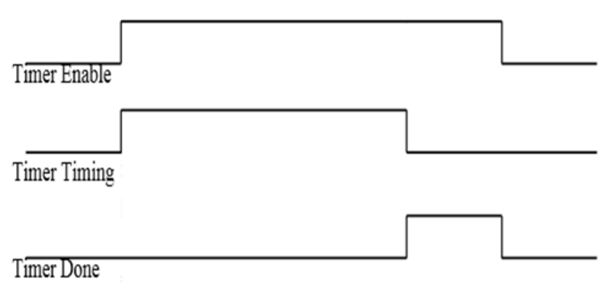
<u>For an ON-delay timer and a retentive timer,</u>

- The Timer Enable bit is high when the timer's rung is true; it is low when the rung is False.
- The Timer Timing bit is high when the timer's rung is true and the Accumulate value is less than the Pre-set value. This bit is low when the rung is false or after the Accumulate value equals the Pre-set value.
- The Timer done bit is high when the rung is true and the timer is done. It is low when the rung is false or before the timer is done.

<u>For an OFF-delay timer,</u>

- The Timer Enable bit is high when the timer's rung is false; it is low when the rung is <u>true.</u>
- The Timer Timing bit is high when the timer's rung is false and the Accumulate value is less than the Pre-set value. This bit is low when the rung is true or after the Accumulate value equals the Pre-set value.
- The Timer done bit is high when the rung is false and the timer is done. It is low when the rung is true or before the timer is done.

Figure 6 is a timing diagram of an ON-delay timer's control bits. In this diagram, the timer is disabled after its Accumulate value reaches its Pre-set value.



Timer enabled (Rung Becoming True) Timer done (Timertime reaching setting time) Timer done (Rung becoming false)

Fig.6 Timer's Control Bit Logic

The types of counters used on PLC. There are Count-up counters and Count-down counters.

A PLC counter instruction can be a count-up instruction or a count-down instruction. These are shown in Figure 7 and Figure 8. When a counter instruction is used in a program, the programmer must specify the counter address. A counter address has the format of C5: N, where N is a positive integer to distinguish it from other counters. The programmer must also specify the Pre-set value, which is a signed (positive or negative) integer.

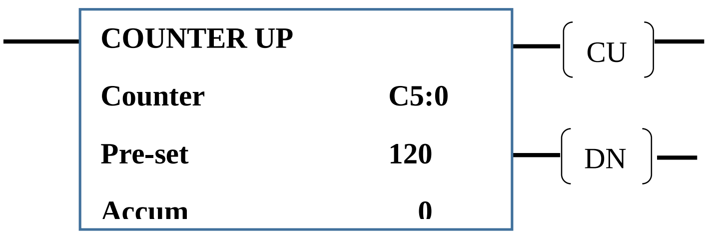


Fig.7 Count-up counter

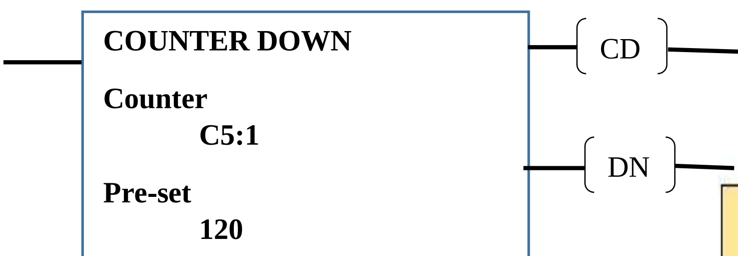


Fig.8 Count –down counter

A counter instruction counts false-to-true rung transitions. Each time a rung condition is changing from false to true, a count-up instruction in the rung increases its Accumulate value by 1 and a count-down instruction in the rung decreases its Accumulate value by 1.

Three of these bits are used frequently in PLC ladder logic programs. These bits are the counter-up enable bit (CU), the counter-down enable bit (CD), and the done bit (DN).

- When a count-up counter is counting, its CU bit is high.
- When a count-down counter is counting, its CD bit is high.

A DN bit is high when its counter's Accumulate value is greater or equal to the counter's Pre-set value.

4. OPERATIONS & SIMULATIONS

4.1 FLOW DAIGRAM OF OVERALL SYSTEM:

This flow chart is explained as full control of project .when included the security system which is used to alert the fault conditions about the multiple machines.

4.2 LADDER LOGIC:

The most popular language used to program a PLC is ladder logic. Ladder Language (LD) is a graphic Language. It can be used to transcribe relay diagram, and is suited to combinational processing. It provides basic symbols like timer, blocks and coils.

The program is stored in the PLC either in battery-backed-up RAM or some other non-volatile flash memory. Often, a single PLC can be programmed to replace thousands of relays Ladder logic is a programming language that represents a program by a graphical diagram based on the circuit diagrams of relay logic hardware. It was primarily used to develop software for programmable logic controllers (PLCs) used in industrial control applications. The name is based on the observation that programs in this language resemble ladders, with two vertical rails and a series of horizontal rungs between them.

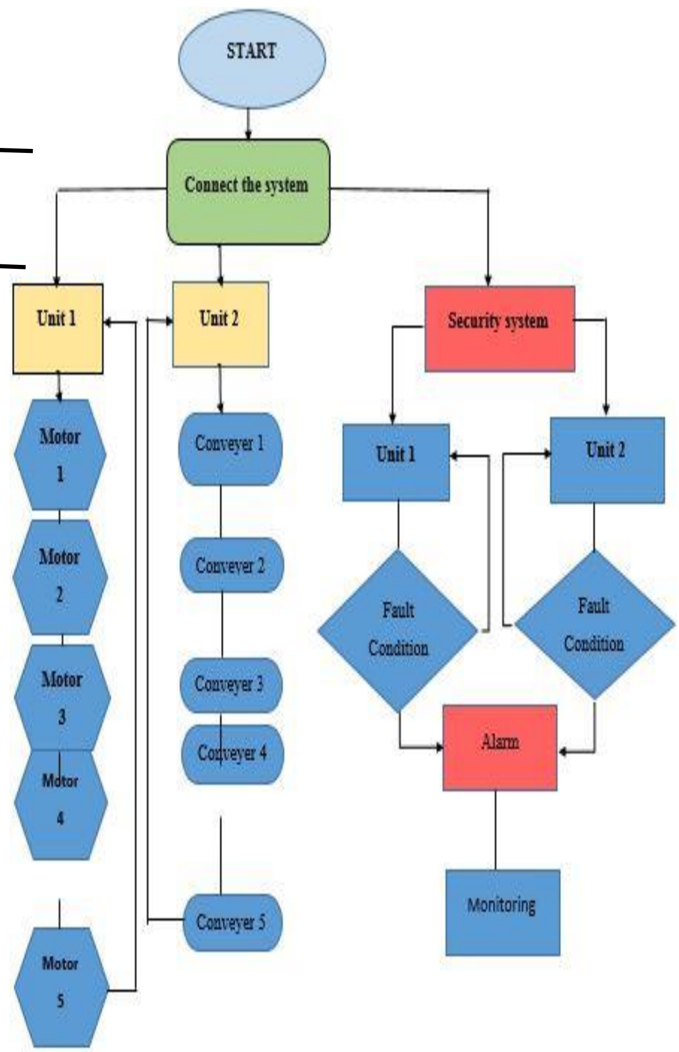


Fig.9 Flow chart of system operation

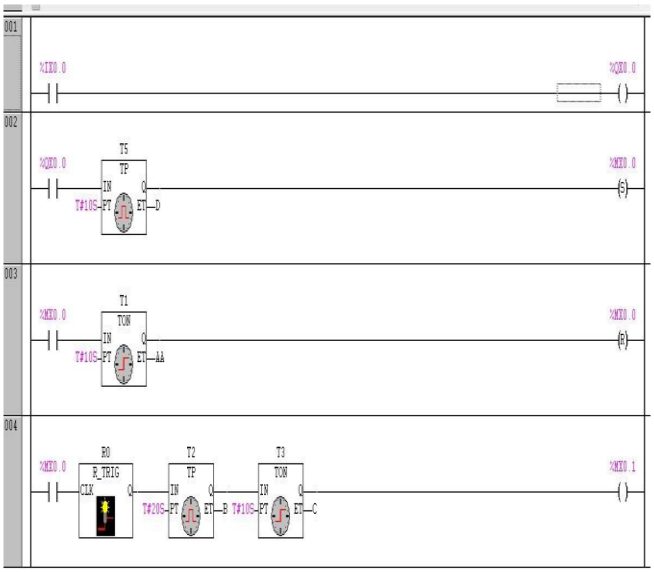


Fig.10 Ladder diagram

4.3 SIMULATION:

In this paper consist of timer controller so our main part of this project is TIMER BLOCK. The timer blocks which actually used to gives information on machine when it's turn ON and turn OFF. This can be checked by clicking on program configuration block which it worked by set program by ladder logic. The time set by ladder program.

B11 is multiple machines such as conveyer and motors etc. B002 is timer block is shown fig.11.

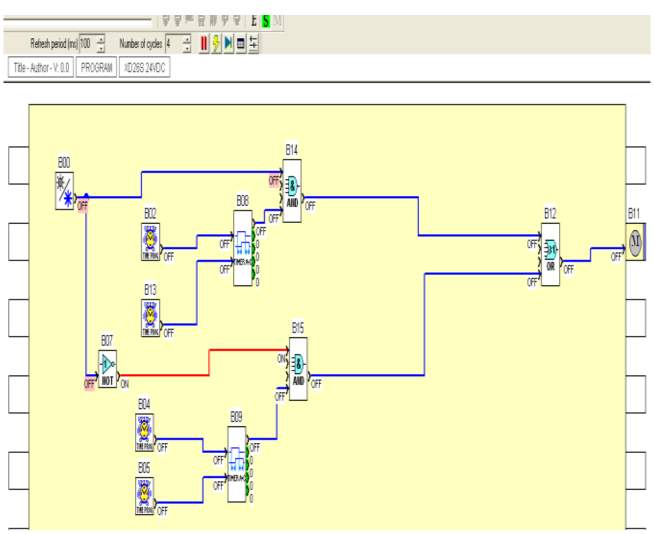


Fig.11 program configuration

Next step is to select PARAMETER Task Bar of B02 timer block. During specified time which machines are turn ON or OFF is set to be the block shown in Fig.12.

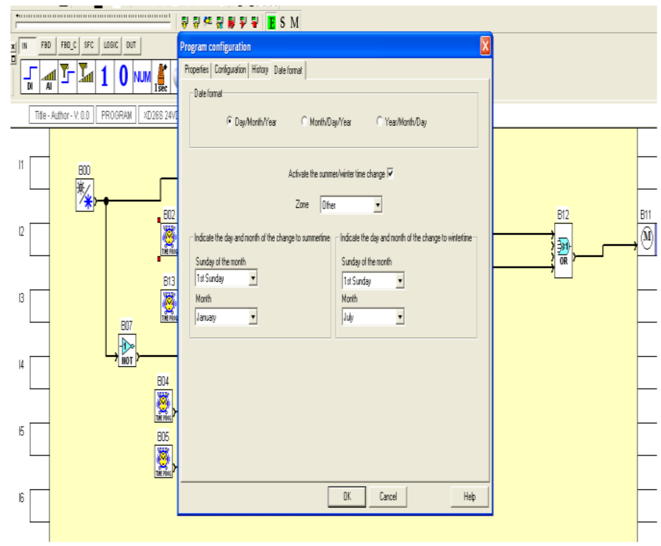


Fig.12 Timer program block

Next step time set to be which unit operating in which time. Shown in Fig.13.

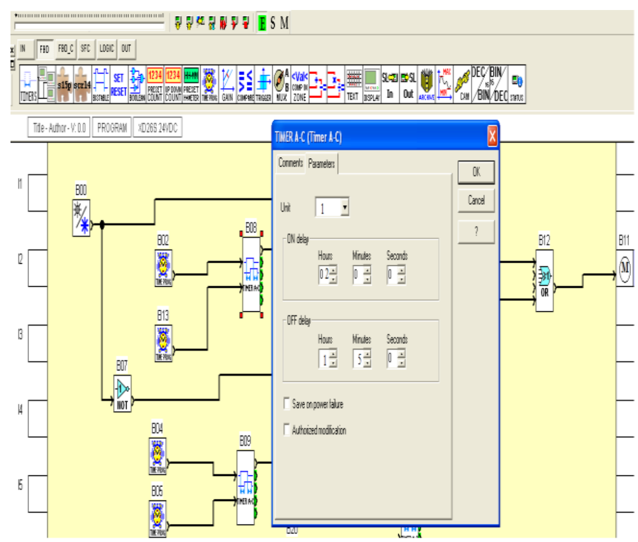


Fig.13 Unit timer block

Finally all values of blocks were programs are simulated .The programs are simulated by PLC software. The programs written according to the specified time.

5. RESULTS

The result of this project is to control time in multiple machines using PLC. In one unit motor is connected and other unit conveyor is connected. A motor is used for a required process [ON] at that time the conveyer is at OFF position. After the completing the unit one process the conveyer want to get start. These two process depend on time by controlling time, the process get completed. Now a days the industries except all work have to be done in speed. The human beings cannot done it effectively as the machine can done, So they need automation for their better convenient by using PLC automation it can be done in efficient manners when compared to another automation.

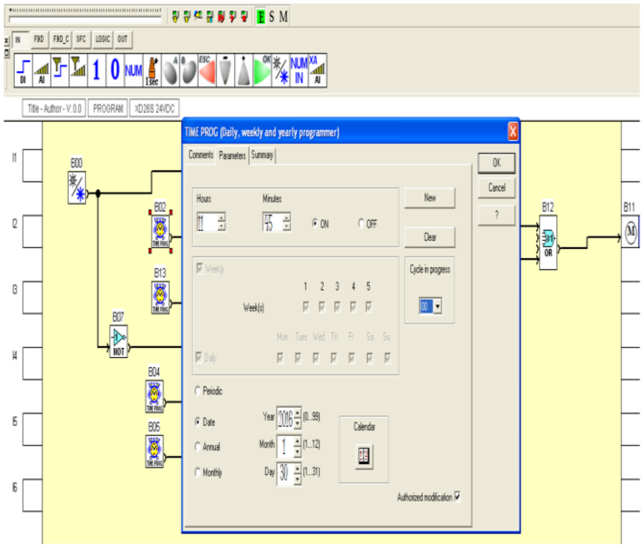


Fig.14 simulation OFF time

In this paper by using PLC we can automatically control time. Till now there is no solution for controlling of time for multiple machines in a time the special advantage of the paper is to control by time with PLC system.

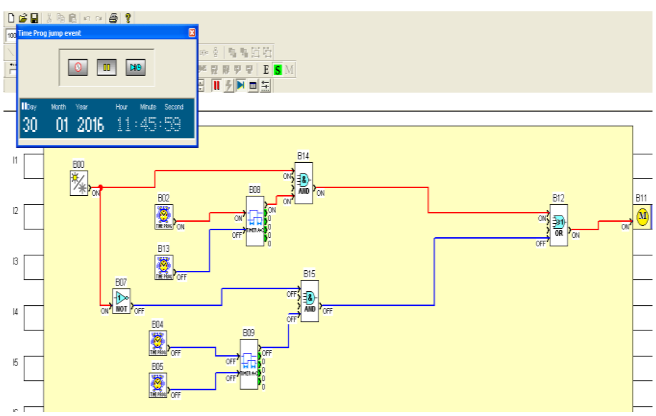


Fig.15 simulation ON time

The simulated results are shown in fig 14, 15. In fig 14 is our project result in PLC at OFF condition by simulating. In fig 15 is our project result in PLC at ON condition by simulating.

6. CONCLUSIONS

In this paper, an approach for controlling time by using PLC is proposed. The proposed controller gives fast, reliable, and power efficient of controlling time. This paper confirms that the proposed PLC based timer controller for multiple machines has great potential to revolutionize for control time which in turn saves large amount of time.

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