



# Andhra Pradesh State Skill Development Corporation



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# INDUSTRIAL AUTOMATION WITH PLC

## PLC TIMERS

Everybody knows why time is so important in our life. Whether it is human or machine, nothing can be done without time. Every little thing around us is getting automated. Here we are interested in PLC (Programmable Logic Controller) automation.

In PLC automation, different types of PLC programming instructions are used with their different specifications. Out of these PLC ladder diagram (LD) programming instructions, timer instruction is one of the most important instructions which plays a very significant role.

## What is the PLC Timer?

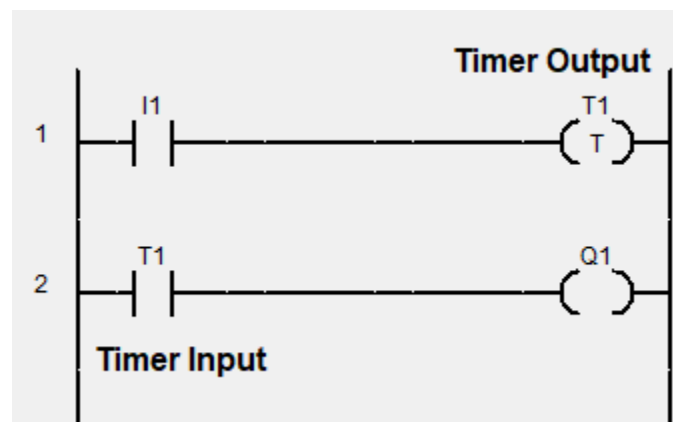
PLC timer is an instruction to control and operate the device for a specific duration. With the timer, we can perform any specific operations for a particular time span.

A timer is one of the most essential and useful entity.

You can set time-based activity with the help of the PLC programming timer instruction. Every PLC having different timer functions.

The timer instruction is used to provide programming logic and to decide when to turn on or off the circuit. It has both normally open (NO) or normally closed (NC) contact.

Let's see here, the representation of the input and output timer NO and NC contact in LD programming.



Timer output contact is shown in the coil form or box form or rectangular form. In AB and Siemens PLC, it is represented in the box shape.

If you want to perform work or device activity in a particular time span, you have to get familiar with the timers. For this, you have to learn I/O timer instructions for writing the PLC program.

In the Ladder Diagram (LD) PLC programming, you can set the PLC timer from millisecond (ms) to an hour (hr) time range.

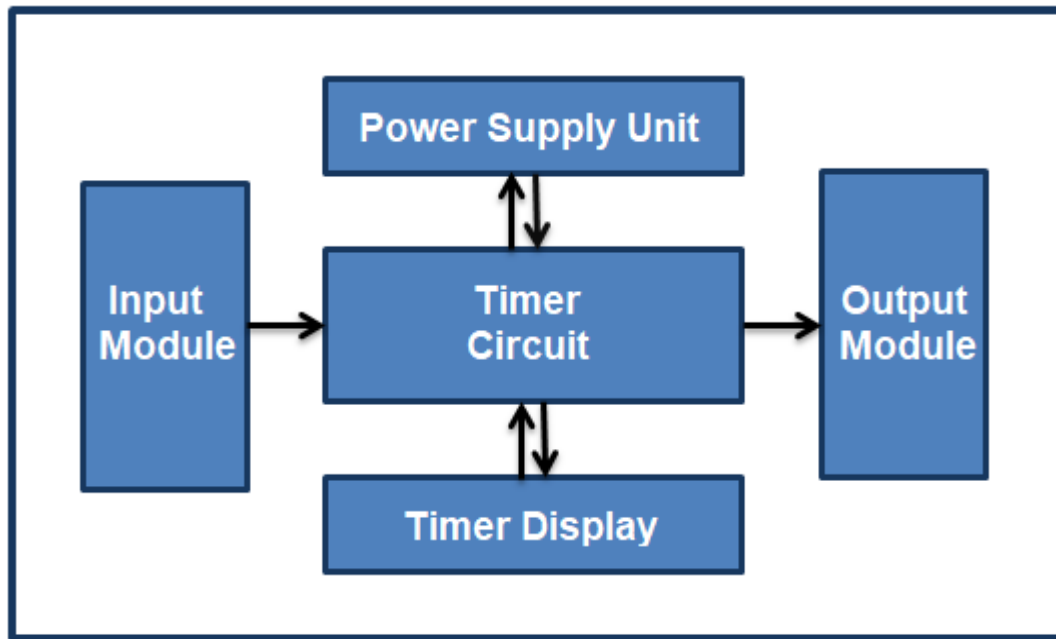
Are you interested in knowing, how does it actually work?

Let's see the internal circuit of the timer.

## Basic Internal Circuit of PLC Timer

Now, we are looking at the internal timer circuit of the PLC. The working of the timer circuit is based on the four main parts.

Each of the internal parts of the timer circuit has various features and functions. This is how they are connected and constructed in the given diagram.



**Block Diagram of PLC Timer**

Here are some of the basic terminologies you need to understand about the timer used in the PLC.

### 1. Input and Output Modules

The module which interacts with the input signal is called as **Input Module**. Input module requires to connect to the timer circuit for providing the input signal.

The module which interacts with the output signal is called as **Output Module**. The output module is required to connect the timer circuit.

### 2. Power Supply Module

The power module provides a power supply for the proper functioning of the timer circuit. It can connect with the ac voltage source (like 120, 230 V AC) or dc voltage source (like 5, 12, 24 V DC).

### 3. Internal Timer Circuit

The timer circuit performs the set and resets functions.

If the auxiliary power supply is 'on', the timer will give the momentary input pulse for the set and reset operation.

## 4. Timer Digital Display

The digital timer displays the set and elapsed timing value.

For the automation purpose, the values can be displayed in a few milliseconds (ms). This will be easy for tracking your automation system.

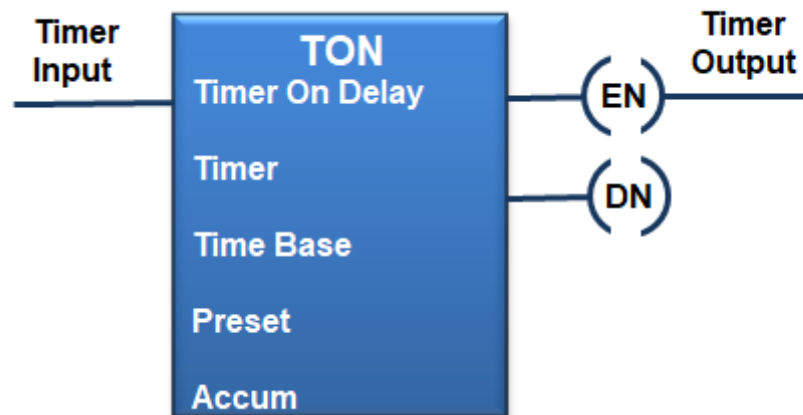
### What are the types of PLC Timer?

For the ladder diagram programming, the classification of the PLC programming timer is-

#### 1. On Delay Timer (TON)

An on-delay timer (TON) is a programming instruction which use to start momentary pulses for a set period of time.

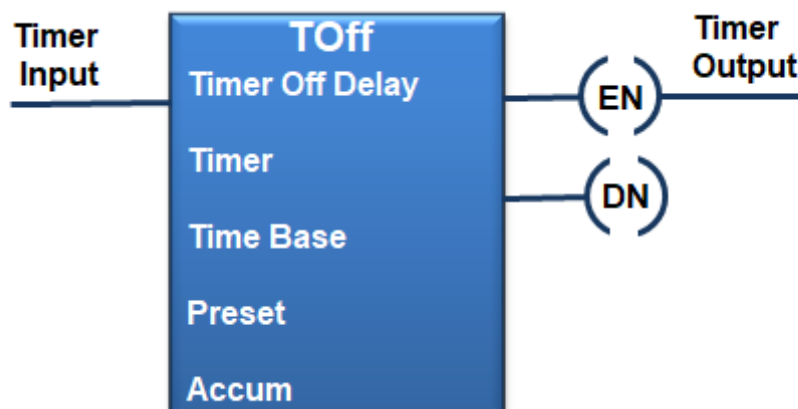
Let's see, a simple construction of the AB PLC On-delay timer programming instruction.



#### 2. Off Delay Timer (TOFF)

An off-delay (TOF) timer is a PLC programming instruction which use to switch off the output or system after a certain amount of time.

See here, a basic structure of AB PLC Off delay timer programming instruction.

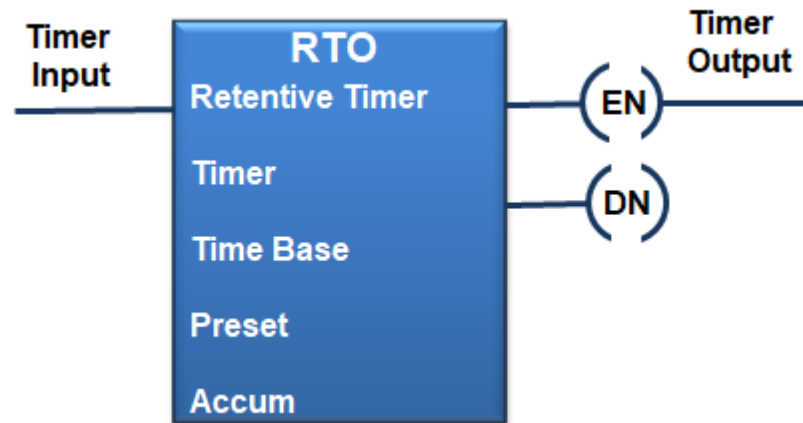


### 3. Retentive On/Off Timer (RTO)

The main function of the RTO is used to **hold** or **store** the set (accumulated) time.

RTO is used in the case when there is a change in the rung state, power loss, or any interruption in the system.

In the AB PLC, retentive timer instruction look like this.



### Timer Instructions Address for Multiple PLC Brands

We have seen three timers provide the time delay functions to control the PLC operations. There are four main values that the timer deals with.

- Timer Address
- Pre-set Value
- Timer Base Value
- Accumulated value

Each timer instruction has three very useful status bits. These bits are:

1. Enable bit (EN)
2. Timer Timing bit (TT)
3. Done Bit (DN).

In the AB and Siemens PLC, the output bit is often called the timer's 'Done bit'. And it indicates the timer has reached its pre-set time.

#### 1. Addressing for ABB PLC

In the ABB PLC programming, we can simply write the I/O timer address of the ladder diagram. We can set the timer value in ranges from 'T0' to 'T255'.

You can see the above diagram of the I/O contact representation.



## 2. Addressing for AB (Rockwell) PLC

For the AB PLC, the timer has the address ranging from 'T4:0' up to 'T4:255'.

Where T4 is the file type.

Addressing format for timer instruction with the three status bits.

File type: Element Number/ Bit status

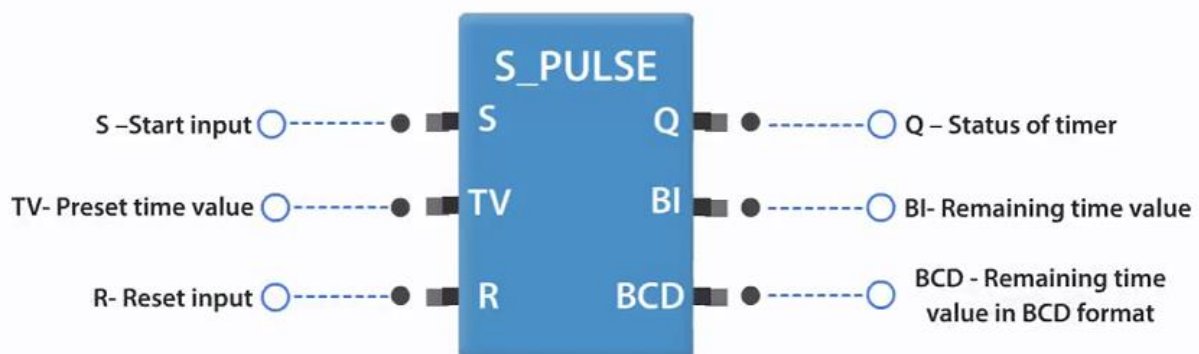
1. Enable bit (EN) address is ranging from 'T4:0/EN' up to 'T4:255/EN'.
2. The addressing for Timer timing bit (TT) is ranging from 'T4:0/TT' up to 'T4:255/TT'.
3. Done bit (DN) address is ranging from 'T4:0/DN' up to 'T4:255/DN'.

## 3. Addressing for Siemens PLC

In the Siemens, LD program can be written with the five types of timers.

- Pulse timer (S\_Pulse)
- Pulse extended timer (S\_PExT)
- On delay timer (S\_ODT)
- On delay extended timer (S\_ODTS)
- Off delay timer (S\_OffDT)

**The general block diagram of the timer (In Siemens PLC)**



Where,

S – Set value or signal for the timer

TV – Time Variable. It is used to store time value in the form of S5T#tv

You can enter the time value from 1 to 9990 seconds.

R- Reset value of the timer

Q – Output of the timer

BI – Current time in binary code

BCD – Current time in binary decimal code

#### 4. Addressing for Delta PLC

For the WPL Soft software (Delta PLC), you can use timer addressing ranging from 'T0' to 'T127'.

In Delta PLC, the input timer address is shown as a general representation (T0, T1... T127). And Output coil is written in the form of

**T (Address rang) K (10\*timer value)**

Where,

'T0' is the timer address and 'K' is the constant term

**Delta PLC timer block diagram:**



For Delta PLC, the timer starts for a 10-second. It should be written in the form of 'T0 K100'.

#### 5. Addressing for Mitsubishi PLC

Both, Mitsubishi PLC and Delta PLC use the same timer addressing format.

#### Example-based on the PLC Timer Instruction

A very basic and real-life example is controlling traffic signals using PLC automation. After a certain (fixed) time, each side signal has to turn on and off. At a time only one side traffic signal should be on.

This logic can be implemented using simple PLC timers.

#### What are the Applications of Timer Instruction?

Here are some of the basics applications of timers you can use in a PLC automation environment.

1. Use for the delay action.
2. It is used to run or stop operations as per the user's command.
3. The RTO timer helps to record or hold an intermediate time value.