TIMER INSTRUCTIONS

TIMER

- Timers are used to turn outputs on and off after a time delay, turn outputs on or off for a set amount of time, and keep track of the time an output is on or off

- **Timer Types:**

1. Timer On Delay(TON)
2. Timer OFF Delay(TOFF)
3. Retentive Timer ON(RTO)

- Timer commands:

1. **TON (Timer On Delay) —**Counts time-based intervals when the instruction is true
2. **TOF (Timer Off Delay) —**Counts time-based intervals when the instruction is false
3. **RTO (Retentive Timer On) —**Counts time-based intervals when the instruction is true and retains the accumulated value when the instruction goes false

QUANTITIES ASSOCIATED WITH TIMER INSTRUCTION

- *preset time*

  Represents the time duration for the timing circuit

- *accumulated time*

  Represents the amount of time that has elapsed from the moment the timing coil became energized

- *time base*

  Once the timing rung has continuity, the timer counts in time-based intervals and times until the preset value and accumulated value are equal

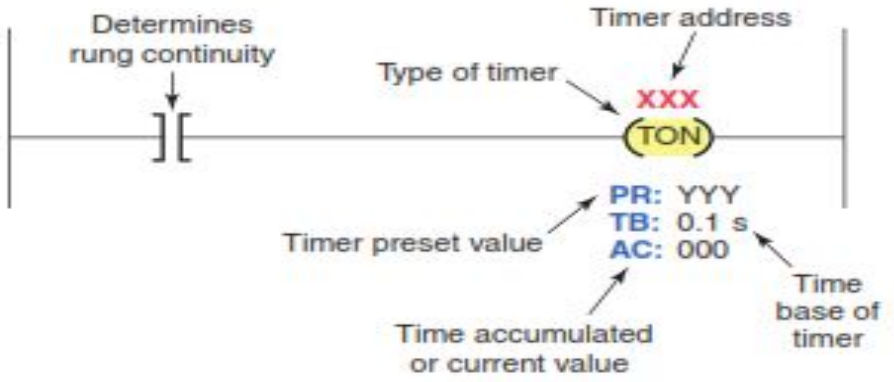


Figure 7-9 Coil-formatted timer instruction.

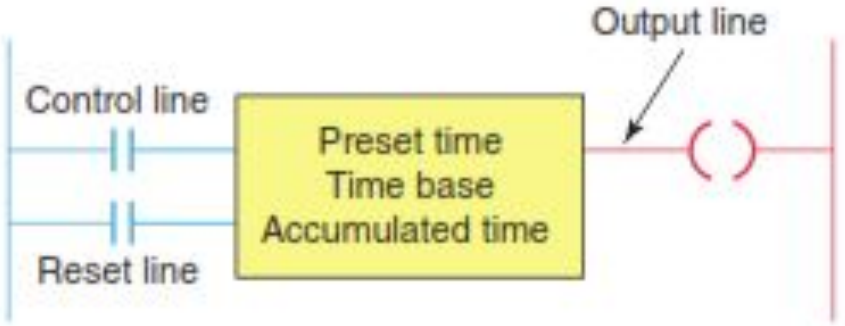


Figure 7-10 Block-formatted timer instruction.

ON DELAY TIMER INSTRUCTION

- The on-delay timer operates such that when the rung containing the timer is true, the timer time-out period commences
- At the end of the timer time-out period, an output is made true

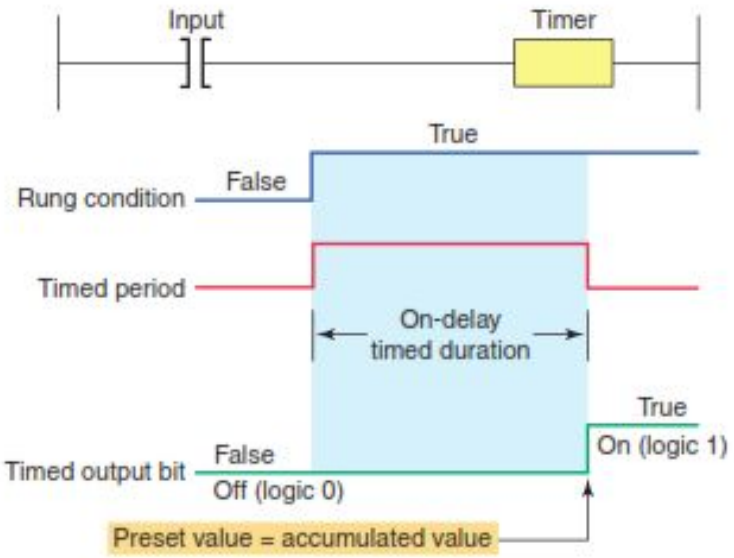


Figure 7-11 Principle of operation of an on-delay timer.

ALLEN-BRADLEY SLC 500 TIMER FILE

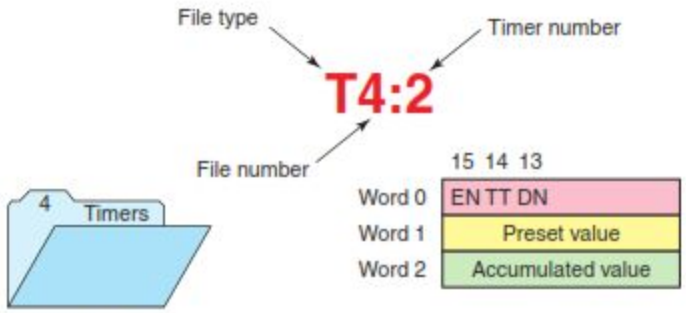


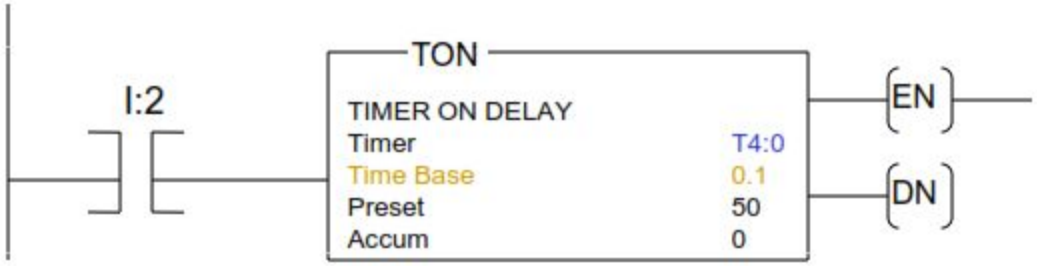
Figure 7-12 SLC 500 timer file.

- T4 : timer file 4
- Timer element number 2 (0–255 timer elements per file)
- T4:2/DN is the address for the done bit of the timer.
- T4:2/TT is the address for the timer-timing bit of the timer.
- T4:2/EN is the address for the enable bit of the timer.

CONTROL BITS

- **Enable (EN) bit**

  The enable bit is true (has a status of 1) whenever the timer instruction is true.
- **Timer-timing (TT) bit —The timer-timing bit is true** whenever the accumulated value of the timer is changing, which means the timer is timing.
- **Done (DN) bit —The done bit changes state whenever** the accumulated value reaches the preset value.
- The *preset value (PRE) word is the set point of the timer,* that is, the value up to which the timer will time. The preset word has a range of 0 through 32,767 and is stored in binary form.

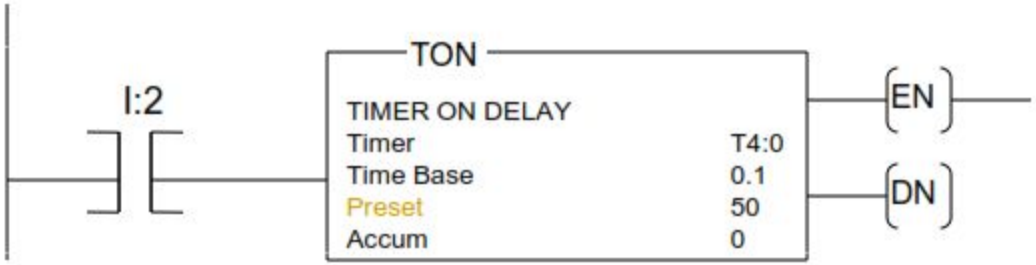


Above Timer is labeled T4:0

Timer Attributes

Time Base:

- Timers are typically programmed with several different time bases
  - 1 second, 0.1 second, 0.01 second, 0.001 second
  - Suppose time base is set to 0.1 and Delay increments is set to 50 → timer has 5 seconds delay (0.1 x 50)



Preset Attribute:

- Preset value is the number of time increments timer must count before changing the state of the output
  - Time Delay = Preset value x Time Base (refer to previous example)
  - Preset can be constant or a variable

Block-Type Timer
Status Bits (EN, DN, TT)

Timer Status bits can be used in ladder logic

Bit	Set When	Remains Set Till
Timer done Bit (bit 13 or DN)	Accumulated value is equal to or greater than the preset value	Rung conditions go false
Timer Timing bit (bit 14 or TT)	Rung conditions are true and the accumulated value is less than the preset value	Rung conditions go false or when the done bit is set
Timer enable bit (bit 15 or EN)	Rung conditions are true	Rung conditions go false

Preset (PRE)

- PRE can be used in ladder logic
  - **T4:0.PRE would access the preset value of T4:0**
    - **Note, PRE value is an integer**
- **Accumulated Value (ACC)**
  - **T4:0.ACC would access the accumulated value of timer T4:0**
- **Time Bases are available in 1 second intervals, 0.01 and 0.001 second intervals**
  - **Potential time ranges:**

Time Base	Potential Time Range
1 Second	To 32,767 intervals (up to 9.1 hrs)
0.01 Second	To 32,767 intervals (up to 5.5 minutes)
0.001 Second	To 32,767 intervals (up to 0.546 minutes)

What if a longer time is needed?

PLC ON-DELAY TIMER PROGRAM

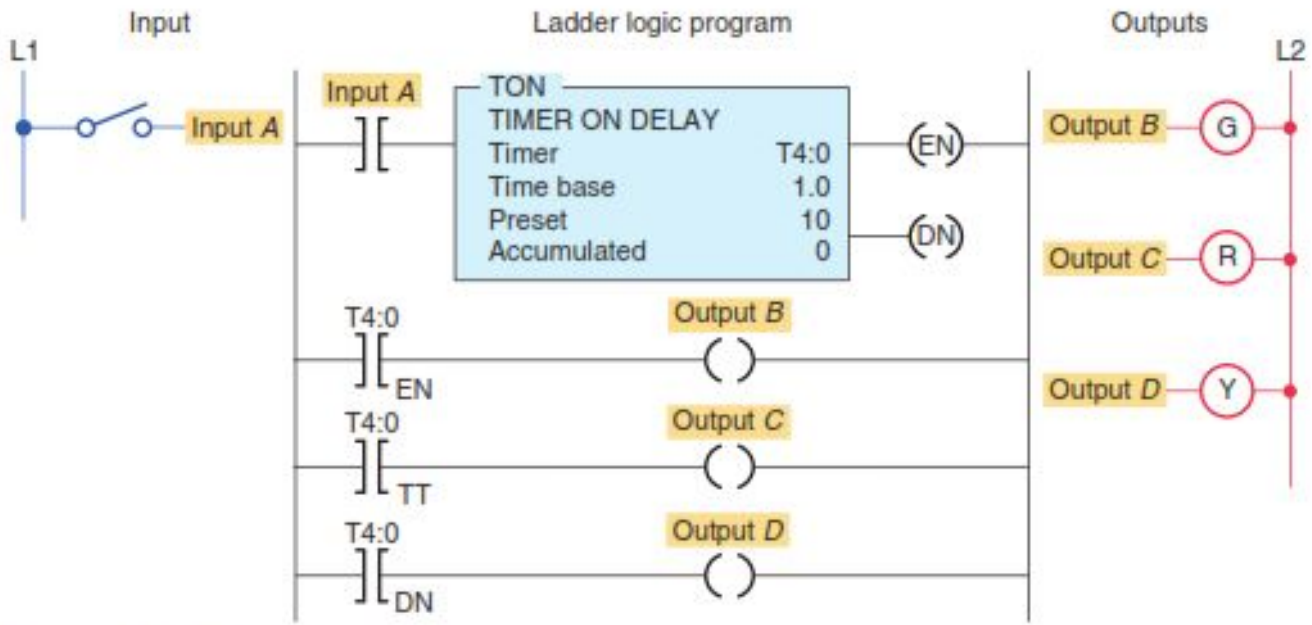


Figure 7-14 PLC on-delay timer program.

OFF DELAY TIMER INSTRUCTION

- The *off-delay timer (TOF) operation will keep the output* Energized for a time period after the rung containing the timer has gone false
- TOF starts to accumulate time when the rung becomes false
- The done bit (DN bit 13) is reset when the ACC value is equal to the PRE value. The DN bit is set when the rung becomes true

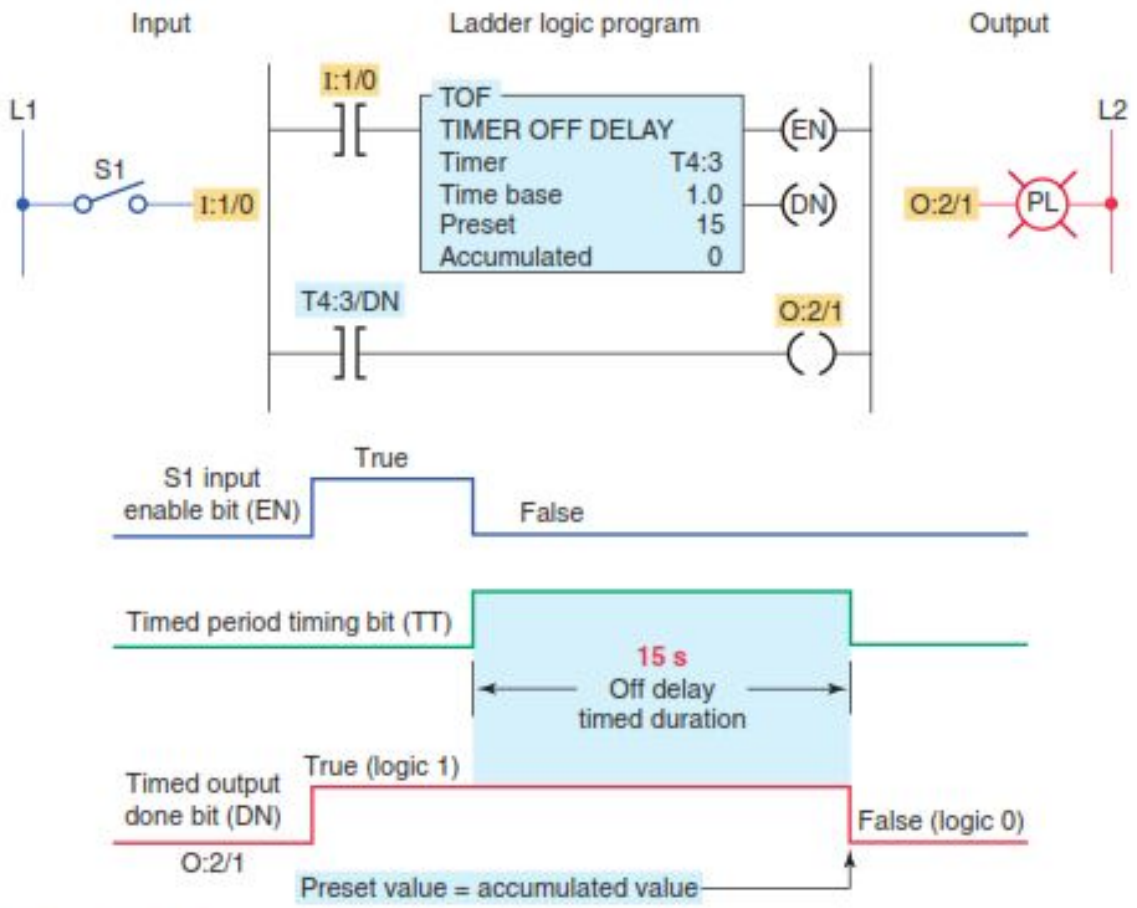


Figure 7-20 Off-delay programmed timer.

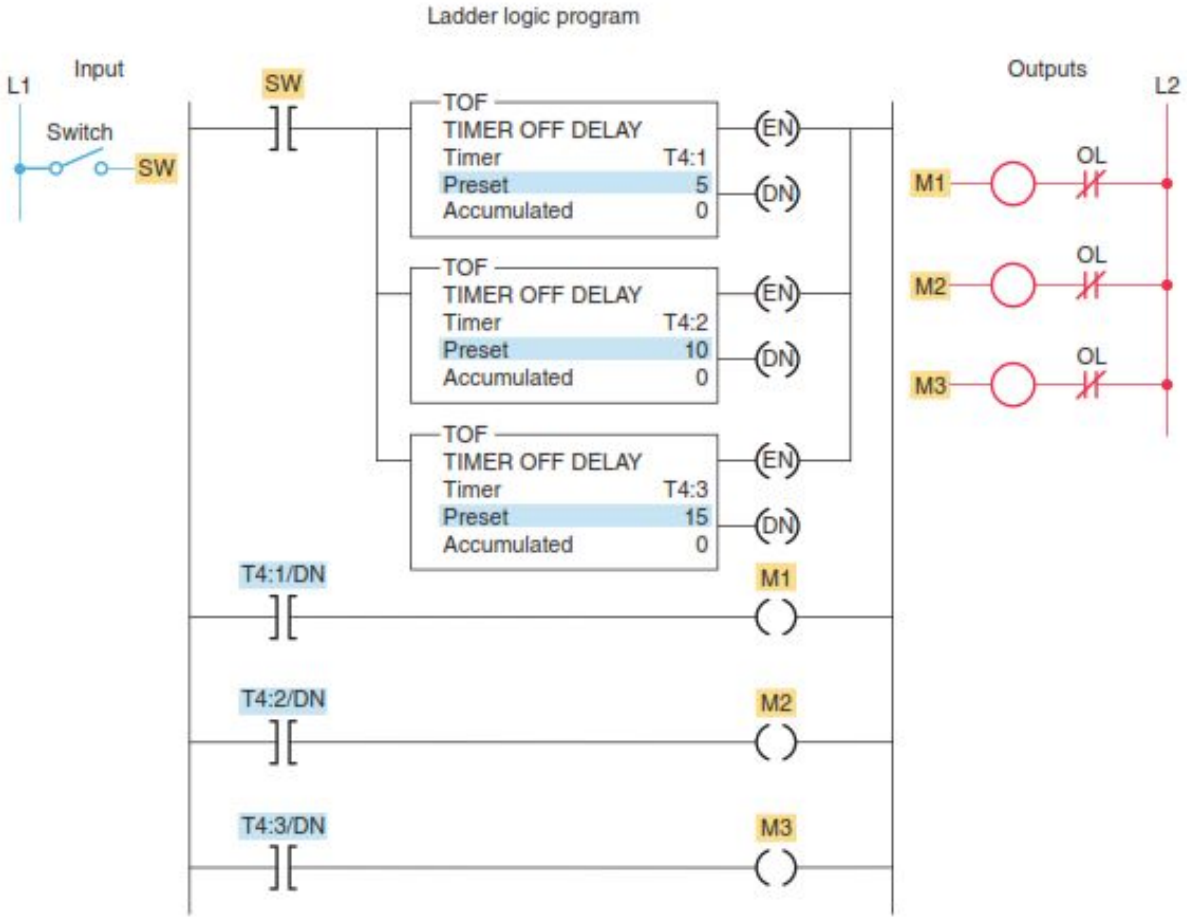


Figure 7-21 Program for switching motors off at 5 s intervals.

RETENTIVE TIMER

- A *retentive on-delay timer (RTO) operates the same* as a TON timer, except that the retentive timer retains
- (remembers) its ACC value even if:

- The rung goes false.
-
- The processor is placed in the program mode.

- The processor faults.
-
- Power to the processor is temporarily interrupted

- and the processor battery is functioning improperly

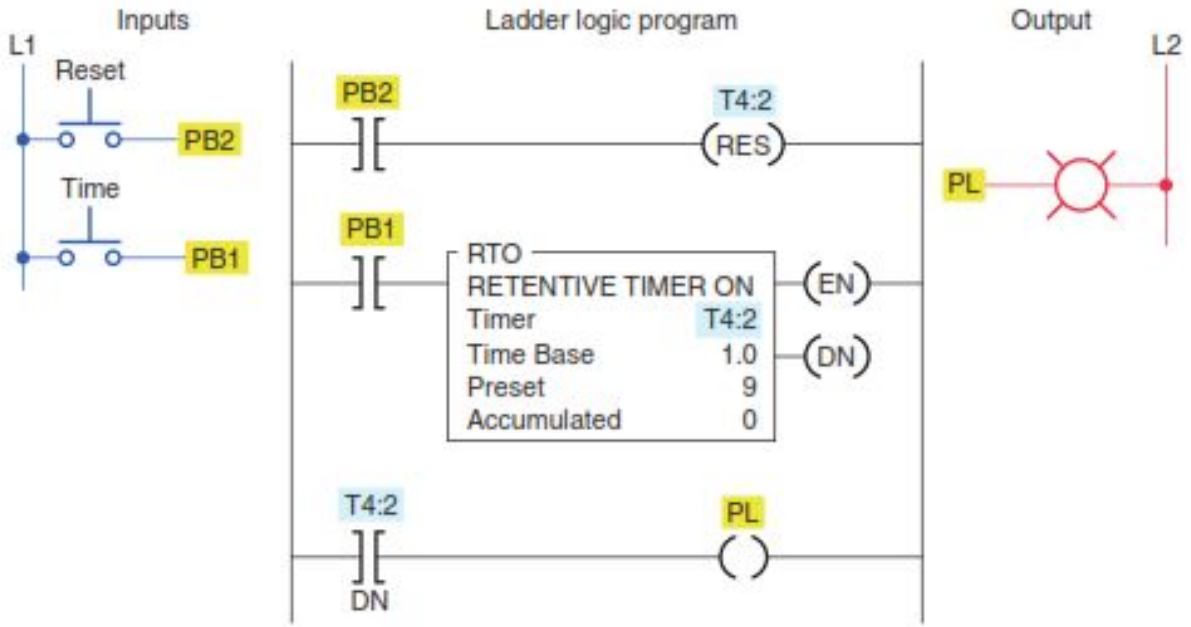
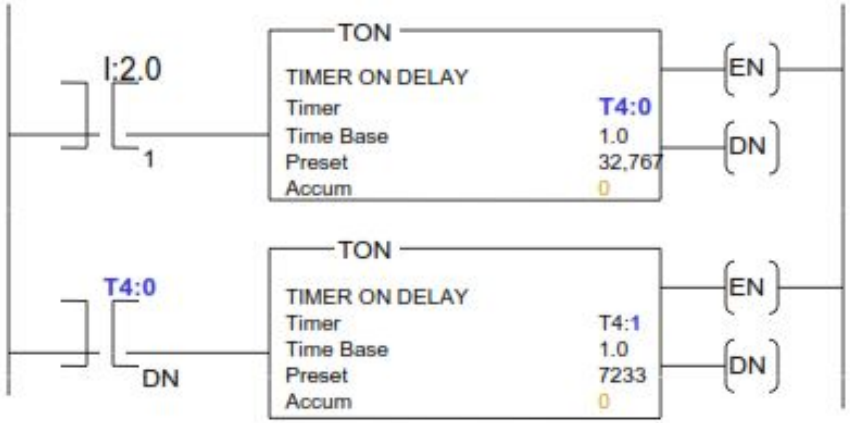


Figure 7-26 Retentive on-delay timer program.

Cascading Timers



Two timers are used to extend the time delay

- The first timer output, T4:0/DN, acts as input to second timer
  - When Input I:2.0 becomes true, timer 1 begins to count to 32,767 seconds (the limit of the timers)
    - When it gets to 32,767 seconds, output T4:0/DN turns on
    - This energizes timer T4:1
    - Timer T4:1 times to 7233 seconds (its preset value)
      - T4:1/DN turns on