PLC Timers

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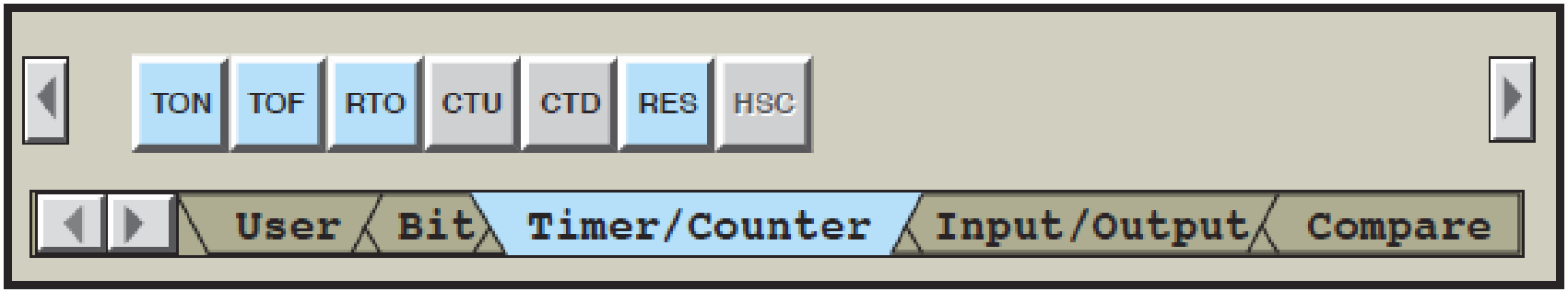
Timers

Timer Output Instruction

- Provides a method of executing a time-driven change in the process being controlled.
  - Creates a time delay in the sequence of process steps of the work cycle program.

PLC timer instructions that provide the same functions as timing relays.



The most common Plc timer instructions are:
On-delay timer (TON)
Off-delay timer (TOF)
Retentive timer on (RTO)

Quantities associated with the timer instruction.

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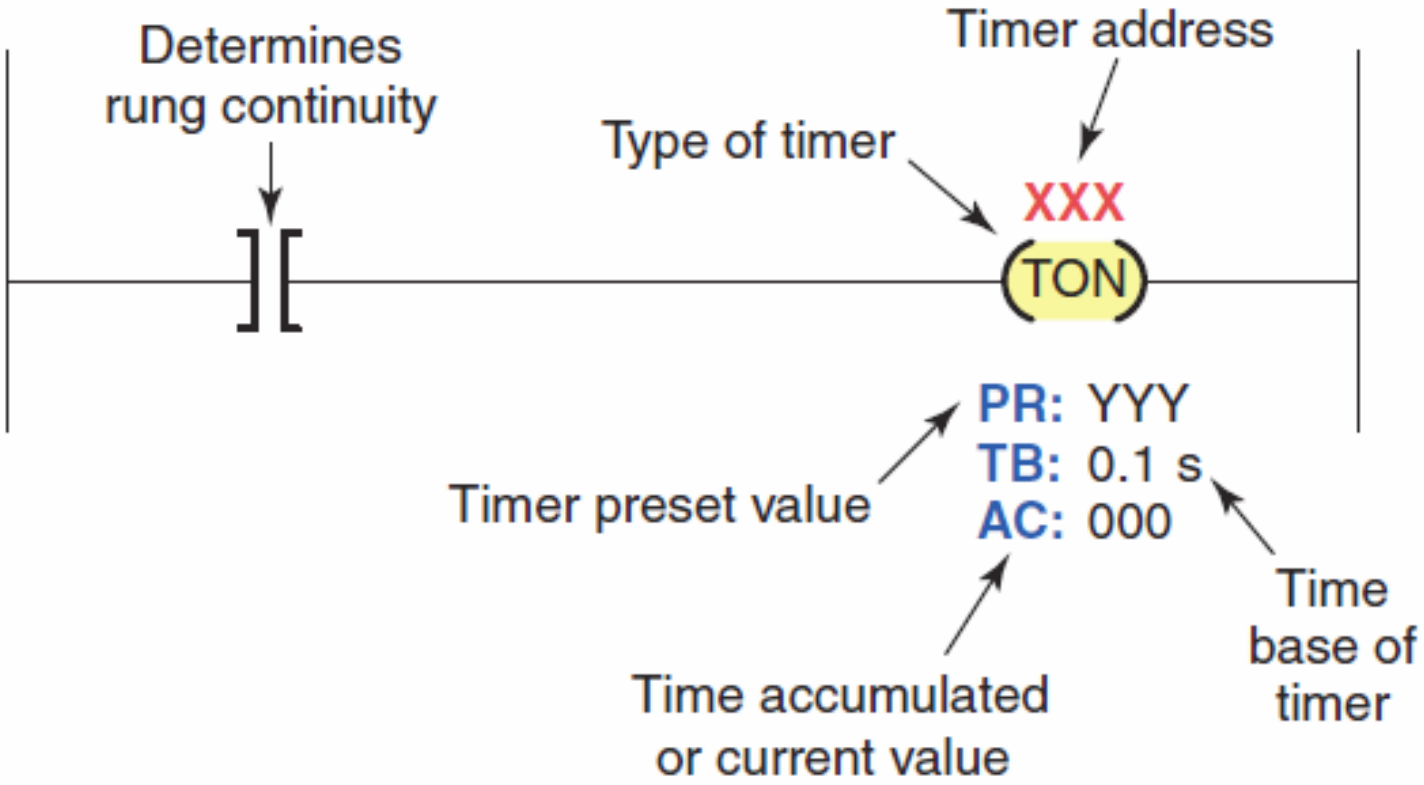
Preset time represents the time duration for the timing circuit.

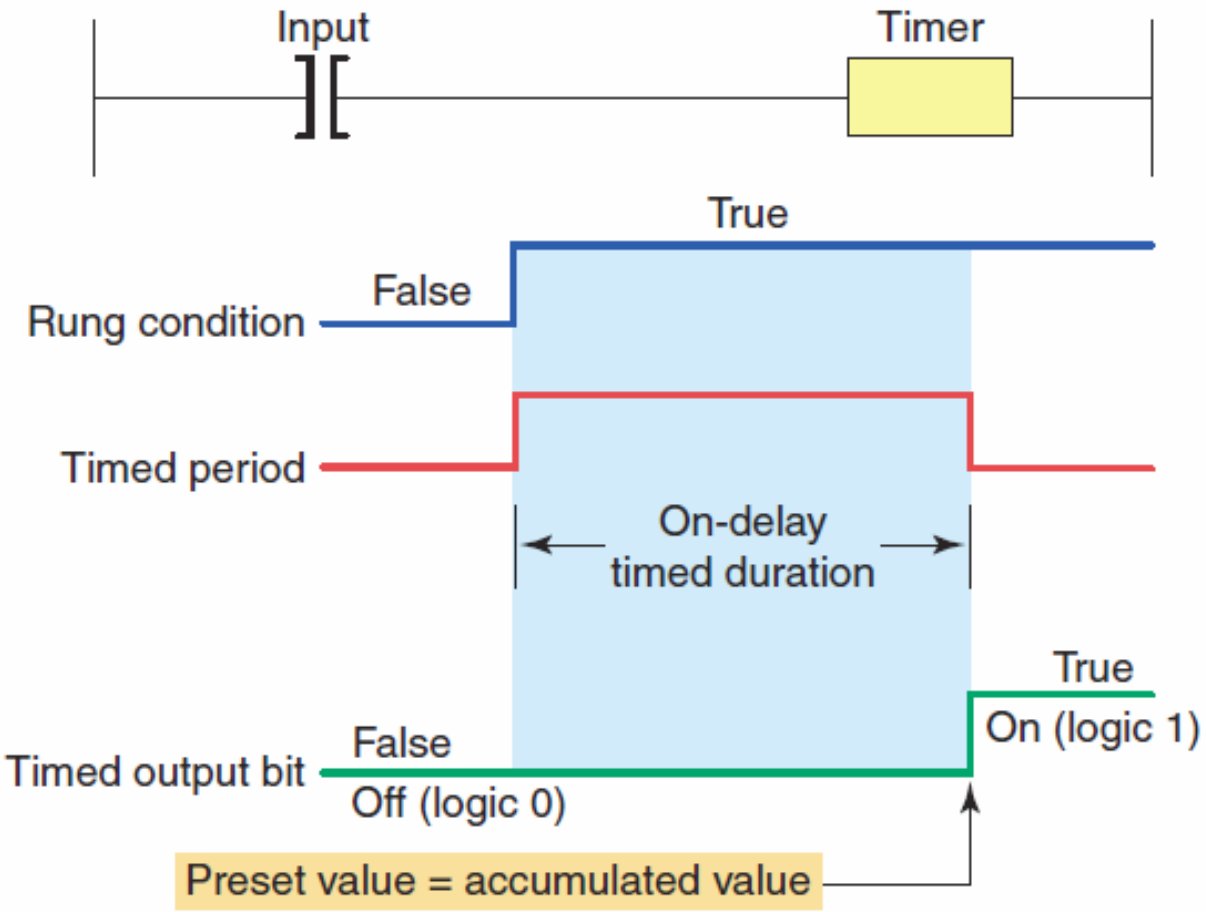
Accumulated time represents the amount of time that has elapsed from the moment the timing started.

Time Base is the intervals that the timers time out at. If a programmer entered 0.1 for the time base and 50 for the preset time, the timer would have a 5-s delay (50 x 0.1 s = 5 s).

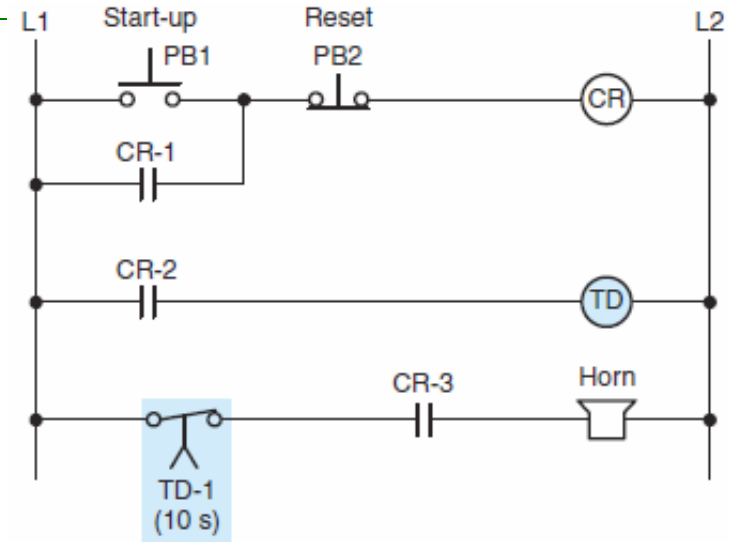
Coil formatted timer instruction.



An *on-delay timer* is used when you want a time delay to occur *before* an instruction becomes true.

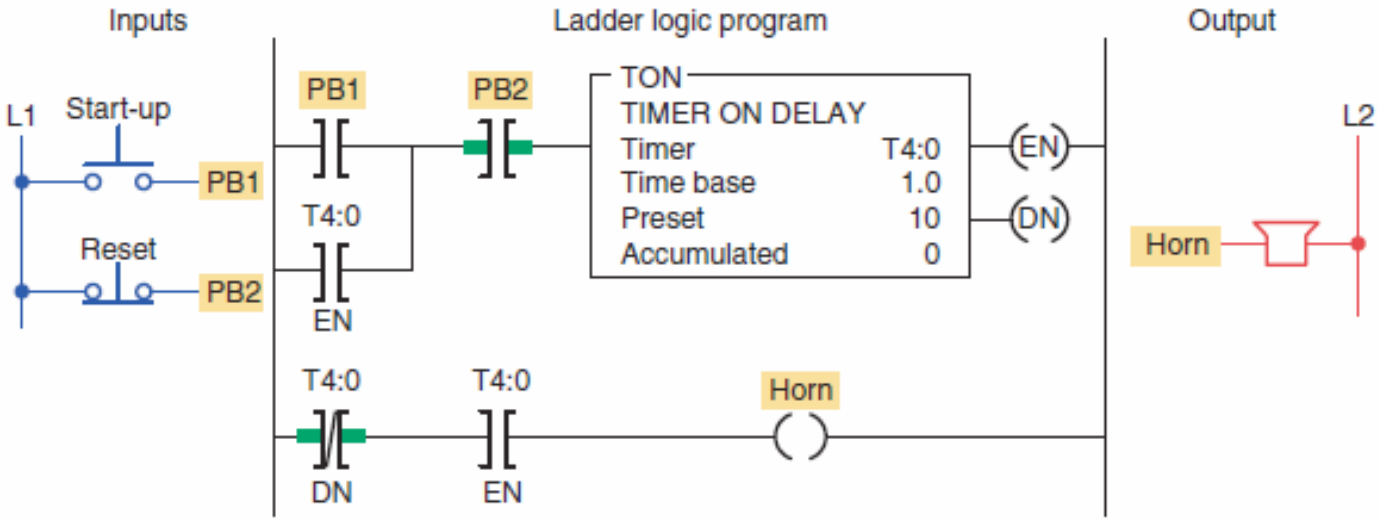


Conveyor *warning signal* circuit.

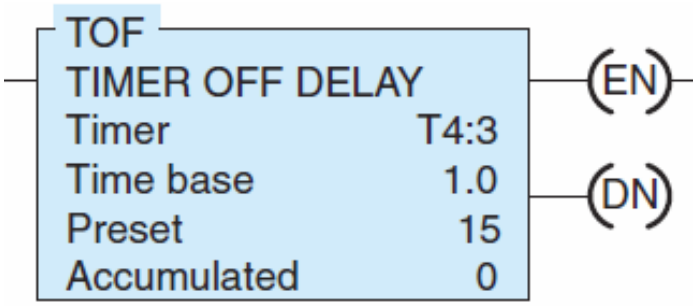


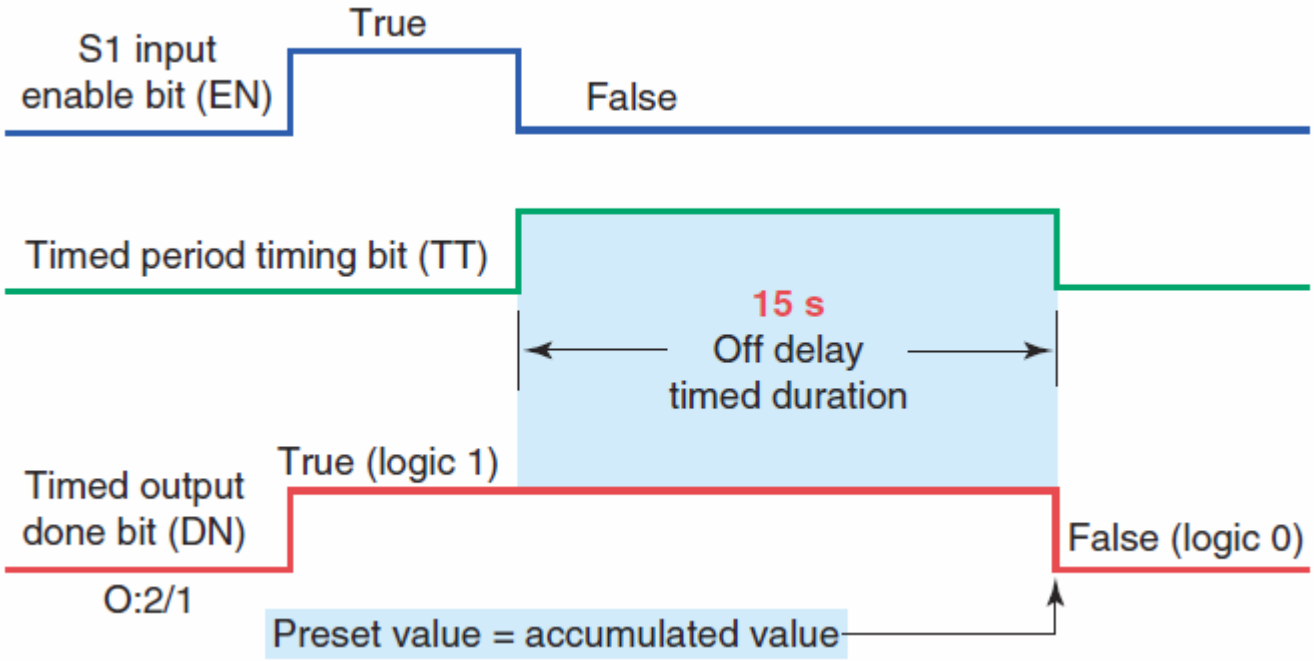
Hardwired Relay Circuit – warning horn sounds for 10 seconds whenever start button is actuated.

Equivalent SLC 500 programmed circuit.

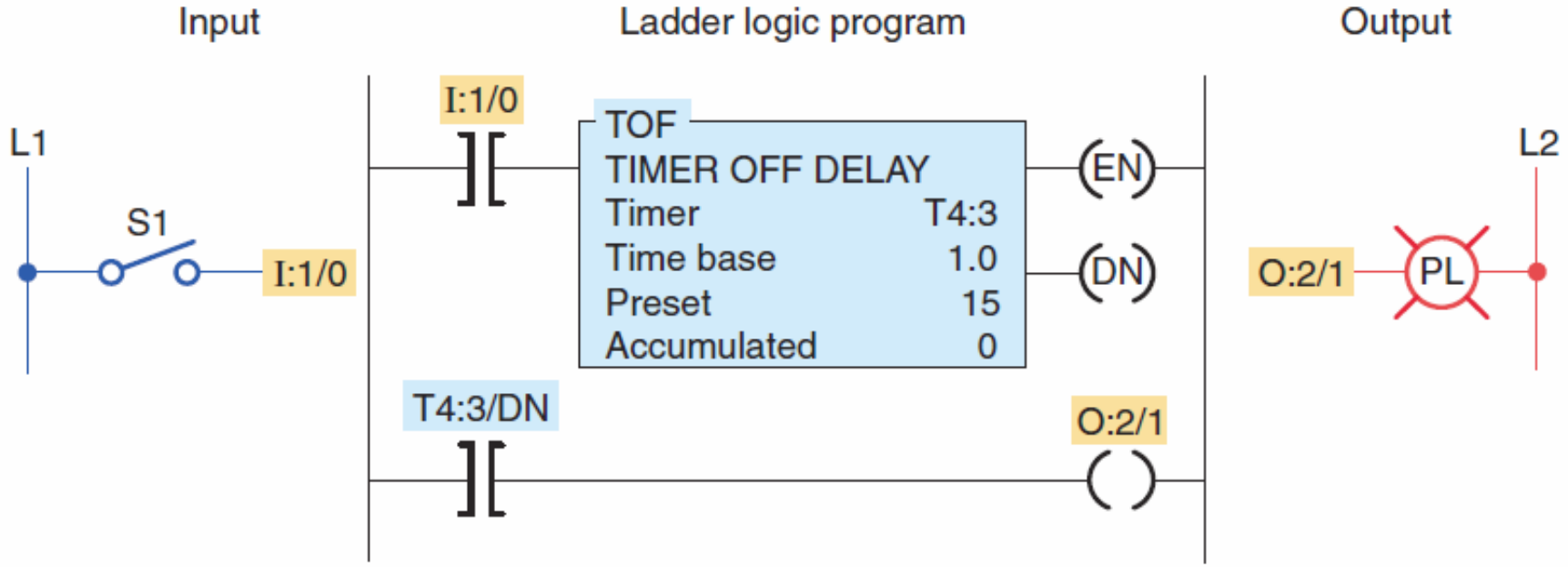


The *off-delay timer (TOF)* operation will keep the output energized for a time period after the rung containing the timer has gone *false*.





Off-delay timer (TOF) program



When the switch is first closed the lamp is switched on.

When switch is opened timing begins and the lamp switches off after a delay of 15 seconds.

If logic continuity is gained before the timer is timed out, the accumulated time is reset to 0.

Resetting Timers

- Resets timers accumulated value to zero
  - Necessary for timer to count again
- Methods of resetting timers:
  - Condition Instruction(s) change state from TRUE to FALSE
  - Second Input Method
    - When reset line changes state, timer clears the accumulated value
  - Separate Reset Instruction
    - Timer is RESET to OFF (FALSE) when the condition instructions for the reset instruction changes to OFF (FALSE).

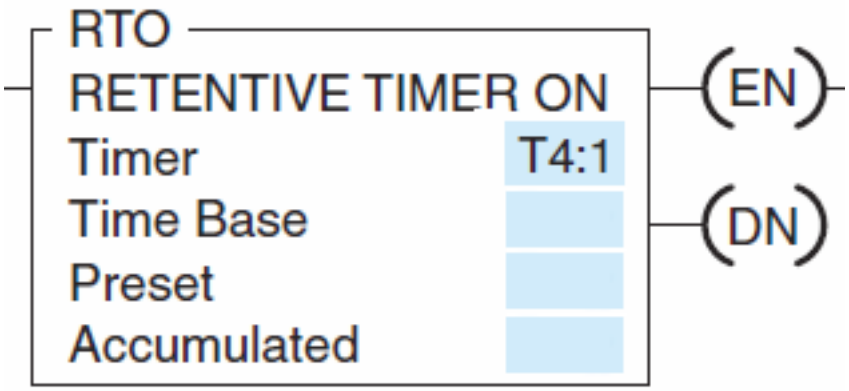
Nonretentive Timers

- Lose accumulated time every time the condition instruction(s) go from TRUE to FALSE
  - Timer count goes to zero

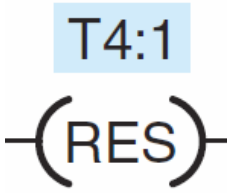
Retentive Timer

- Does not lose the accumulated time when the condition instruction(s) changes from true to false.
- Retain and add to the count when the condition instruction becomes true again.
- Like a stop watch
  - Must be reset to zero value
- Also called accumulating timers

A PLC retentive timer is used when you want to *retain accumulated time* values through power loss or the change in the rung state from true to false.

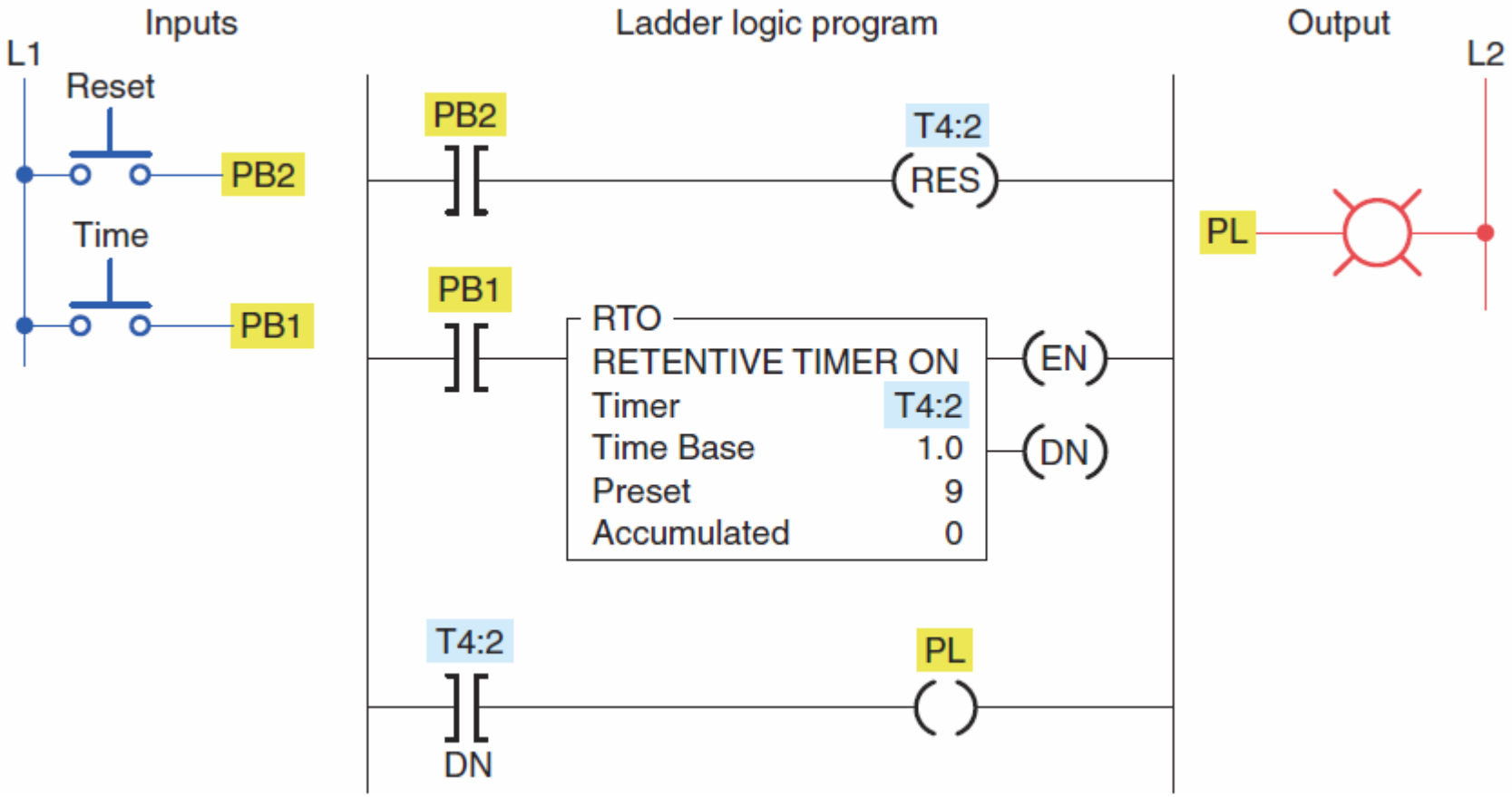


This timer must be accompanied by a timer reset instruction to reset the accumulated value of the timer to 0.



The RES instruction has the same address as the timer it is to reset.

Retentive on-delay timer program.



Rockwell Automation Timers

- Time ON-Delay (TON)
  - Begins accumulating time when the rung goes true and continues until one of the following conditions is met
    - Accumulated value equals preset value
    - The rung goes false (stops timing)
    - A reset timer instruction resets the timer
  - Nonretentive

Rockwell Automation Timers
Time On-Delay (TON) Status Bits

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- Timer enable bit (EN)
  - The enable bit indicates that the TON instruction is enabled.
  - Set to 1 immediately when rung is TRUE
    - Stays set until rung goes false
  - Can be used for logic
    - T4:0.EN (For timer number 0)
- Timer done bit (DN)
  - The done bit is set when .ACC ≥ .PRE.
  - Remains set until the rung goes false or a reset instruction resets the timer

Rockwell Automation Timers
Time On-Delay (TON) Status Bits

Swagelok

- Timing Bit (TT)
  - The timing bit indicates that a timing operation is in process
  - Set to 1 when rung goes true
  - Remains true until rung goes false or reset instruction issued
- Preset Value
  - Can be accessed by programmer
  - Address – T4:0.PRE (For timer 0)
- Accumulated Value (ACC)
  - Can be accessed by programmer
  - Address -- T4:0.ACC

Rockwell Automation Timers
Time On-Delay (TON) Status Bits

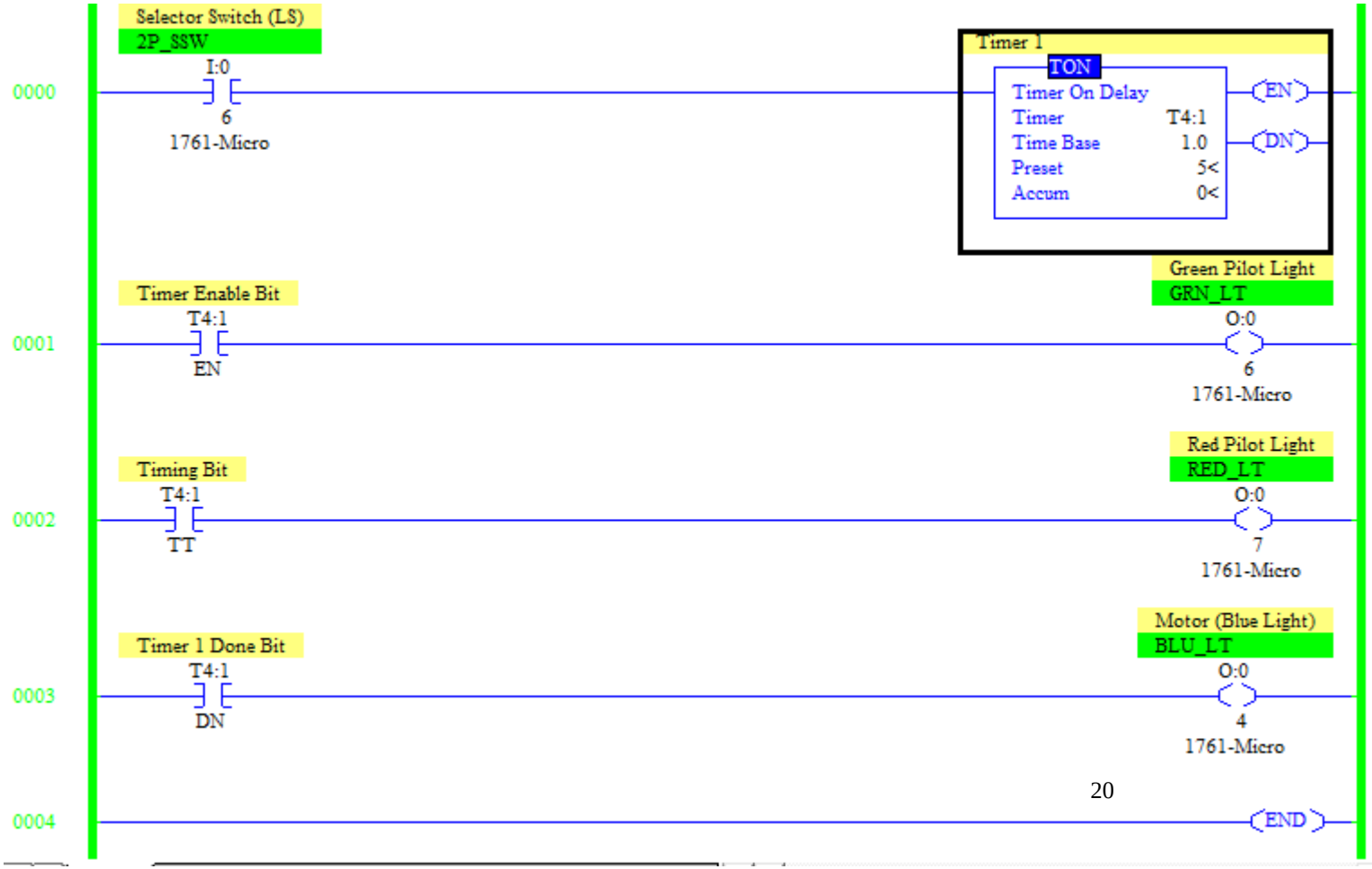
Swagelok

- Time Base
  - The time base is always 1 msec.
    - For example, for a 2-second timer, enter 2000 for the .PRE value.

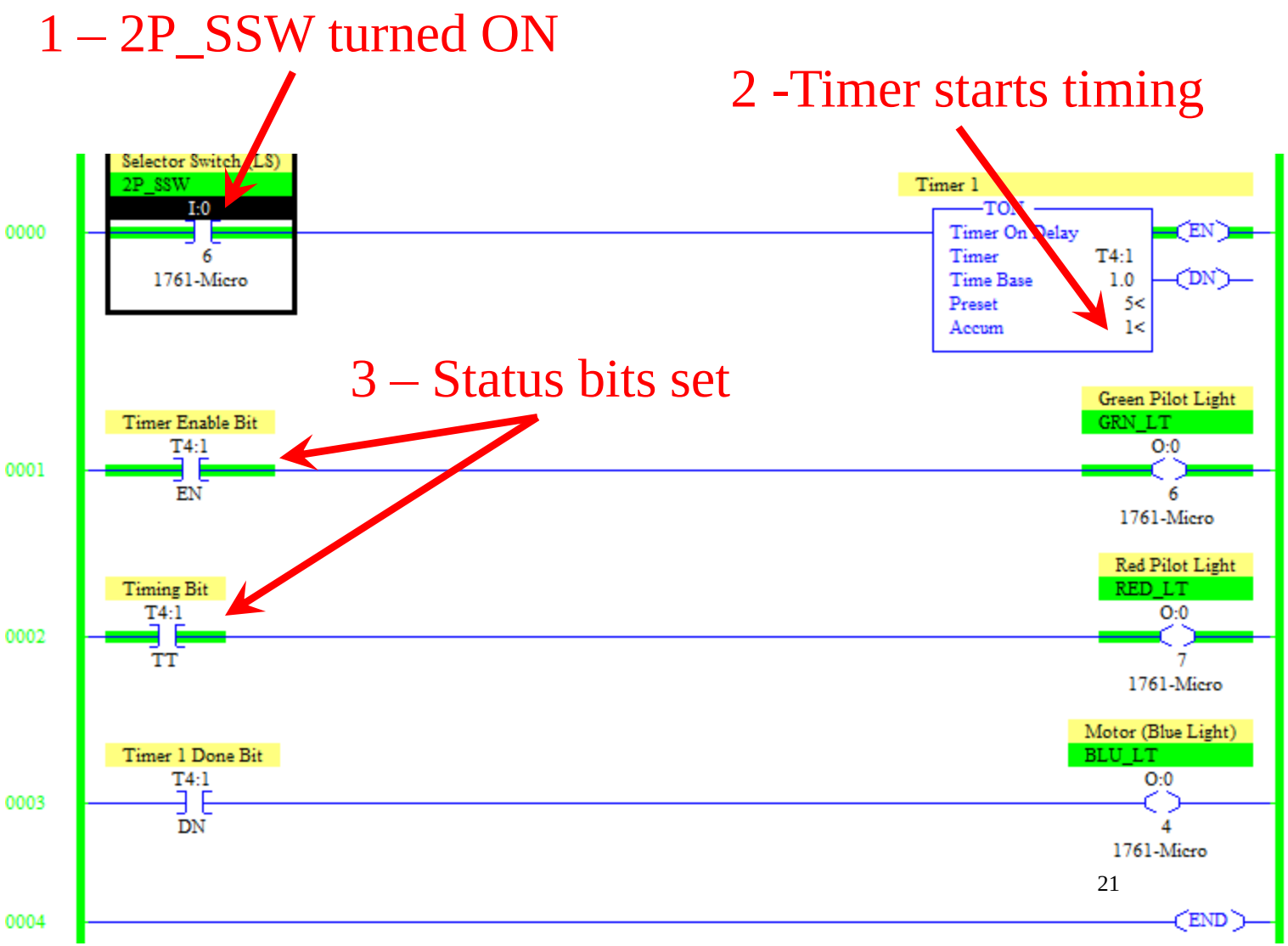
Rockwell Automation Timers
Time On-Delay (TON)

Swagelok

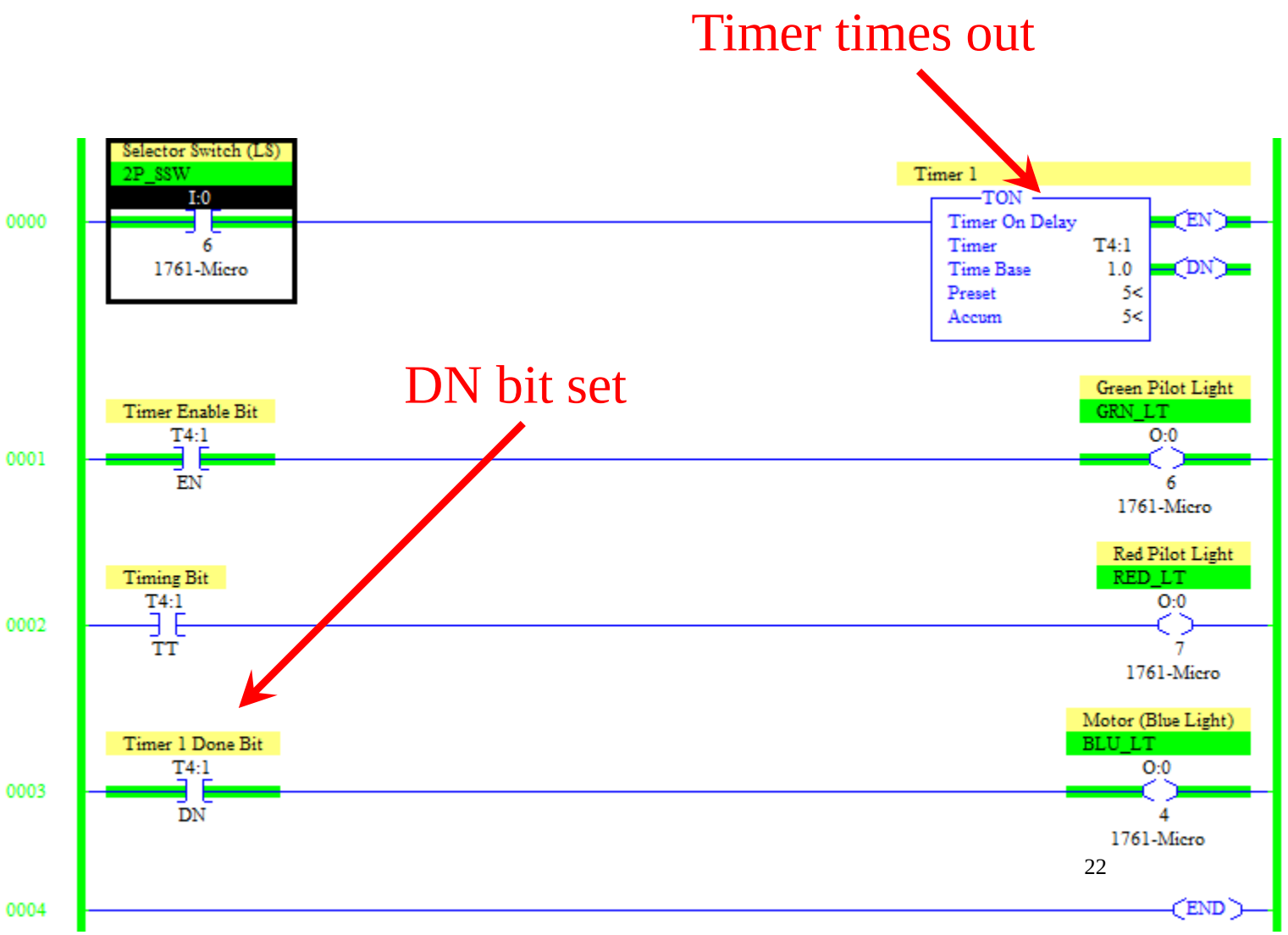
Program Running



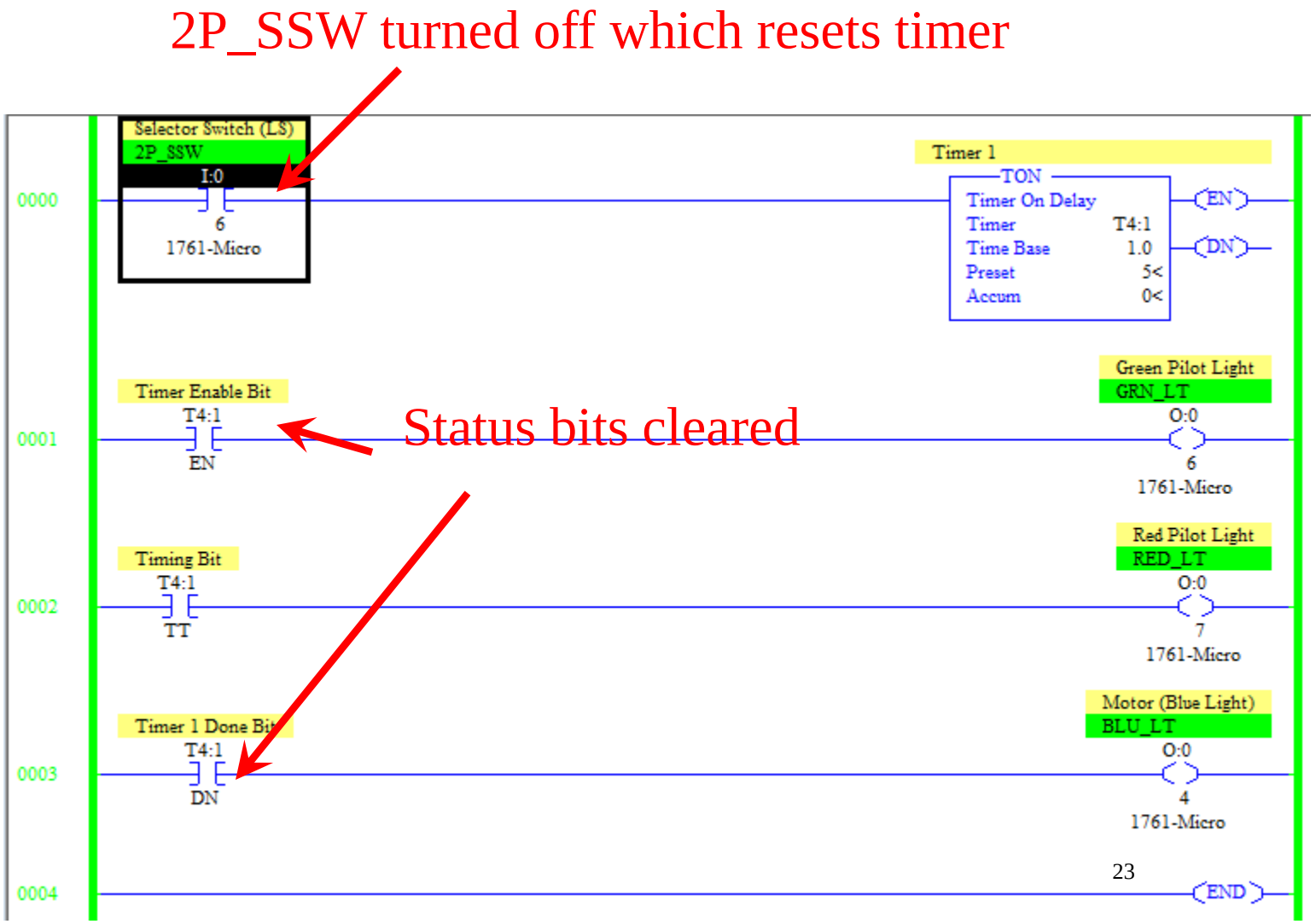
Rockwell Automation Timers
Time On-Delay (TON)



Rockwell Automation Timers
Time On-Delay (TON)



Rockwell Automation Timers
Time On-Delay (TON)



Rockwell Automation Timers
Time Off-Delay (TOF)

Swagelok

- Time Off-Delay (TOF)
  - Begins accumulating time when the rung goes FALSE and continues until one of the following conditions is met
    - Accumulated value equals preset value
    - The rung goes TRUE (stops timing)
    - A reset timer instruction resets the timer
  - Nonretentive

Rockwell Automation Timers
Time Off-Delay (TOF) Status Bits

Swagelok

- Timer enable bit (EN)
  - Set to 1 when rung is TRUE
    - Stays set until rung goes false
- Timer done bit (DN)
  - Is set to 1 when rung goes true
  - Remains set until:
    - The rung goes false AND the accumulated value is equal to the preset value
    - A reset instruction resets the timer

Rockwell Automation Timers
Time Off-Delay (TOF) Status Bits

Swagelok

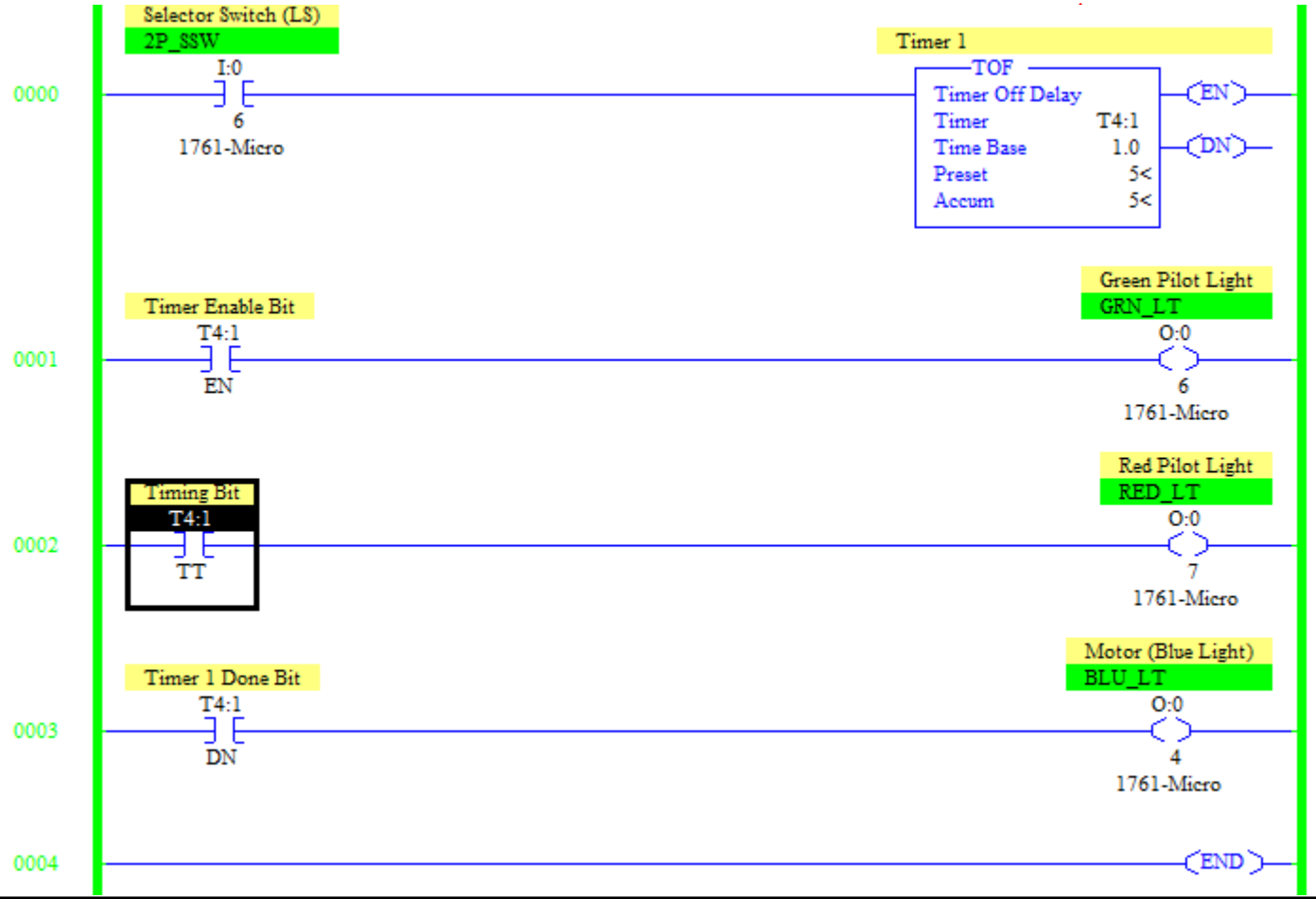
- Timing Bit (TT)
  - Set to 1 when rung goes FALSE
  - Set to 0 when
    - Condition Instr. TRUE OR Accum. Val. = Preset Value OR Reset Function issued
- Time Base
  - The time base is always 1 msec.
    - For example, for a 2-second timer, enter 2000 for the .PRE value.

Rockwell Automation Timers
Time OFF-Delay (TOF)

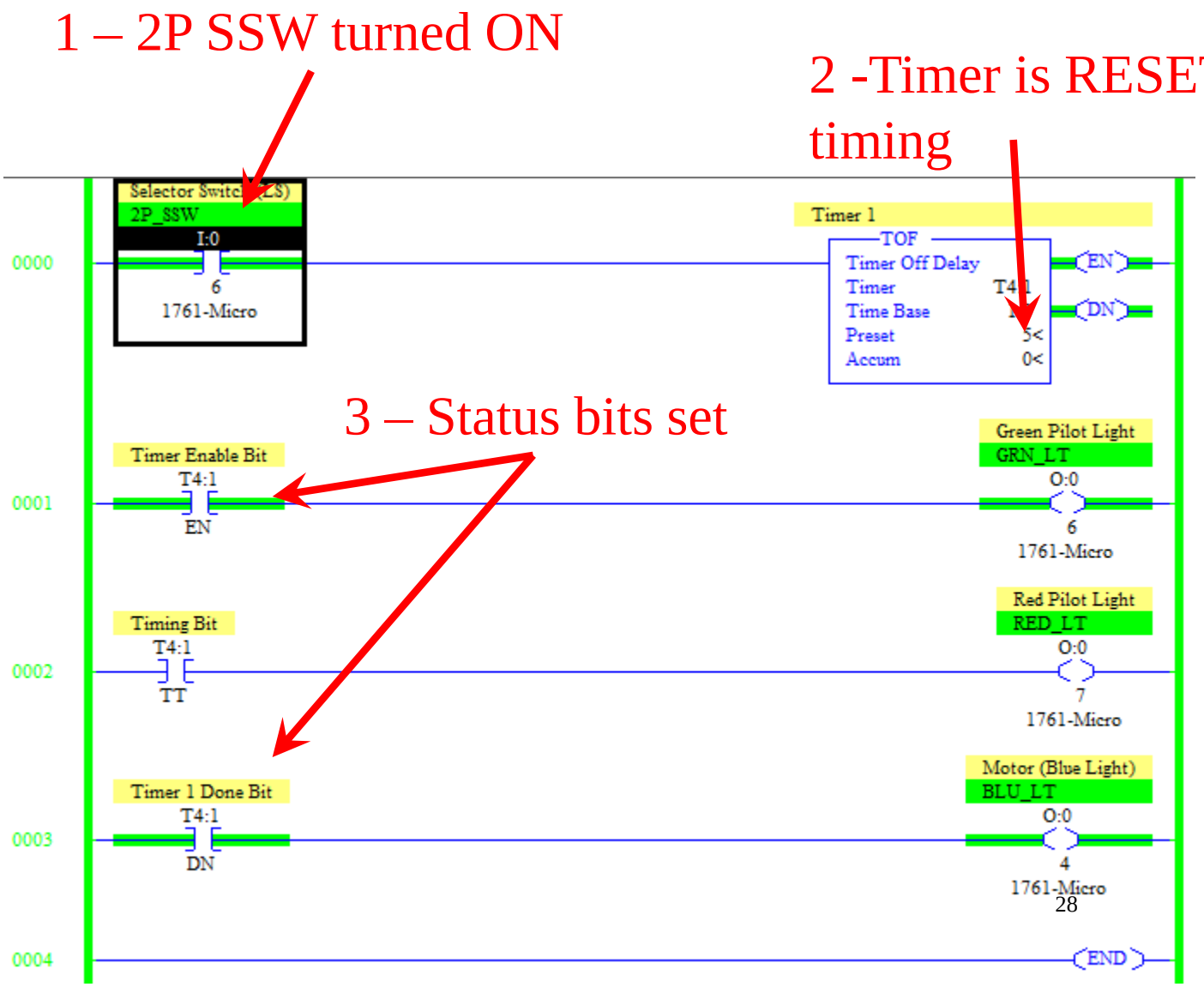
Swagelok

Program Running

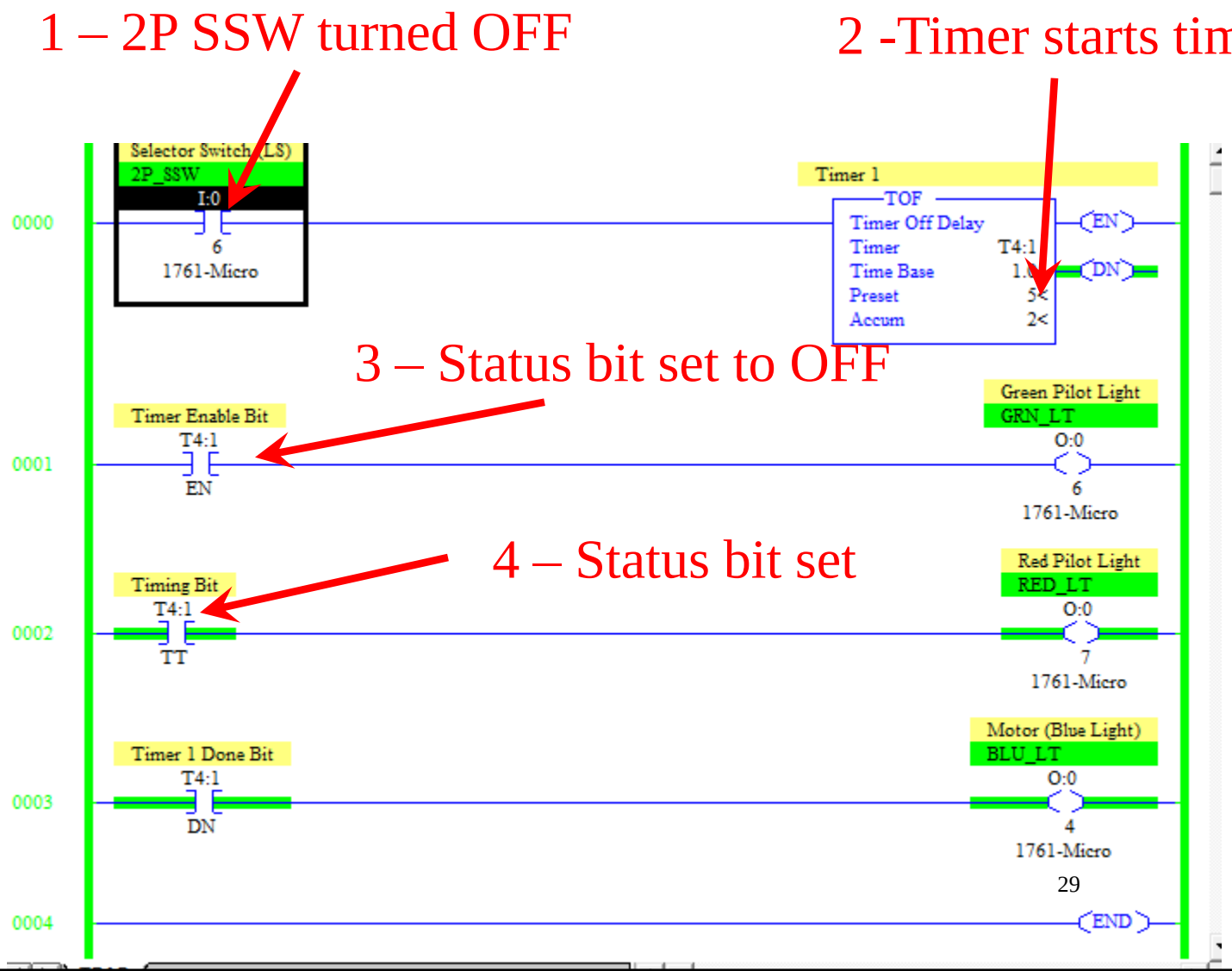
Note Accumulator value



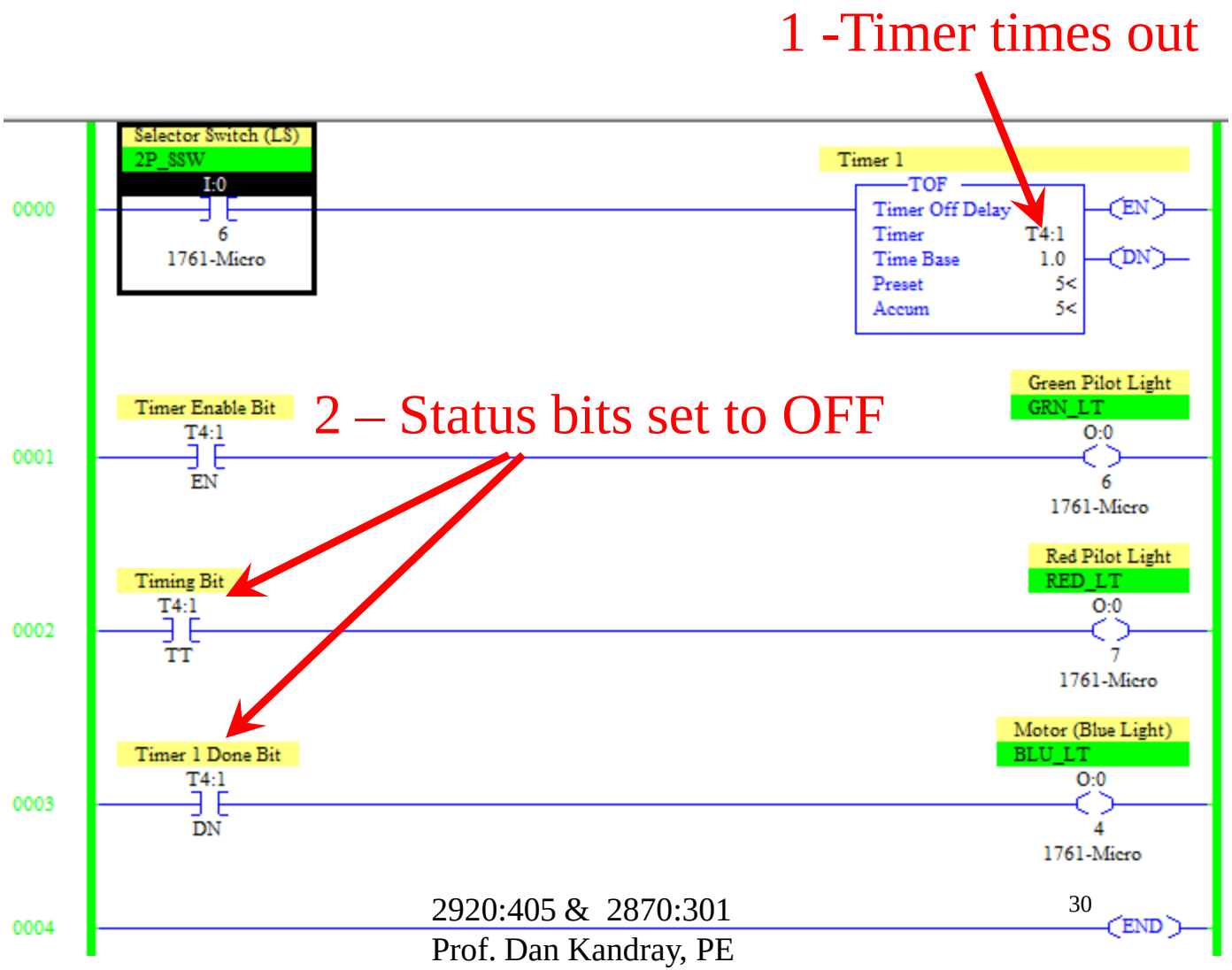
Rockwell Automation Timers
Time OFF-Delay (TOF)



Rockwell Automation Timers
Time OFF-Delay (TOF)

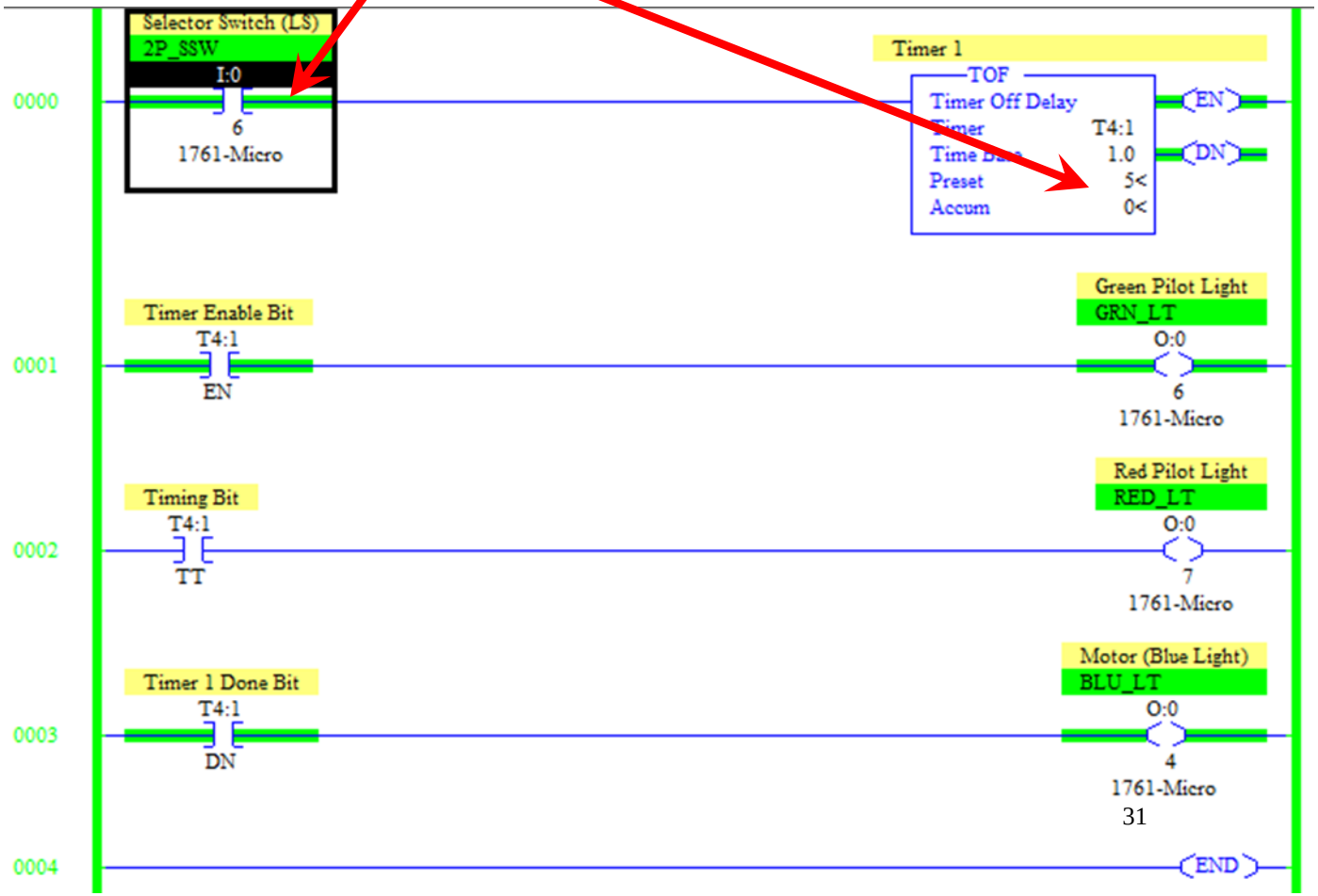


Rockwell Automation Timers
Time OFF-Delay (TOF)



Rockwell Automation Timers
Time OFF-Delay (TOF)

2P_SSW switch turned back ON resets timer



Rockwell Automation Timers
Retentive Timer On (RTO)

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- Retentive Timer On (RTO)
  - Turns an output on after a set time period
  - Accumulating timer
    - Retains the accumulated value even if rung goes false
  - Can only be reset by the reset (RES) instruction with the same address as the RTO

Rockwell Automation Timers
Retentive Timer On (RTO) Status Bits

Swagelok

- Timer enable bit (EN)
  - The enable bit indicates that the RTO instruction is enabled.
  - Set to 1 when rung is TRUE
    - Stays set until rung goes false or reset instruction zeros accumulator
- Timer done bit (DN)
  - Is set to 1 when accumulated value is equal to the preset value
  - Remains set until:
    - A reset instruction resets the timer

Rockwell Automation Timers
Retentive Timer On (RTO) Status Bits

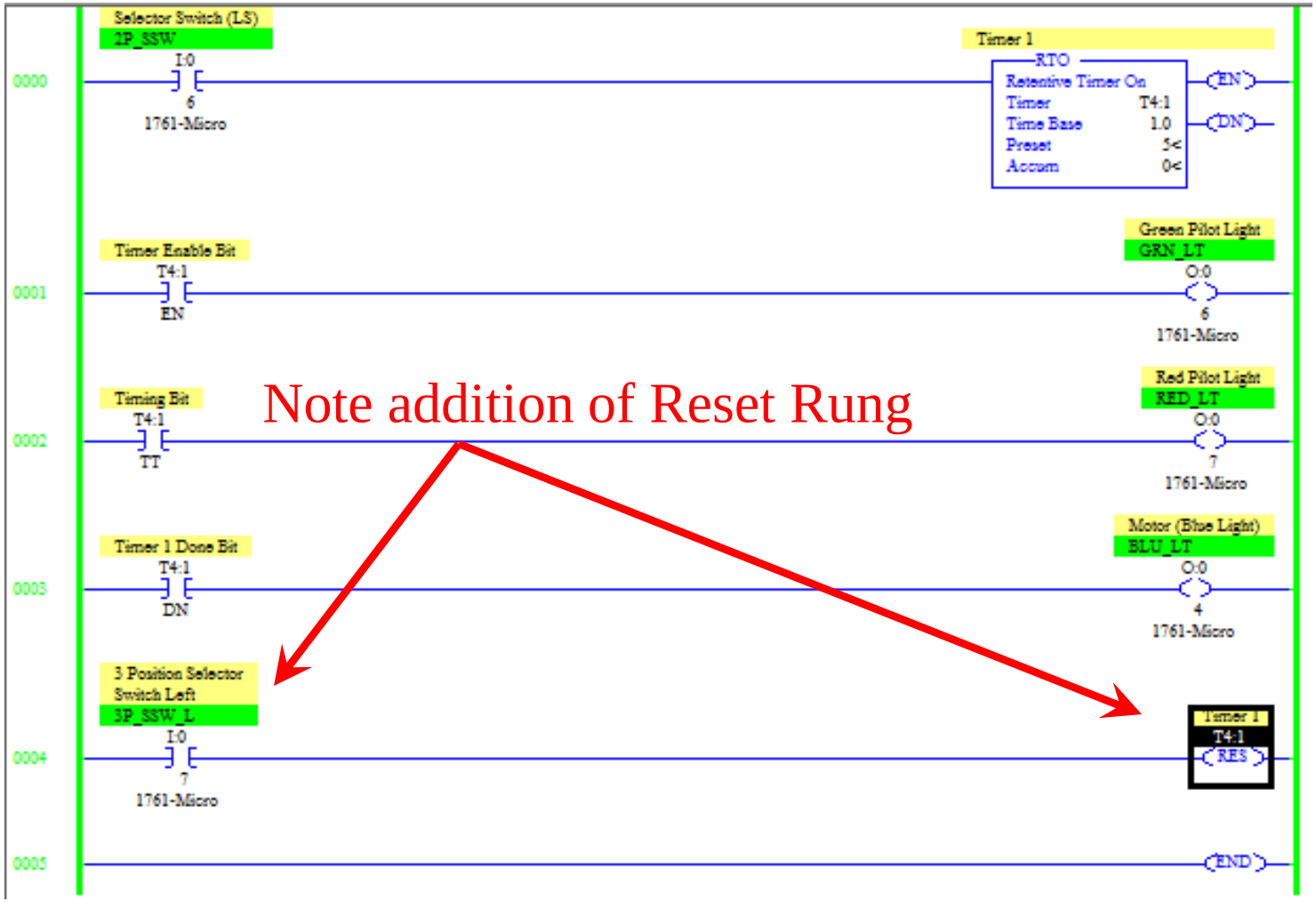
Swagelok

- Timer timing bit (TT)
  - The timing bit indicates that a timing operation is in process
  - Set to 1 when rung is TRUE
    - Stays set until accumulated value is equal to the preset value OR
    - Rung goes false OR
    - A reset instruction resets the timer

Rockwell Automation Timers
Retentive Timer On (RTO)

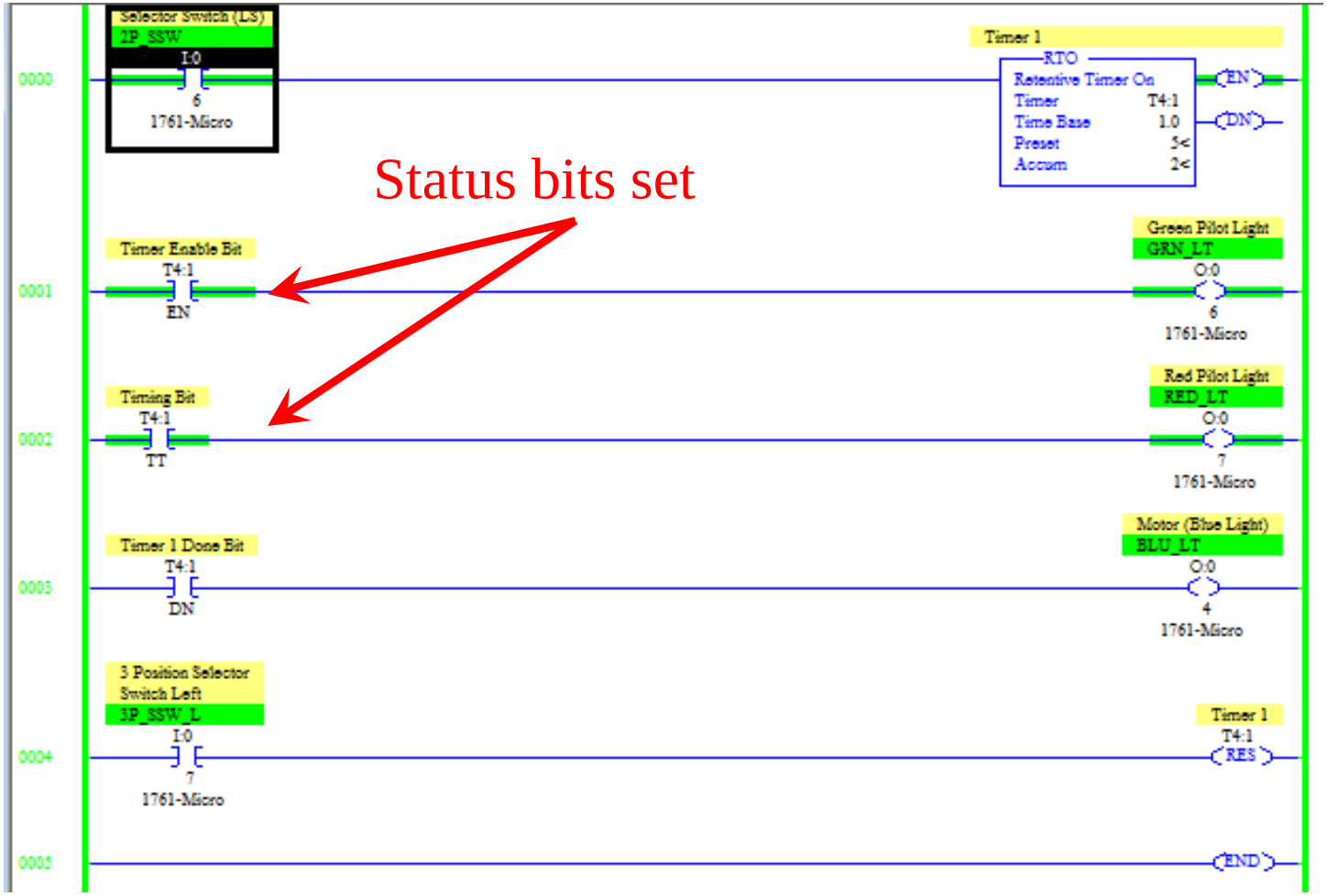
Swagelok

Program running



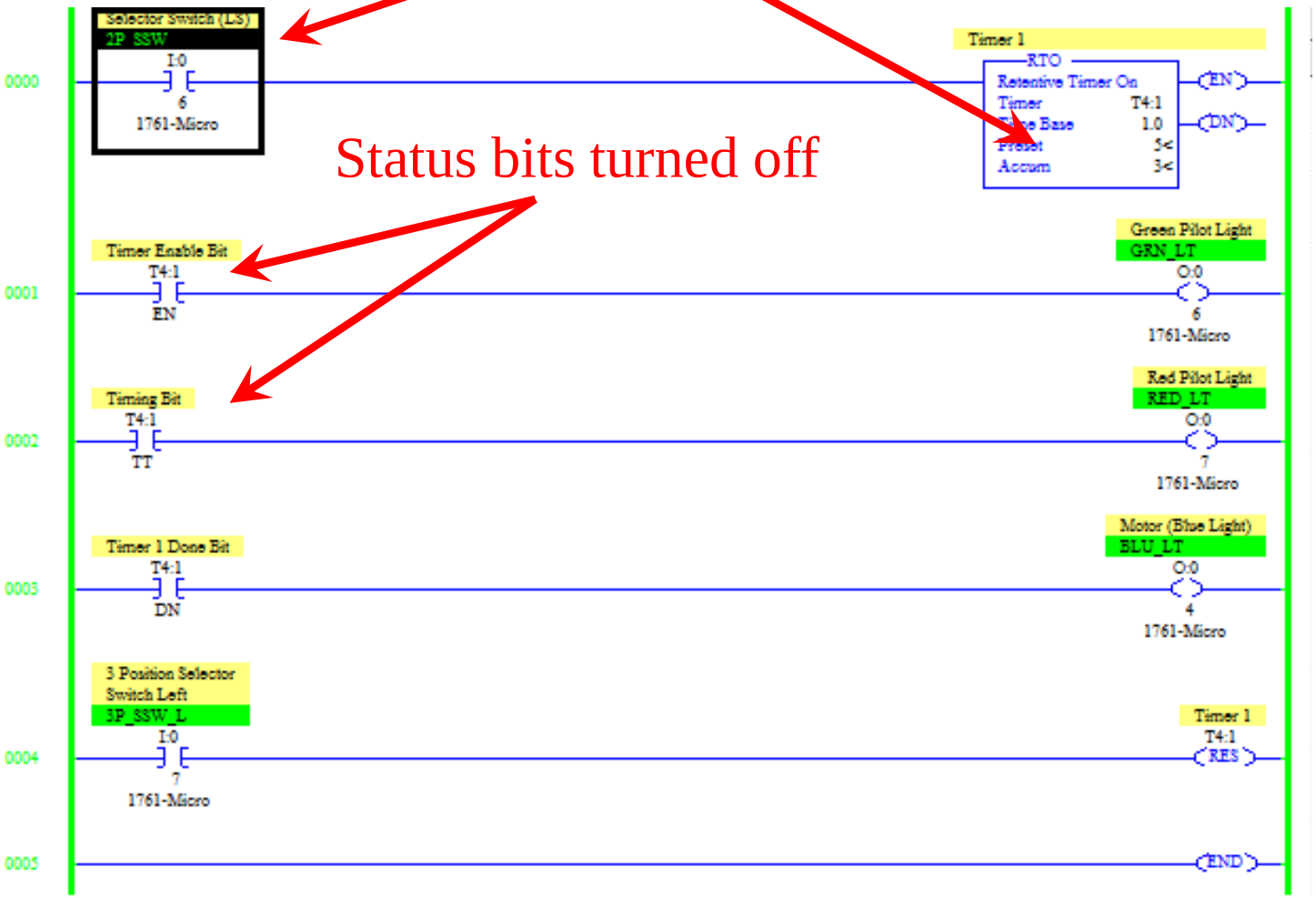
Rockwell Automation Timers
Retentive Timer On (RTO)

2P_SSW turned ON, timer starts timing



Rockwell Automation Timers
Retentive Timer On (RTO)

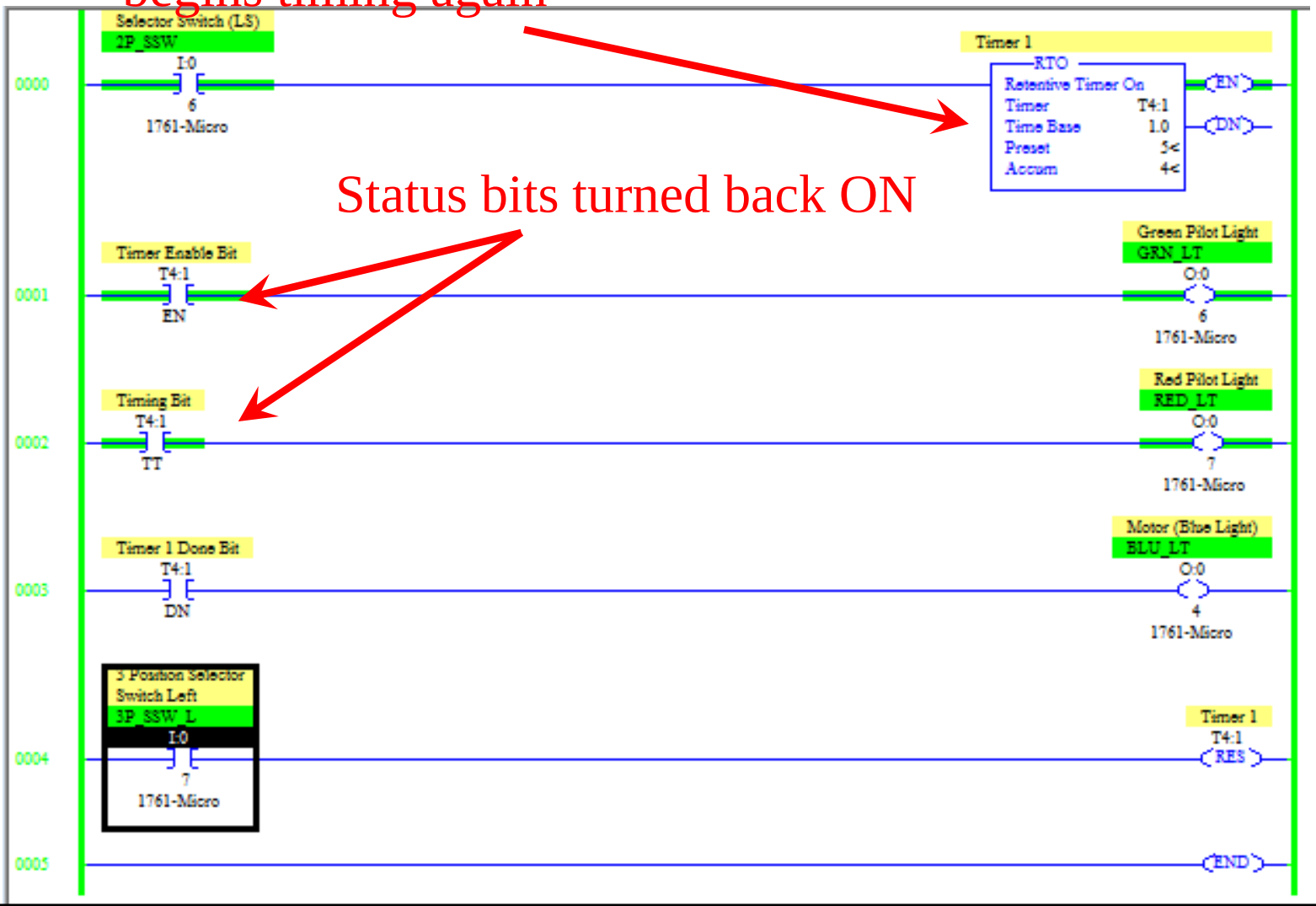
2P_SSW turned OFF, timing stops but accumulator does not clear



Rockwell Automation Timers
Retentive Timer On (RTO)

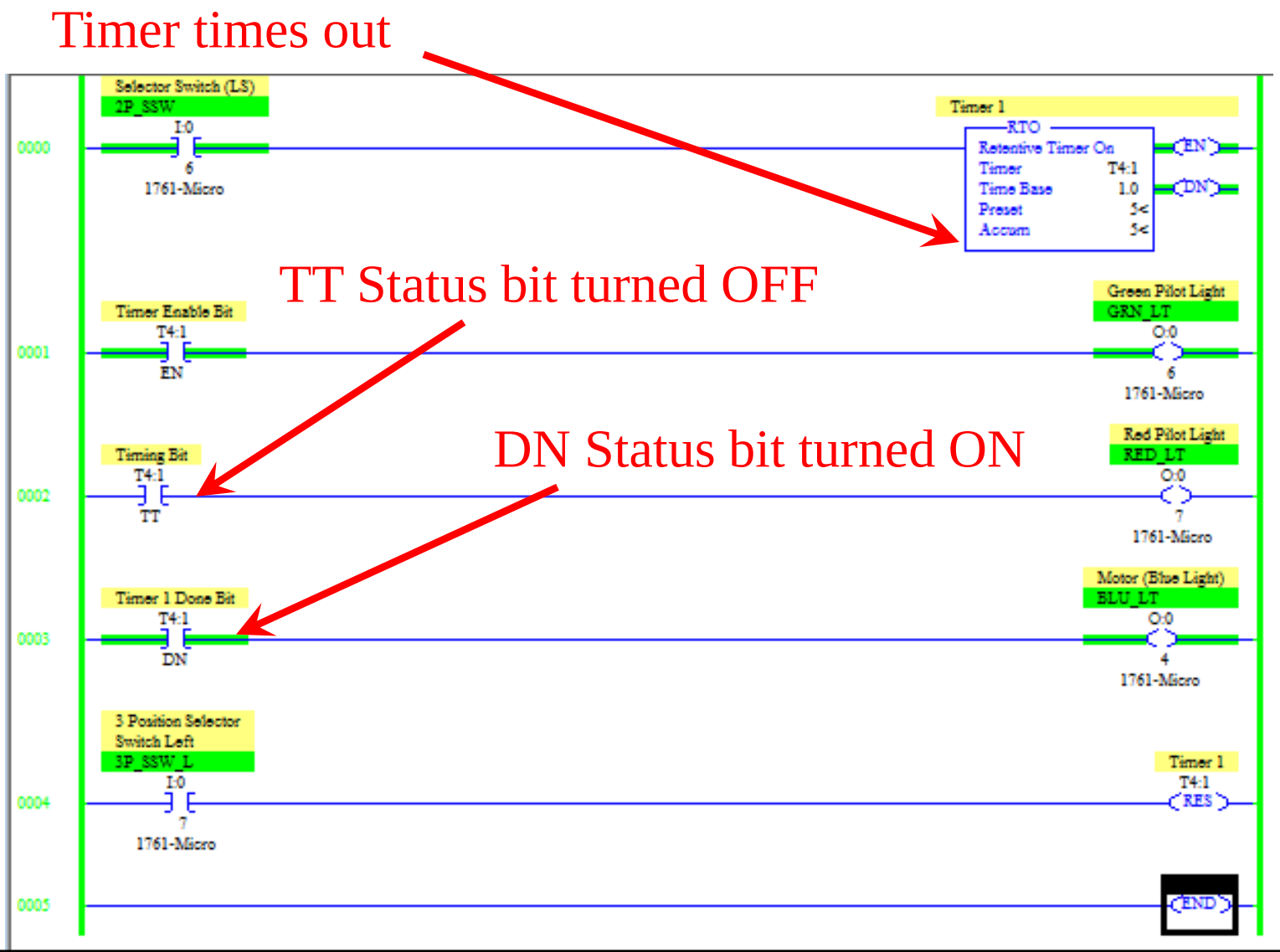
2P_SSW turned back ON, timer begins timing again

Status bits turned back ON

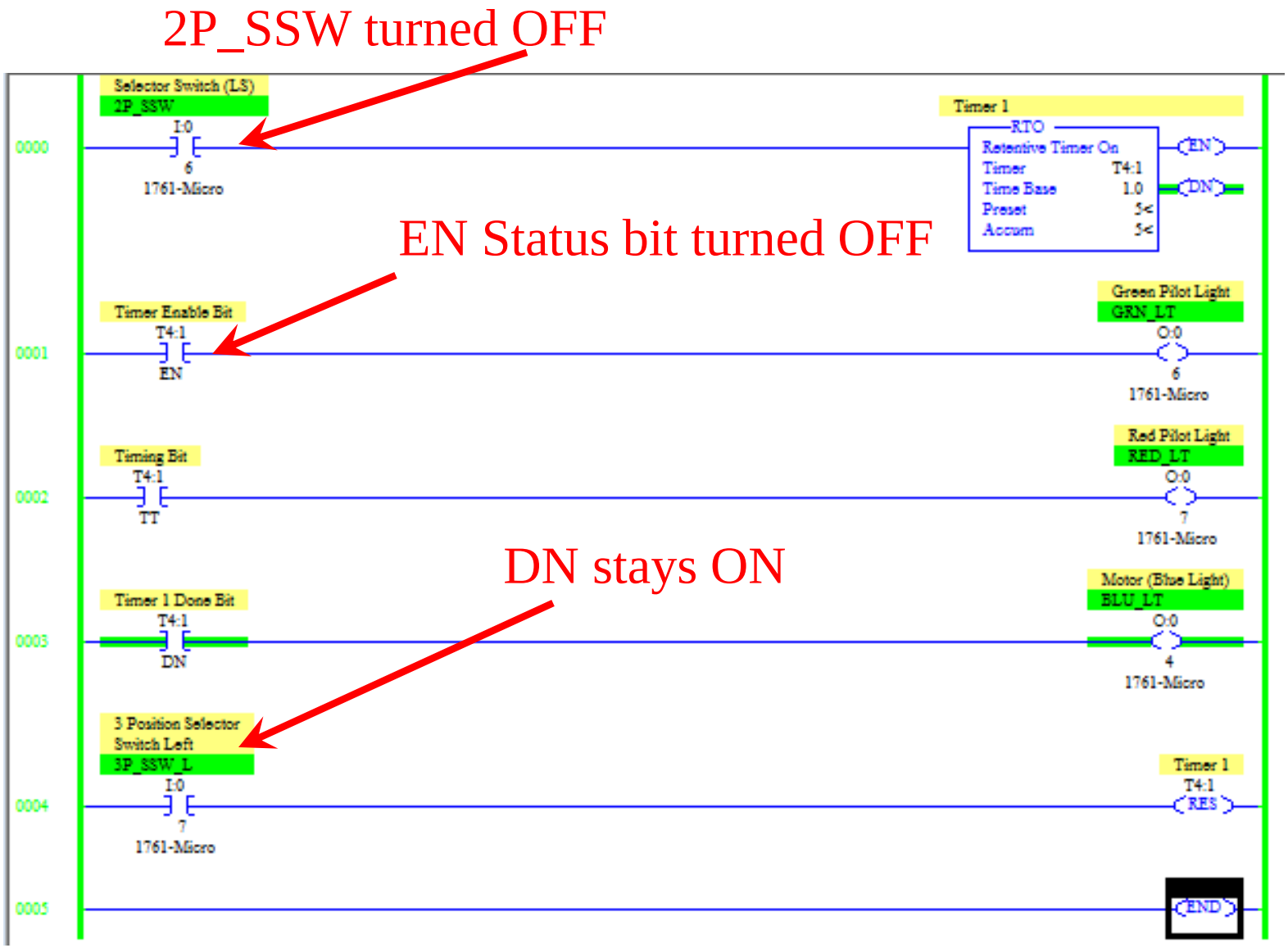


Rockwell Automation Timers
Retentive Timer On (RTO)

Swagelok



Rockwell Automation Timers
Retentive Timer On (RTO)



Rockwell Automation Timers
Retentive Timer On (RTO)

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Turning on 3P_SSW_L resets the timer and turns DN bit Off