EET165 Lecture #6

1) **Review:** Answer any questions from last week.

2) **Timers:** Timers will add a delay to the PLC program. It can delay a coil starting, hold it on for a fixed length of time, or delay a shutdown. There are three timers: TON, TOF, and RTO. They are all very similar. These are found in the Timer/Counter tab.

3) **Parts of the timers:** All three timers have four variables built into them. Three of the variables are controlled by the programmer and one is controlled by the PLC. There are also 3 outputs that are controlled by the PLC.

   The timer has 3 values that you need to fill in and one that is controlled by the PLC.

   a. **Timer:** Timer is the Timer's name, it starts with T4: and then the timer number that can be 0-255. For example: T4:0, T4:88, T4:100.

   b. **Time Base:** The timer can count up to 32767 (a signed 16-bit integer). The time base is how long it is between pulses. There are three choices.

      1 second: 32767 clock ticks is 9 hrs, 6 min, and 7 sec.
      .01 seconds: 32767 clock ticks is 5 min and 27 sec.
      .001 seconds: 32767 clock ticks is 32 sec.

   c. **Preset:** The preset is the number the timer will count up to. The number is between 1 and 32767. The delay is equal to this number times the time base.

   d. **Accum:** Accum is the number of ticks the timer has counted so far.

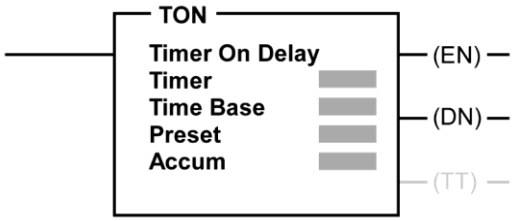
   All three timers have three outputs that are controlled by the timers. but for some odd reason the symbol only shows two of the three outputs.

   a. **EN:** EN stands for enabled. This goes high when the input of timer is high.

   b. **DN:** DN stands for done. This goes high when the timer reaches the preset time.

   c. **TT:** TT stands for Timer Ticking. This goes high when the timer is running (counting clock pulses). This output does not show up on the symbol, but it can be used just like the other two.

4) **TON:** TON stands for Timer On Delay – that means you can program a delay to turn something on or off. Below is the TON symbol.



To use TON you need to fill in three pieces of information, the timer's name, time base, and the preset value. For example, timer 3, set for 1 second time base, and the preset set to 4 (4 * 1 second = 4 seconds) would be:

Timer:	**T4:3**
Timer Base:	**1 Second**
Preset:	**4**

When the input is 0:

ACCUM: Accum is set to zero. A zero input resets Accum.
EN: EN is set to zero. EN follows the input. When the input is low, EN is low.
DN: DN is set to zero. DN stands for done, and a zero input resets the values.
TT: TT is set to zero. TT is timer tick. If the timer is off, TT is zero.

When the input is 1 (and the Accum <= Preset):

ACCUM: Accum is incremented every "Time Base", in this example – 1 Second.
EN: EN is set to one. EN follows the input. When the input is high, EN is high.
DN: DN is zero. If the preset is larger than Accum, it is not done and DN is zero.
TT: TT is one. TT is timer tick. If the timer is on, TT is one.

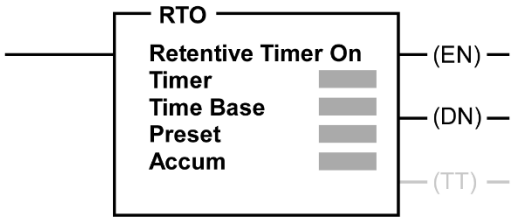
When the input is 1 (and the Accum >= Preset):

ACCUM: Accum is equal to Preset, because Accum stops adding when it is done.
EN: EN is one because there is a one on the input of the timer.
DN: DN is set to one because the timer has reached the preset value and it is done.
TT: TT is zero because the timer is no longer running.

You can access the output using:

T4:3/EN
T4:3/DN
T4:3/TT

5) **RTO:** RTO stands for Retentive Timer On, think if it as RTON. Below is the RTO symbol.



To use RTO you need to fill in three pieces of information, the timer's name, time base, and the preset value. We will use the same information as before, timer 3, set for 1 second time base, and the preset set to 4 (4 * 1 second = 4 seconds) would be:

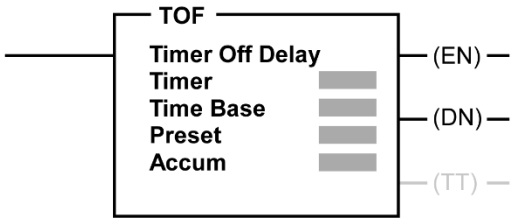
Timer: **T4:3**
Time Base: **1 Second**
Preset: **4**

The RTO is EXACTLY the same as the TON, with one exception. The ACCUM is not set to zero when the input is zero.

With the TON, the ACCUM goes to zero when the input is zero. With the RTO, the ACCUM is retained (saved) when the input goes low. When the RTO gets a 1 input, it picks up where it left off.

The only way to clear the ACCUM is with the reset command. When the reset gets a 1, then it resets the timers ACCUM. Below is what it will look like:

TOF: TOF stands for Timer Off Delay. It runs with a zero input instead of one input. **Also, DN is on until the count is reached and then it turns off.**



To use TOF you need to fill in three pieces of information, the timer's name, time base, and the preset value. For example, timer 5, set for .01 second time base, and the preset set to 2000 (2000 * .01 second = 2 seconds) would be:

Timer: **T4:5**
Time Base **.01 Seconds**
Preset: **2000**

When the input is 1:
ACCUM: Accum is set to zero. A one input resets a TOF Accum.
EN: EN is set to one. EN follows the input. When the input is high, EN is high.
DN: DN is set to one. DN stands for done, and a TOF resets to a done state.
TT: TT is set to zero. TT is timer tick. If the timer is off, TT is zero.

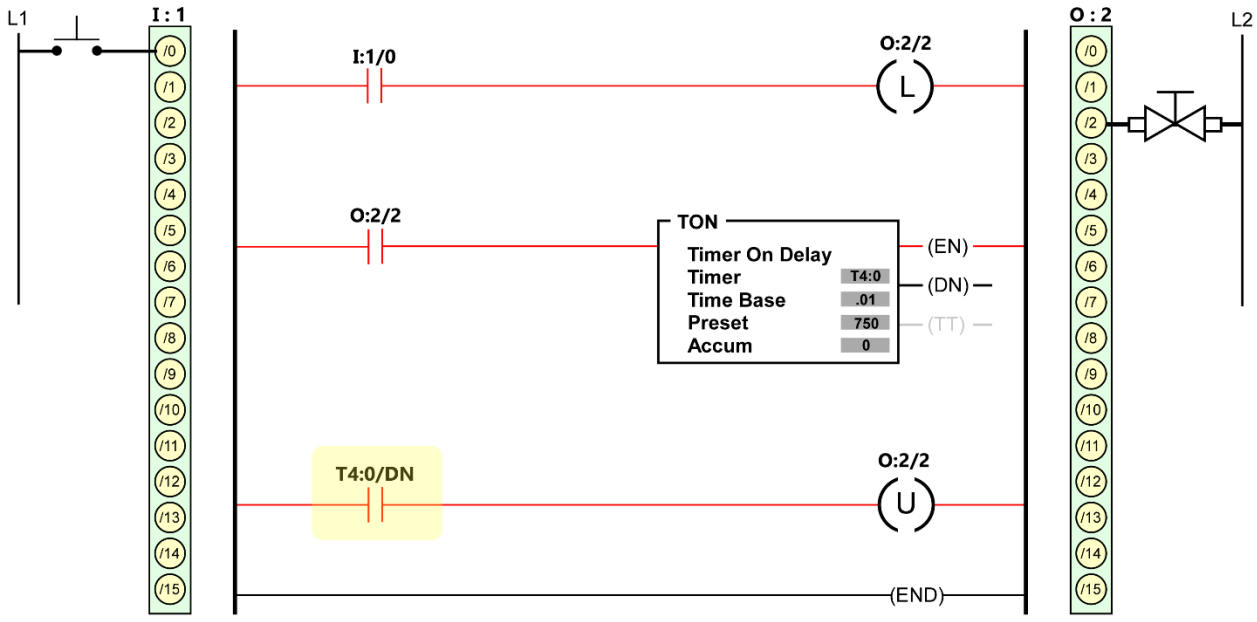
When the input is 0 (and the Accum <= Preset):
ACCUM: Accum is incremented every "Time Base", in this example – 1/100 Second.
EN: EN is set to zero. EN follows the input. When the input is low, EN is low.
DN: DN is one. If the preset is larger than Accum, it is done and DN is one.
TT: TT is one. TT is timer tick. If the timer is on, TT is one.

When the input is 0 (and the Accum >= Preset):
ACCUM: Accum is equal to Preset, because Accum stops adding when it is done.
EN: EN is zero because there is a zero on the input of the timer.
DN: DN is set to zero because the timer has reached the preset value and it is done.
TT: TT is zero because the timer is no longer running.

You can access the outputs using:
T4:5/EN
T4:5/DN
T4:5/TT

Example 1: Below is a machine to fill a drink at a fast-food restaurant. The employee puts a cup under the nozzle and presses the fill button and walks away. The momentary button latches the fill valve open and at the same time starts a timer. When the timer finishes, the done signal unlatches the valve, and the cup is filled without the employee having to manually fill the cup.

Questions: **What type of timer is this?**
What is the timer ID number?
How long does the timer hold the valve open and fill the cup?



Note: This symbol (command) would also work.

Example 2: Below is a machine to fill one of two drink sizes at a fast-food restaurant. The employee puts a cup under the nozzle and presses the fill button for one of two sized cups and walks away. The momentary button latches the fill valve open and at the same time starts a timer. When the timer finishes, the done signal unlatches the valve, and the cup is filled without the employee having to manually fill the cup.