Family edition

PLC Lab: Timers on the Line, On-Delay and Pulse Timers on a Conveyor

Ages 15-18 · about 45 minutes, in one sitting

In PLC Lab your teen programs a pretend factory conveyor to wait: each box stops under a label machine for 3 seconds, and a horn warns everyone before the belt starts. Nothing in the app drives real hardware.

What you need

- A computer or Chromebook with a current browser.
- The link: mytekdev.com/try/plclab?lesson=timers-on-the-line&ref=fam-plclab-2. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/plclab?lesson=timers-on-the-line&ref=fam-plclab-2. A short guide opens over Job 2, Stop at the Eye, on the Build it tab. A labeler stands over the belt, and a photoeye shines across it where a box should stop.

1. **The wiring list.** Start, Stop and Motor as in Job 1, plus Eye at %IX0.2: a through-beam photoeye, ON while the beam is clear, OFF when a box blocks it.
2. **The starting program.** Two rungs: Job 1's seal-in on a bit called Running, and Running to Motor. Run the shift: six boxes ride past the labeler and none is labeled.
3. **Job 2's answer.** A rung with a normally closed Eye to a Timer named Hold, 3000 ms; in the Motor rung, after Running, a branch of normally open Eye or normally open Hold.DN. The hint box gives these one at a time.
4. **The preset.** The labeler needs the box still for about 2.7 seconds. At 2650 ms or less every label smears; from 2700 ms up the shift passes. Fix the line on Job 2 is the same program with the preset at 300 ms.
5. **Job 7.** Pick The Signal Tower. Its panel has only Start and Stop. The starting program runs the belt with no warning. The answer: a Pulse timer (under More) named Warn, 3000 ms, on Running; a normally closed Warn.Q in the Motor rung; Warn.Q to Horn; and a flasher of two 500 ms timers for the amber light. The crew starts, stops and restarts the line, so there are two warnings to pass.

> In the wiring list, Field is the wire at the PLC's terminal right now, and Image is the PLC's own copy, taken at the start of each scan. Image only changes while the line is on. A timer's accumulated time shows on the ladder while the line is on.

The ideas, in plain words

Most children first meet sensors that are ON when they see something. A through-beam photoeye sees its own beam, so it is ON while nothing is in the way, the "light-on" setting. The app's wiring list says which way each eye is set up, and on Build it Eye can be switched to dark-on, which flips it. Reading that line before writing a rung is the habit to build.

An on-delay timer's time resets when its rung goes false, which is why the Job 2 timer goes on a normally closed Eye: it times only while a box is in the way, and starts fresh for the next box. The belt starts again on the done bit, Hold.DN, while the box still blocks the eye.

Texas's PLC II course lists TON, TOF and TP together, and a flasher made from two timers, as recommended activities. Allen-Bradley Micro800 has a TP instruction; MicroLogix and ControlLogix do not, and do the same job with a TON whose done bit is read normally closed. The app's More menu has all three IEC timers and a retentive timer.

> On a real line the warning time is set by each plant; 3 to 5 seconds is common. Job 7 uses 3.

Do it together

1. Open mytekdev.com/try/plclab?lesson=timers-on-the-line&ref=fam-plclab-2 together, press `Turn the line on`, then press `Start`. Watch `Eye` in the wiring list as a box reaches the labeler.

   > **You'll know it worked when:** Your teen sees the Eye lamp go OFF while the box blocks the beam.

2. Follow the hints on the right to stop the belt on Eye, and add a `Timer` named Hold with a preset of 3000 ms.

   > **If you get stuck:** `Show me how` gives the exact moves.
   >
   > **You'll know it worked when:** A box stops under the labeler and waits.

3. Put `Hold.DN` in a branch around the Eye contact, then press `Run the shift`.

   > **You'll know it worked when:** Six boxes, every label clean.

4. Change the preset to 2000 ms and run the shift again.

   > **You'll know it worked when:** Every label smears: the labeler needs about 3 seconds.

5. Pick Job 7, `The Signal Tower`. Add a `Pulse timer` (under `More`) named Warn, 3000 ms, and follow the hints to sound the horn before the belt moves.

   > **You'll know it worked when:** The horn sounds for 3 seconds, then the belt starts.

6. Talk it over: why a pulse timer for the horn, and not the timer from Job 2?

   > **You'll know it worked when:** Your teen explains that a pulse lasts its full time from one press, however long Start is held.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Is Eye ON or OFF while a box is under the labeler? Why?
- Why does the timer rung use a normally closed Eye contact?
- What lets the belt start again while the box is still blocking the eye?
- Why does a pulse timer suit the horn better than an on-delay timer on Start?
- Where would you use an off-delay timer on this line?

> The third question is the one that matters. A child who points at Hold.DN on the branch understands the done bit as a signal other rungs can read.

For younger and older kids

Younger: For a younger teen, finish Job 2 and try a few presets to find where the labels start to smear.

Older: For an older teen, build Job 7's flashing amber light: two timers that restart each other.

Keep going

- Job 7's flasher: two 500 ms timers that restart each other. Change it to 250 ms on and 750 ms off.
- Find the shortest Hold preset that still labels all six boxes on Job 2. Why is the shortest one not the best one to use on a real line?
- Job 7's Fix the line tab: the crew says the horn only chirps now. Find it.

Bring it into other subjects

- Math: the belt moves at 0.12 m per second. How far would a box travel in the 0.3 seconds of a 300 ms timer? In 3 seconds?

- Physics: look up how a through-beam, a retroreflective and a diffuse photoeye differ, and which one Job 5's bottle sensor is.
- Writing: write the warning sign for a conveyor that starts after a horn, in fifteen words or fewer.
- Careers: find a job posting for a packaging machine technician and underline every skill this lesson touched.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	PLC Lab: Timers on the Line, On-Delay and Pulse Timers on a Conveyor
SUBJECTS	Career and technical education, Engineering
TIME	45 minutes
WHAT WE DID	Programmed a simulated conveyor with an on-delay timer to hold each box at a labeler, read a through-beam photoeye, and used a pulse timer for a start-up warning horn.
SKILLS PRACTICED	PLC timers; Sensors; Testing a design

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/plclab?lesson=timers-on-the-line

Essential question: How does a PLC make a machine wait, and how does it know what to wait for?

Warm-up: A machine that waits a set time: _____ What goes wrong if the wait is too short?

_____

1. **Vocabulary.** Through-beam photoeye, on-delay timer, preset, done bit, pulse timer, off-delay timer: write each in your own words.

2. **The eye.** While a box blocks the beam, Eye is _____. While the beam is clear, Eye is _____.
3. **Job 2.** My timer's name and preset: _____ The contact that lets the box go: _____ With a preset of 2000 ms, the labels _____.
4. **Timers.** Fill in: TON is done _____. TP is ON _____. TOF stays done _____.

5. **Job 7.** The timer I used for the horn: _____ Its preset: _____ Did the shift pass? _____ If not, the result said: _____

1. Why does the Job 2 timer rung use a normally closed Eye contact, not a normally open one?

2. Name one place on a real line, or at home, for each kind of timer: TON, TP, TOF.

Quick check

Name: _____

1. A through-beam photoeye's input while a box blocks the beam is: (A) ON (B) OFF (C) it depends on the box's color

2. An on-delay timer with a 3000 ms preset. Its rung is true for 2 seconds, then false. Its done bit: (A) turns on at 3 seconds anyway (B) never turns on, and the time resets (C) turns on at 2 seconds

3. A horn must sound for exactly 3 seconds each time Start is pressed, however long Start is held. Which timer, and why?

Answers

QUESTION	ANSWER	WHY
1	B	The receiver sees the beam while nothing is in the way, so the input is ON when clear and OFF when blocked.
2	B	An on-delay timer resets when its rung goes false before the preset is reached.
3	Open answer	A pulse timer (TP): its bit is ON for the preset from the moment the rung turns on, whatever the rung does next. A TON on Start would last only while Start is held.

If your state or umbrella school asks, this lesson covers Texas Programmable Logic Controller II (innovative course N1303690) (2)(A), Texas Programmable Logic Controller II (innovative course N1303690) (2)(B), Texas Programmable Logic Controller II (innovative course N1303690) Recommended activity, Texas Programmable Logic Controller II (innovative course N1303690) Recommended activity, Texas Programmable Logic Controller I (innovative course N1303689) (3)(F), Massachusetts Robotics and Automation Engineering Technology, July 2025 Standard 9, PMMI Mechatronics: Programmable Logic Controllers 1 PLC 1 competency, SACA C-207 Programmable Controller Systems 1 C-207 key skills, CSTA 2017 3A-AP-16.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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