Family edition

PLC Lab: Find the Fault, Troubleshooting a Line from Symptom to Rung

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

In PLC Lab your teen troubleshoots a pretend factory line: six programs that used to work, each with one fault, and on the last one a failed sensor. 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=find-the-fault&ref=fam-plclab-4. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/plclab?lesson=find-the-fault&ref=fam-plclab-4. A short guide opens over Job 1's Fix the line. This starter shows Jobs 1 to 6 with Fix the line only; Setup changes that. Each job's card holds the crew's complaint, and the program is a finished one with one fault planted in it.

1. **The result.** On Fix the line the result after a shift lists the counts and the checks that failed, and never the cure: on Job 1, Delivered 0 of 8, and all three checks. One clean shift passes a Fix the line job.
2. **The faults.** Job 1: Stop changed to a normally closed contact, the belt never starts. Job 2: the Hold timer at 300 ms, every label smears. Job 3: the counter's reset reads Start instead of Reset, so the line never starts after the first case. Job 4: the Reset Pusher output deleted, so the pusher stays out and parts pile up and fall. Job 5: the Bottle contact taken out of the valve rung, so liquid pours between bottles.
3. **Job 6.** The program is right. The case eye has failed, stuck ON, so nothing is counted: a shift ends with 6 of 12 in cases and 6 on the floor, and the jam check fails too, because the jam timer reads the same eye.
4. **Forcing and replacing.** With the line on, each row of the wiring list can force a signal ON or OFF; forces end when the line goes off. With the line off, Fix the line shows Replace this device on each input. Replacing Eye on Job 6 says the old one was dead; replacing a good device says it tested fine and the swap cost time and money. Start this job over puts the program back and undoes the replacements.

> 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. On Job 6 the Eye lamp stays lit as boxes drop in; on Job 3 it goes OFF for a moment each time. The app's Sheet button has a maintenance log question on every Fix the line tab, which can be printed instead of the worksheet.

The ideas, in plain words

Texas's PLC II course says children should "be able to troubleshoot the PLCs in common industrial applications", and PMMI's PLC 1 list asks for using the force function and troubleshooting a filler program. The hard part for beginners is not the fix: it is resisting the urge to change things before they know what is wrong.

The Fix the line result is written to make that hard to skip. It reports what a supervisor would see (counts, and which checks failed) and never names the rung. A child who reads "the line never starts again after the first case" has the symptom; the rung that clears the counter is one step away.

Job 6 is the case most children are least ready for. After five jobs where the fault was in the program, they expect another. The program is right and the case eye is stuck ON, which the Field lamp shows if anyone watches it while a box falls. On a real line a technician would check the sensor's own light and its wiring, and swap it only once it is proven dead; the app charges nothing but a message for a wrong swap, so ask about every replacement in the fix report.

> Setup can give any job a failed sensor, stuck ON or stuck OFF, in place of its own fault, for a retest that the answer key does not give away.

Do it together

1. Open mytekdev.com/try/plclab?lesson=find-the-fault&ref=fam-plclab-4 together. Read the complaint on the right, then press `Run the shift` and watch before changing anything.

   > **You'll know it worked when:** The belt never starts: Delivered 0 of 8.

2. Press `Turn the line on` and read the `Stop` row in the wiring list. Then look at the Stop contact on the ladder. Change one thing and run the shift.

   > **You'll know it worked when:** The shift passes.

3. Write it down together: what the line did, what you checked, what the fault was, and how you proved it.

   > **You'll know it worked when:** Four short lines, the first fix report.

4. Pick Job 3, `Fill a Case`, and do the same.

   > **If you get stuck:** The result says the line never starts again after the first case. Which rung clears the count?
   >
   > **You'll know it worked when:** Two cases fill.

5. Pick Job 6, `Run the Line`. Nobody changed the program. Turn the line on and watch each input lamp as boxes drop into the case.

   > **If you get stuck:** A sensor that works goes OFF for a moment as each box falls past it.
   >
   > **You'll know it worked when:** Your teen spots the Eye lamp that never goes OFF.

6. Turn the line off, press `Replace this device` on that row only, and run the shift.

   > **You'll know it worked when:** The shift passes, and the app says the old part was dead.

Talk about it

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

- What did the line do wrong, in words the crew would use?
- What is your idea, and which lamp or force would show it is right?
- You changed something. How will you prove it fixed the fault?
- On Job 6, how could you tell the program apart from the sensor?
- What will the next technician need from your fix report?

> The second question is the one that matters. A child who can say which lamp would prove the idea before changing anything is troubleshooting; a child who cannot is guessing.

For younger and older kids

Younger: For a younger teen, do Jobs 1 and 3 together, and talk through Job 6 before trying it.

Older: For an older teen, open `Setup`, give one job a failed sensor, and trade: one sets the fault, the other finds it.

Keep going

- Jobs 7 to 12 have a Fix the line tab too: Job 8's fuses blew, Job 10's arm hits the guard. Pick one.
- Write a troubleshooting card for the next technician: five steps, each one a thing to look at, in order.
- Setup can give any job a failed sensor instead of its own fault. Set one up for a friend and swap.

Bring it into other subjects

- Writing: rewrite one fix report for a reader who was not there, in five sentences or fewer.
- Math: if a technician earns $30 an hour and a wrong part costs $85, what did replacing two good sensors on Job 6 cost, with ten minutes each?
- Science: compare the troubleshooting steps with the steps of an experiment. Where do the idea and the test fit?

- Careers: look up the job of an industrial maintenance technician. How much of the day is finding faults?

For your records

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

LESSON	PLC Lab: Find the Fault, Troubleshooting a Line from Symptom to Rung
SUBJECTS	Career and technical education, Engineering
TIME	45 minutes
WHAT WE DID	Troubleshot faulty programs on a simulated conveyor line by reading symptoms and input and output lamps, found a failed sensor where the program was correct, and wrote a fix report for each repair.
SKILLS PRACTICED	Systematic troubleshooting; Reading PLC inputs and outputs; Technical writing

Activity sheet (optional)

Name: _____ Date: _____

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

Essential question: How do you find a fault you cannot see, and prove you found it?

Warm-up: A bike makes a new grinding noise. What do you check first, before buying a part?

_____

1. **Job 1 (together).** Symptom: _____ Checked: _____ Fault: _____ Proof: _____
2. **Job 3.** Symptom: _____ Checked: _____ Fault: _____ Proof: _____
3. **Job ____.** Symptom: _____ Checked: _____ Fault: _____ Proof: _____
4. **Job ____.** Symptom: _____ Checked: _____ Fault: _____ Proof: _____
5. **Job 6.** Symptom: _____ What told me it was not the program: _____ Devices I replaced: _____ Proof: _____

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1. On Job 6, the program was right. What did you look at that showed it?

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2. Write one rule for the next technician: Before you change _____, check _____.

Quick check

Name: _____

1. A belt will not start. What is the best first step? (A) rewrite the rung (B) run it and watch, and read the input lamps (C) replace the Start button

2. As a box drops past a working through-beam eye, its Field lamp: (A) stays lit (B) goes off for a moment (C) stays off

3. Name one thing a fix report must say, and why the next technician needs it.

Answers

QUESTION	ANSWER	WHY
1	B	The symptom and the lamps come before any change: a change made without them may hide the fault or add a new one.
2	B	A through-beam eye is ON while the beam is clear and OFF while something blocks it. On Job 6 the lamp stayed lit: the eye was stuck ON.
3	Open answer	For example: the symptom, so the next person knows if it comes back; or the proof, so they know the fix was tested and not guessed.

If your state or umbrella school asks, this lesson covers Texas Programmable Logic Controller II (innovative course N1303690) Course description, Texas Programmable Logic Controller II (innovative course N1303690) (2)(D), Massachusetts Robotics and Automation Engineering Technology, July 2025 Standard 9, PMMI Mechatronics: Programmable Logic Controllers 1 PLC 1 competency, PMMI Mechatronics: Programmable Logic Controllers 1 PLC 1 competency, SACA C-207 Programmable Controller Systems 1 C-207 key skills.

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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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