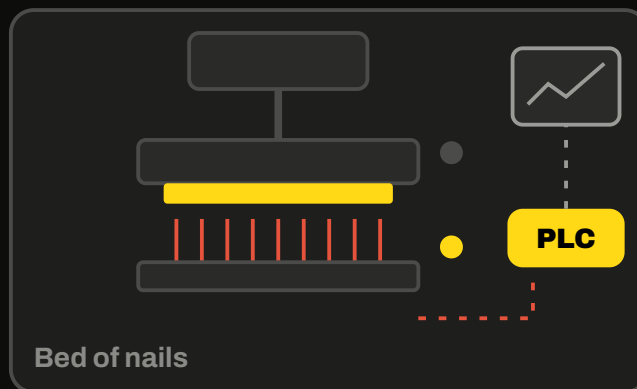


BOARDS · ESP32 PLC

Press the board on the nails. The PLC reads every contact.

An ESP32 PLC runs a bed-of-nails test station for five new products.

[Read the interactive case study online ›](#)



5 products, 1 station
Schematic illustration

5

new products, one station

2

checks: continuity and resistance

4

conveyors at most per PLC

10"

Panel PC with Grafana

THE CHALLENGE

Five new boards. Each one tested before packaging.

The company had a new range of five products. Before shipping, each board had to pass different types of tests, to meet the quality standard of the company, of its customers and of the market. The test sits at the end of production, just before packaging.

01

Manual and slow

Before the project, the boards were tested by hand. It took a long time, and errors slipped through.

02

Many points, one verdict

Each board has many points to check. The station must check the continuity and the resistance of each connection, and give one result per board.

03

Do not damage the board

The fixture moves the board up and down. Sensors watch the ends of the path, so the press never goes further than it should.

04

Ready to grow

Demand was expected to grow, and a manual test would not scale. The station had to be designed for expansion from the start.



The result

The automated station proved highly effective. The company now meets the growing demand for its five new products. Errors during testing went down significantly and test times went down, so the company can verify the quantity of products that its production plan expects.

HOW IT WORKS

Three parts: the press, the contacts and the station.

Part 1 · The press

Down to the nails, only as far as the sensors allow.

The PLC drives pneumatic cylinders that move the fixture holding the board. The fixture travels up and down along a predefined path, and sensors watch the limits of the path so the board is not damaged. A typical way to do it: the test starts only when the bottom sensor confirms that the fixture reached the end of its path.

- Pneumatic cylinders move the fixture
- Sensors at both ends of the path
- No bottom sensor, no test: the fixture goes back up (example)

Part 2 · The contacts

Continuity and resistance, point by point.

On the nails, the test points of the board touch the pins. Wires run from the pins back to the PLC, which checks the continuity and the resistance of each connection. The operator selects the test parameters on the touch screen. In this example, picking the product sets them.

- The product sets the points and the windows
- Continuity: the connection must be closed
- Resistance: the value must sit in its window

Part 3 · One PLC per station

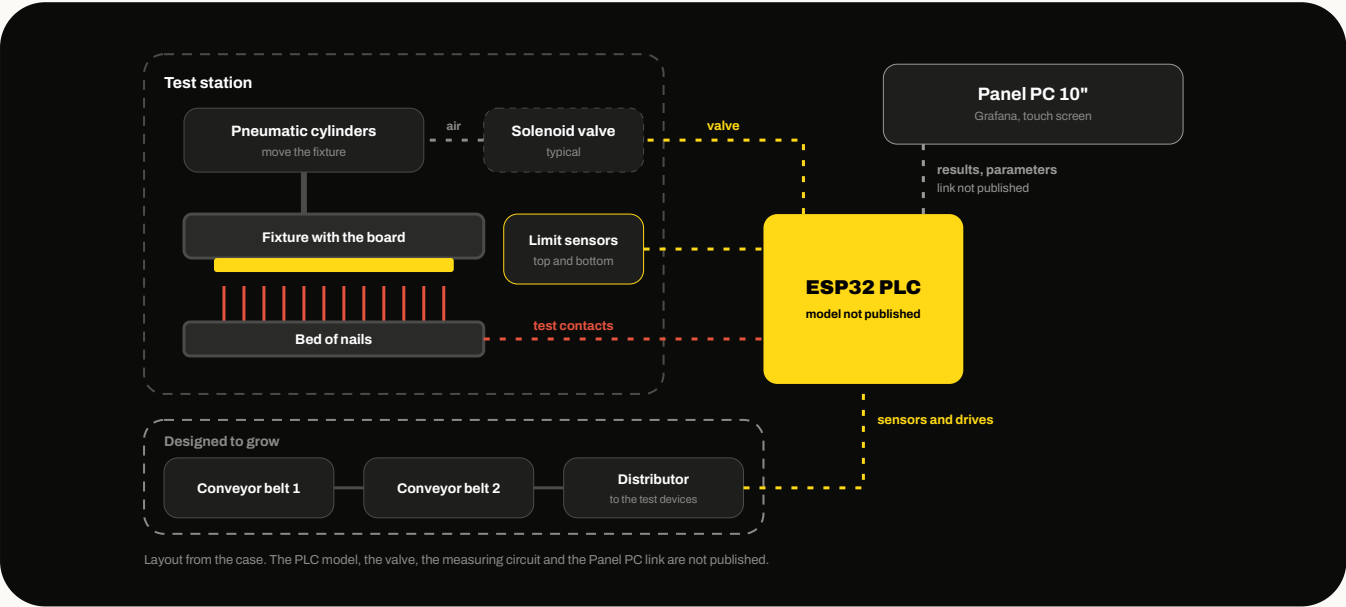
Conveyors, distributor, two fixtures: count the I/O.

The station was designed to grow. Two conveyor belts and a distributor spread the boards to different test devices. They have sensors and the ESP32 PLC controls them. The case says that one PLC per workstation can manage up to four conveyors, one distributor, two test fixtures, the I/O of the bed of nails and the output to the screen. Change the station and check the I/O on an ESP32 PLC 58.

- Up to 4 conveyors and 1 distributor
- Up to 2 test fixtures
- Measured points on analog inputs (example)

How does a PLC test an electronic board on a bed of nails?

Put the board in a fixture that pneumatic cylinders move up and down. Watch the ends of the path with two sensors. At the bottom, the test points of the board touch a bed of nails, and wires bring each contact back to the PLC. In this case an ESP32 PLC moved the fixture, checked the continuity and the resistance of each connection, and sent the results to a 10" industrial Panel PC, where Grafana showed them. The case does not name the PLC model or the link between the PLC and the Panel PC.



— PLC, valve and sensors — Test contacts — Data with the Panel PC — Compressed air

Signals and data

Signal	Between	Type	Purpose
Press valve	ESP32 PLC → solenoid valve	Digital output (typical)	Moves the fixture down and up
Top limit	Sensor → ESP32 PLC	Digital input	Fixture at the top: safe to load the next board
Bottom limit	Sensor → ESP32 PLC	Digital input	End of the path: the board sits on the nails
Test contacts	Bed of nails → ESP32 PLC	Wires to the PLC (circuit not published)	Continuity and resistance of each connection
Test parameters	Panel PC → ESP32 PLC	Touch screen selection (link not published)	Product and tests to run
Results	ESP32 PLC → Panel PC	Data shown by Grafana (link not published)	Results in real time for the operator
Belt and distributor sensors	Sensors → ESP32 PLC	Digital inputs	Position of the boards on the line
Belts and distributor	ESP32 PLC → drives and actuators	Digital outputs (typical)	Spread the boards to the test devices

A PLC for the station, a Panel PC for the operator.



ESP32 PLC 58

The case used an ESP32 based PLC to move the fixture, read the contacts and control the conveyors and the distributor.

Role in this station	Drives the press, checks each contact and runs the belts and the distributor
Processor	ESP32 dual core, up to 240 MHz, 16 MB flash, 520 KB SRAM
Inputs	37: 16 analog/digital (0-10 V, 11-bit) and 21 digital optoisolated, 5 to 24 Vdc, 6 with interrupt
Outputs	24: 9 analog/digital/PWM (0-10 V, 12-bit) and 15 digital optoisolated, 5 to 24 Vdc
Communications	Ethernet 10/100, Wi-Fi 2.4 GHz, Bluetooth LE, RS-485, RS-232, TTL, I2C, SPI

The ESP32 PLC 58 has no relay outputs. The valves and the drives switch through its 5 to 24 Vdc digital outputs or through external relays: check the current of each load against the datasheet.

[See the ESP32 PLC 58 >](#)



TouchBerry Pi Panel PC 10.1" FLEX

The case shows the results with Grafana on a 10" industrial Panel PC, and the original case shows the TouchBerry Pi 10.1".

Role in this station	Operator screen: test parameters and results
Display	10.1", 1280 x 800, capacitive touch, 900 nits
Computer	Raspberry Pi 4, Linux preinstalled
Own I/O	3 digital inputs, 2 analog inputs (0-10 V or 4-20 mA), 5 digital outputs
Communications	Gigabit Ethernet, 2 x USB 2.0, 2 x USB 3.0, one serial port (RS-485, RS-232 or TTL)

The case does not publish how the PLC sends the results to Grafana. A typical way: the PLC sends each result over Ethernet, a database on the Panel PC stores it, and Grafana shows it.

[See the TouchBerry Pi 10.1" >](#)

The path has limits

The cylinders move the fixture along a fixed path, and two sensors watch its ends. The board reaches the nails without going further than it should.

The PLC reads every contact

Each pin is wired back to the PLC. The same program moves the fixture and checks the continuity and the resistance of each connection, so the motion and the test stay in step.

Few buttons for the operator

The interface has a short list of menus and actions, because most of the process is automatic. Operators need little training to use it with confidence.

TESTING BOARDS OR ASSEMBLIES?

Tell us what you test. An engineer will answer.

Tell us the product, how many test points it has, what each point must measure and how the boards reach the fixture. We will propose the PLC, the I/O and the operator screen.

READ IT ONLINE

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