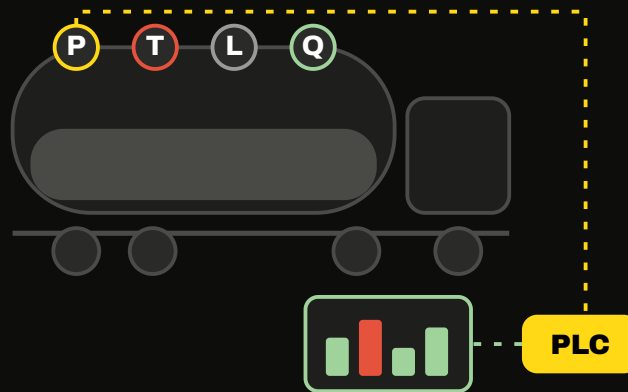


FLUID TRANSPORT AND STORAGE · ESP32 PLC

Fluids on the move. A PLC that watches them.

Pressure, temperature, level, quality and composition, from the sensor to the dashboard.

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


5 parameters, 1 controller
Schematic illustration

5

parameters watched:
pressure, temperature,
level, quality, composition

2

kinds of notification:
recurring status and alerts

2

ESP32 cores: process and
communications apart

1

ESP32 PLC from the
sensors to the dashboard

THE CHALLENGE

Keep a fluid safe and fit for use while it travels.

Liquids and gases can be contaminated or deteriorate during transport and storage. Automatic systems keep the conditions in range and detect deviations early, so the team can take preventive or corrective measures.

01

Five things to watch

Pressure, for safe and optimal conditions.
Temperature, away from extremes that change the fluid. Level, for the right volume with no overflow or shortage. Quality, against the required specifications. Chemical composition, against contamination.

02

Sensors that depend on the fluid

The case uses Mettler Toledo amperometric sensors, Pt100 temperature sensors and other specific sensors, such as compression or viscosity, chosen for each fluid.

03

Mixed connections

Some sensors connect through common interfaces, others through the analog or digital inputs of the PLC. One controller has to read them all.

04

Information where it is needed

The readings go to a monitoring system on the transport and appear on a dashboard with several data screens.

The goal



Guarantee the safety and the quality of the fluid by detecting incidents in time. Keep the fluid fit for the process where it will be used. And optimise transport and storage, to reduce costs and improve the performance of the process.

HOW IT WORKS

Three jobs: read the sensors, judge the change, keep sending.

Job 1 · Read the sensors

From a current to a value.

The case connects some sensors to the analog inputs of the PLC. The inputs of the ESP32 PLC measure 0 to 10 V. Many industrial transmitters give 4 to 20 mA, so a shunt turns the current into a voltage and the program scales it. Change the current, then cut the wire.

- 4 mA is the bottom of the range, 20 mA the top
- A 500 Ω shunt gives 2 to 10 V
- No current is a fault, not a zero

Job 2 · Judge the change

A recurring status. An alert when it matters.

The case programs two kinds of notification: a recurring status of the fluid, and an alert when a key indicator has an unexpected or alarming variation. A typical way to do it: one limit for the value and one for its rate of change.

- Recurring status at a fixed interval
- Alert above the limit (alarming)
- Alert on a fast change (unexpected)

Job 3 · Keep sending

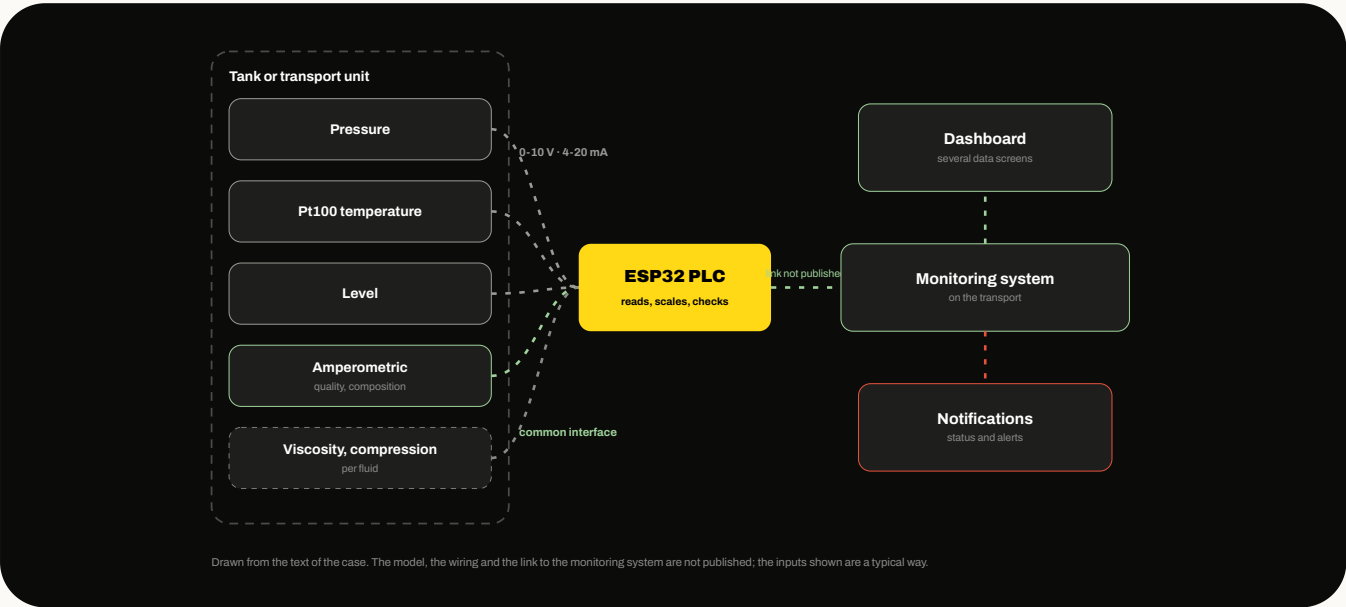
One core measures. The other talks.

The case says that the dual core of the ESP32 manages processes and communications separately. So the readings can go on when the link is busy or down.

- Sensors and logic on one core
- Messages on the other core
- Readings kept on the PLC while the link is down (example)

How do you monitor a fluid during transport and storage?

Put the sensors that the fluid needs on the tank: pressure, temperature, level, quality and composition. Wire them to one ESP32 PLC, through its analog and digital inputs or through a common interface. The PLC reads and checks the values and sends them to a monitoring system on the transport, with a dashboard and the notifications. The case does not publish the link between the PLC and the monitoring system.



PLC Analog and digital inputs Data and notifications Alerts

Signals and data

Signal	Between	Type	Purpose
Pressure	Pressure sensor → ESP32 PLC	Analog input, 0-10 V or 4-20 mA with a shunt (typical)	Safe and optimal transport and storage conditions
Temperature	Pt100 sensor → ESP32 PLC	Through a transmitter to an analog input (typical)	Keeps the fluid away from extreme temperatures
Level	Level sensor → ESP32 PLC	Analog or digital input (typical)	Correct volume, no overflow or shortage
Quality and composition	Amperometric sensor (Mettler Toledo) → ESP32 PLC	Through its transmitter: analog input or common interface (typical)	Meets the specifications, no contamination
Other variables	Compression, viscosity and other sensors → ESP32 PLC	Depends on the sensor	Chosen for each fluid
Readings	ESP32 PLC → monitoring system on the transport	Link not published	Dashboard with several data screens
Status	Monitoring system → users	Recurring notification	Informs of the status of the fluid
Alert	Monitoring system → users	Notification on an event	Unexpected or alarming variation of a key indicator

The PLC for this case.



ESP32 PLC 21 FLEX

The case uses an ESP32 PLC and does not publish the model. The ESP32 PLC 21 FLEX fits the five parameters: 6 analog inputs, RS-485 for sensors with a digital interface, and an optional 4G board for a vehicle.

Role in this case	Reads the sensors of the fluid, checks the values and sends them to the monitoring system
Processor	ESP32 dual core, up to 240 MHz, 16 MB flash, 520 KB SRAM
Inputs	13: 6 analog/digital (0-10 V, 11-bit) and 7 digital optoisolated, 5 to 24 Vdc, 2 with interrupt
Outputs	8: 3 analog/digital/PWM (0-10 V, 12-bit) and 5 digital optoisolated, 5 to 24 Vdc
Communications	Ethernet 10/100, Wi-Fi 2.4 GHz, Bluetooth LE, RS-485, RS-232, I2C, SPI
Power and options	12 to 24 Vdc, DIN rail TS35, IP20; one optional board: 4G LTE-M/NB-IoT, LoRa or CAN

The case does not publish the exact ESP32 PLC model. The image shows the ESP32 PLC 21 FLEX.

[See the ESP32 PLC 21 FLEX ›](#)

Accurate readings

Specific sensors for each variable, read and processed in the PLC, give an accurate picture of the fluid. That raises safety and lowers the risk of errors.

Many ways to connect

Analog and digital inputs for sensors with a signal, and Ethernet, Wi-Fi, Bluetooth LE, RS-485 and RS-232 for devices with a digital interface and for the monitoring system.

Code that fits the fluid

The PLC is programmed in C++ with the Arduino IDE and open source libraries. Each fluid can have its own scaling, limits and messages.

MONITORING A FLUID IN A TANK OR ON THE ROAD?

**Tell us the fluid and what must not change.
An engineer will answer.**

Tell us the fluid, the variables you need, the sensors you have, where the data must go and who gets the alerts. We will propose the PLC, the inputs and the link.

READ IT ONLINE

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