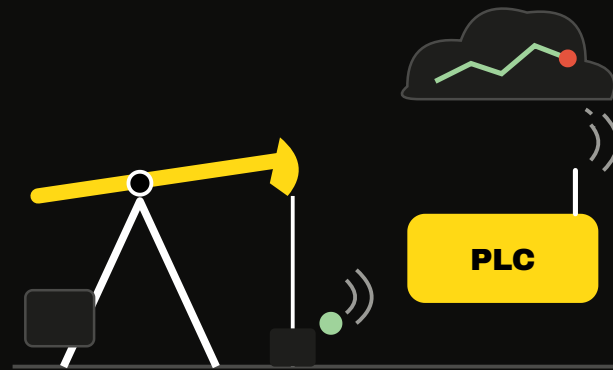


OIL AND GAS

Watch the well from afar. **Act** when it matters.

A PLC reads the well, sends the data over 4G and raises the alarms.

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



Schematic illustration

3

sensors at the well:
pressure, temperature and
a digital flowmeter

0 to 1023

raw 10-bit values,
converted to units by the
program

2

remote buttons: stop and
slow down, read by the
PLC

4G

board on today's
ESP32 PLC 21 FLEX
, in place of GPRS

THE CHALLENGE

Data from the well, without going to the well.

In oil extraction, the useful variables are the oil temperature, the pressure and the flow rate, which help to forecast production, and any sign of damage to the probe. The study wanted to read them without wires at the well, send them to the cloud and keep an eye on the process from anywhere. In petrochemical facilities the goal is the same at a larger scale: key indicators in real time, events by line and machine, and dashboards for each level of responsibility.

01

Read three sensors

Pressure, temperature and a digital flowmeter, received by the PLC without wires and converted from raw values to units.

02

Alarm at critical levels

Program alarms for critical levels, so nobody has to consult the variables all the time.

03

Act from afar

When a sensor reaches a critical level, the operator can stop the process or slow it down remotely.

04

Grow to many wells

Replicate the same model in a network of wells in different regions and countries, with central control.



Trends that point to the failures

With the data of many wells, calculate a trend per region to see where failures happen most often, and plan solutions before they are needed.

HOW IT WORKS

Three jobs of one program: read, react, compare.

Job 1 · Read

Raw values in, units and alarms out.

The PLC reads the three sensors at a fixed period. Each value arrives as a 10-bit number from 0 to 1023, and the program converts it to bar, degrees or cubic metres per hour. Then it sends the values to the cloud and checks them against the alarm levels.

- Periodic reading of three sensors
- Conversion from 0-1023 to units in the program
- A probe that reads nothing is an alarm too

Job 2 · React

The alarm offers two answers: slow down or stop.

At a critical level, the online application raises an alarm and offers two virtual buttons: slow the extraction down, or stop it. The PLC reads by program whether a button was pressed, from a message that arrives over the mobile network, and acts on the well. Push the pressure up, then choose an answer.

- Alarm at a critical level
- Virtual buttons in the online application
- The PLC reads the command and acts

Job 3 · Compare

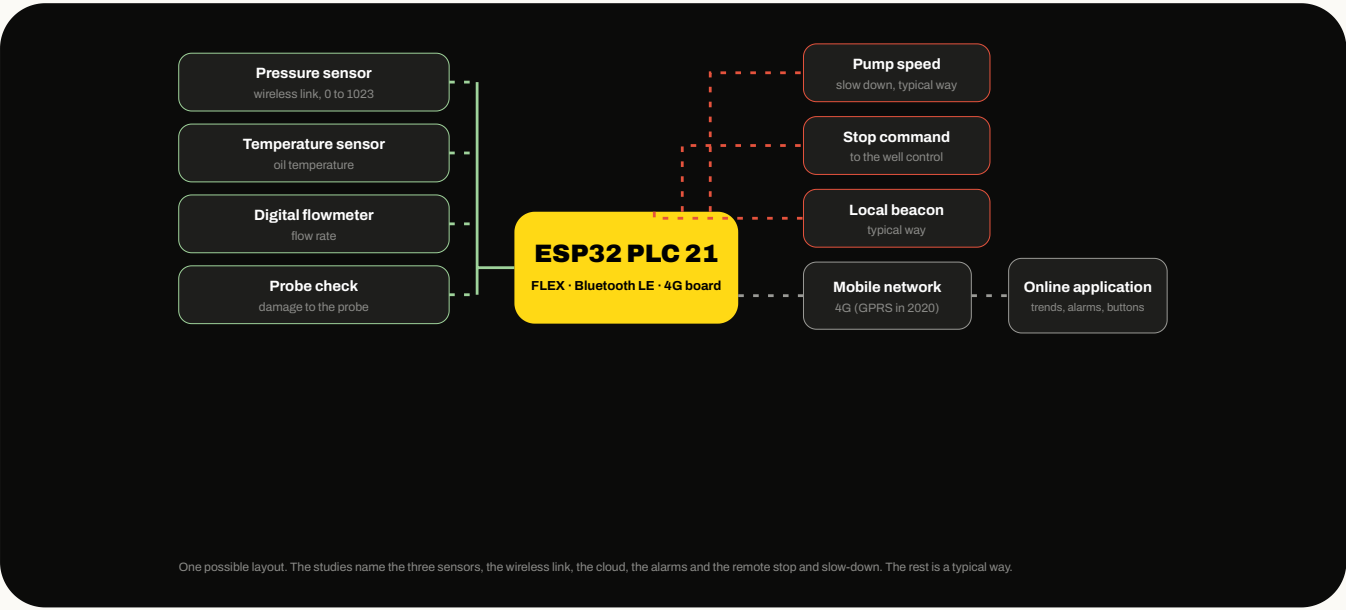
Many wells, one view, a trend per region.

The same model repeats in every well. With all the data in one place, the application counts the alarms per region and shows where failures happen most often, so maintenance can go there first. Change the period.

- The same PLC program in every well
- Alarms counted per region
- Maintenance planned where the trend points

How does a PLC monitor an oil well remotely?

An ESP32 PLC 21 FLEX receives the pressure, temperature and flow sensors without wires, converts the values and checks the alarm levels. Over a 4G board it sends the data to an online application that shows the process, raises the alarms and offers the remote stop and slow-down buttons. The PLC reads those commands and acts on the well.



Inputs to the PLC Outputs Mobile network and cloud

Signals

Signal	Between	Type	Purpose
Pressure	Sensor → ESP32 PLC 21	Wireless, 0 to 1023	Production and alarm at a critical level
Oil temperature	Sensor → PLC	Wireless, 0 to 1023	Process state and alarm
Flow rate	Digital flowmeter → PLC	Wireless	Production forecast
Probe state	Calculated from the readings (typical way)	Program	Detect damage to the probe
Slow down	Online application → PLC → pump drive (typical way)	4G, then output	Lower the extraction speed
Stop	Online application → PLC → well control	4G, then output	Stop the extraction
Values and alarms	PLC → online application	4G	Trends, alarms, reports per region

HARDWARE USED

One ESP32 PLC with Bluetooth and a 4G board.



CURRENT EQUIVALENT

ESP32 PLC 21 FLEX

An industrial controller built on the dual-core ESP32, for DIN rail, programmed with the Arduino IDE.

Role	Reads the sensors, converts the values, sends data and alarms, runs the remote commands
Processor	ESP32 dual core, up to 240 MHz
Inputs	13: 6 analog/digital (0-10 V, 11-bit), 7 digital optoisolated (5 to 24 Vdc), 2 of them with interrupt
Outputs	8: 3 analog/digital/PWM (0-10 V, 12-bit), 5 digital optoisolated (5 to 24 Vdc)
Wireless	Wi-Fi and Bluetooth LE built in; option board 4G (M1)-NB1 IoT LTE (u-blox), LoRa or CAN

The 2020 study used a PLC with an Arduino Mega inside, a Bluetooth module and GPRS, and does not name the model. GPRS runs on 2G networks, which some operators have already switched off, so today the equivalent is the ESP32 PLC 21 FLEX with the 4G board.

[See the ESP32 PLC 21 FLEX >](#)

No wires at the wellhead

The sensors reach the PLC over a wireless link, as the study proposes. A typical alternative at an industrial site is 4-20 mA wiring, which the same PLC reads on its 0-10 V inputs through a shunt resistor or a signal converter.

Units in the program

The PLC gets raw 10-bit values and the program converts them. Changing a sensor range is a change of two numbers, not of hardware.

Alarms instead of watching

The study puts alarms on the critical levels, so the online application calls the operator only when it matters.

SIMILAR PROJECT?

Tell us about your remote site. An engineer will answer.

Tell us what you need to measure, how far the site is, which network you have there and who must get the alarms. We will tell you which controller, which sensors and which link fit.

READ IT ONLINE

industrialshields.com/case-study-oi-l-well-remote-monitoring-esp32-plc

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