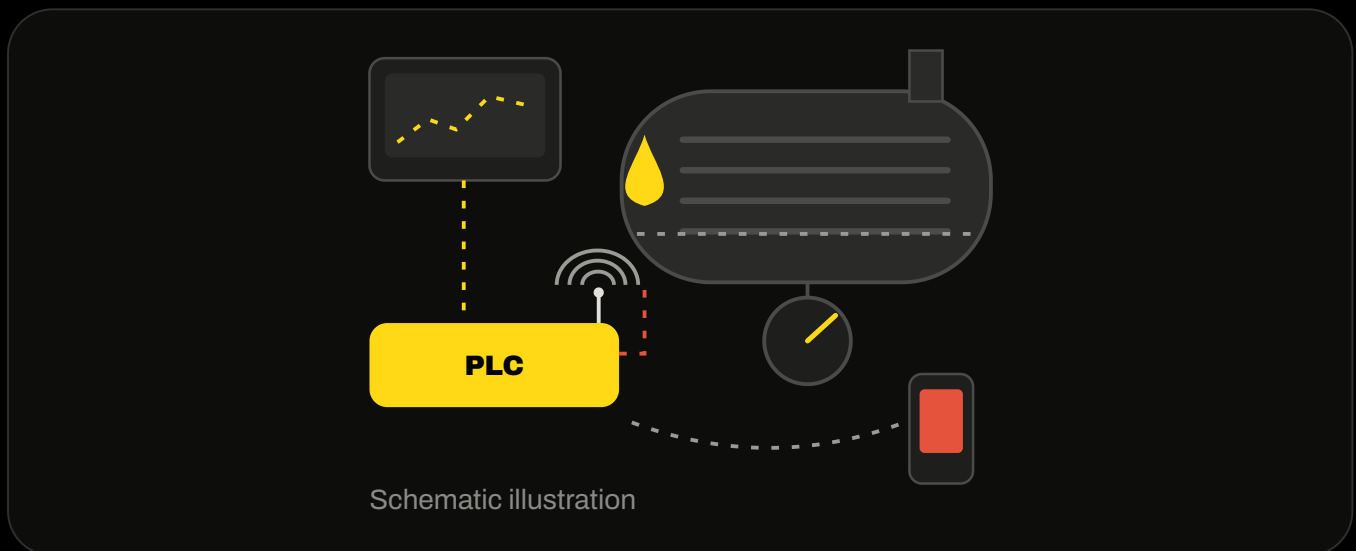


STEAM BOILER · WIFI PLC

Water, purge, flame, pressure. In that order.

A relay PLC with WiFi runs the burner sequence of a fire-tube boiler.

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

**2 bar**

the PLC switches the burner off

1 bar

the PLC lights the burner again

3

ignition repeats before the PLC aborts

4

relay loads at 220 V: pump, fan, transformer, gas valve

THE CHALLENGE

A boiler start is a sequence. Each step needs a condition.

Steam generation must run correctly and safely. The burner must not light without water, without a clean combustion chamber or without a confirmed flame. The pressure must stay in its band. And when something goes wrong, a person must know, even when nobody is next to the boiler.

01

Water before fire

The PLC checks the water level first. With low water, the pump runs until the level is right.

02

A clean chamber

Before the ignition, the fan sweeps the combustion gases out for a defined time.

03

An ignition that stops

No flame: the PLC tries again, three times. If the fourth try fails, it purges and aborts.

04

Pressure in a band

The burner fires up to 2 bar, stops, and starts again at 1 bar, until the user stops the cycle.



Alerts that reach someone

A fault shows first as a local alert on the Panel PC. If nobody is there, the alert goes out over WiFi. The case adds a database and a mobile application with security alerts and emergency shutdown.

HOW IT WORKS

Three stages: prepare, ignite, hold.

Stage 1 · Water, then purge

No water, no fire. Then the fan clears the chamber.

When the user switches the boiler on, the PLC first checks the water with the level sensor, on a digital input. If there is not enough water, it turns the pump on until the level is right. Then the fan sweeps the combustion gases out of the boiler for a defined time. Only then can the ignition start.

- Level sensor on a digital input
- Pump on a relay output until the level is right
- Fan purge for a defined time before the ignition

Stage 2 · Ignite, retry, abort

Spark and gas. No flame: try again. Then stop.

The ignition turns on the transformer, which makes the spark, and opens the solenoid valve, which lets the gas pass. The flame sensor tells the PLC if there is a flame. If there is no flame, the PLC repeats the ignition three times. If the fourth try also fails, the PLC runs another purge and aborts the ignition.

- Transformer and gas solenoid valve on relay outputs
- Flame sensor on a digital input
- Three repeats, then purge and abort

Stage 3 · Hold the pressure, raise the alert

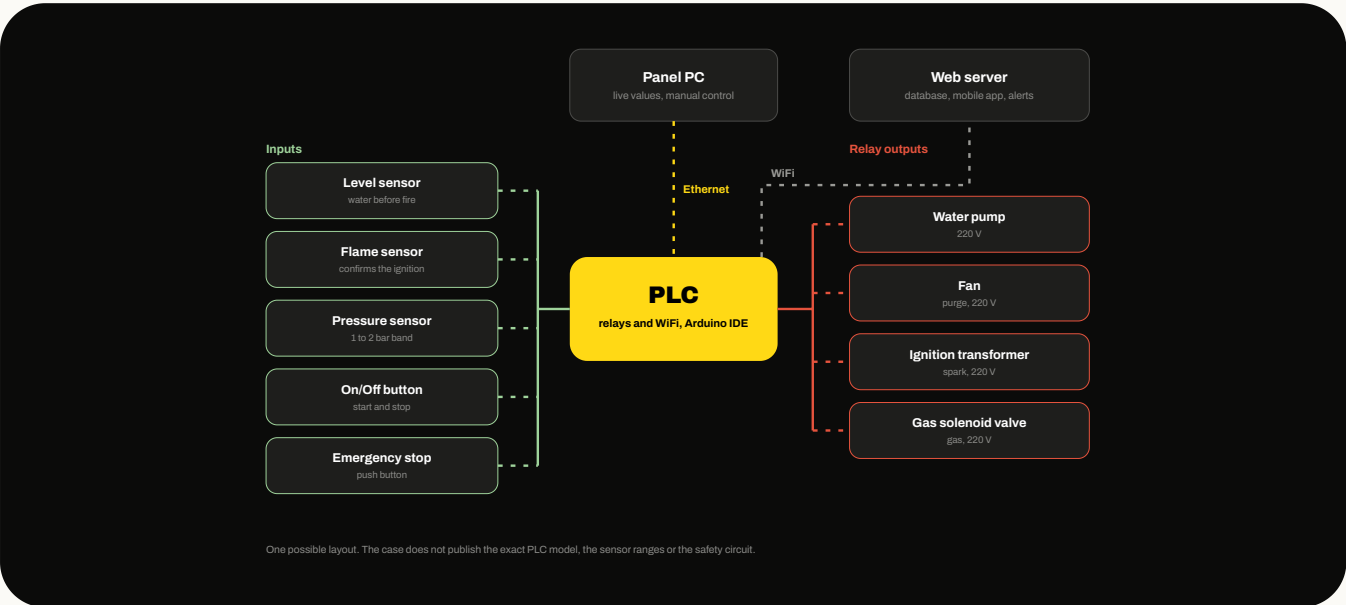
The burner works between 1 and 2 bar. A fault goes to the panel, then out.

With a flame, the PLC reads the boiler pressure on an analog input. At 2 bar it switches the burner off. When the pressure drops to 1 bar, it starts the burner again. The cycle repeats until the user stops it. If a level or an element does not behave as expected, the PLC shows a local alert on the Panel PC. If nobody is there, the alert must go out remotely, over WiFi.

- Pressure sensor on an analog input
- Burner off at 2 bar, on again at 1 bar
- Local alert on the Panel PC, remote alert over WiFi

How does a PLC automate a steam boiler?

A PLC with relay outputs and WiFi reads the level sensor, the flame sensor and the two buttons (On/Off and Emergency stop) on digital inputs, and the pressure sensor on an analog input. Its relay outputs switch the four 220 V loads: the water pump, the fan, the ignition transformer and the gas solenoid valve. A Panel PC on Ethernet shows the live values and lets the operator control each actuator by hand. Over WiFi, the PLC sends all the information to a web server.



Inputs Relay outputs (220 V) Ethernet WiFi

Signals and data

Signal	Between	Type	Purpose
Water level	Level sensor → PLC	Digital in	Enough water before the ignition. Low level starts the pump
Flame	Flame sensor → PLC	Digital in	Confirms the ignition. No flame: repeat, then purge and abort
Boiler pressure	Pressure sensor → PLC	Analog in	Burner off at 2 bar, on again at 1 bar. Sensor range not published
On/Off	Push button → PLC	Digital in	Starts and stops the boiler cycle
Emergency stop	Push button → PLC	Digital in	Emergency stop of the boiler. See the FAQ on safety
Water pump	PLC → pump	Relay out	Fills the boiler until the level is right
Fan	PLC → fan	Relay out	Sweeps the combustion gases for a defined time
Ignition transformer	PLC → transformer	Relay out	Makes the spark of the ignition
Gas solenoid valve	PLC → valve	Relay out	Lets the gas pass to the burner
Live values, manual control	Panel PC ↔ PLC	Ethernet	Parameters in real time, each actuator by hand, local alerts
Data and alerts	PLC → web server	WiFi	All the information. Database, mobile app, remote alerts

HARDWARE USED

A relay PLC with WiFi to run it. A Panel PC to watch it.



ESP32 PLC 19R

An industrial controller built on the dual-core ESP32, with WiFi, Bluetooth LE, Ethernet, RS-485 and RS-232, 8 relay outputs, for DIN rail. It is programmed with the Arduino IDE.

Inputs **6: 4 analog/digital (0-10 Vdc analog, 0-24 Vdc digital), 2 digital optoisolated (5-24 Vdc)**

Outputs **11: 8 relays (230 Vac 4 A / 24 Vdc 2 A, resistive), 3 analog/digital/PWM (0-10 V)**

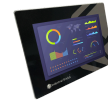
Wireless **WiFi 2.4 GHz, Bluetooth LE**

Wired comms **Ethernet (RJ45), RS-485, RS-232, I2C, SPI**

Programming **Arduino IDE**

The case names an Arduino based PLC with relays and WiFi and does not fix the model. The current controller with relays and WiFi on board is the ESP32 PLC 19R, also programmed with the Arduino IDE. In digital mode its analog/digital inputs take 24 Vdc signals.

[See the ESP32 PLC 19R >](#)



TouchBerry Pi Panel PC 10.1" FLEX

The local SCADA screen of the boiler. An industrial Panel PC with a Raspberry Pi 4, connected to the PLC over Ethernet. It shows the parameters in real time, lets the operator switch each actuator by hand and shows the local alerts.

Role	Live values, manual control, local alerts
Screen	10.1"
Computer	Raspberry Pi 4
Link to the PLC	Ethernet

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

A limit on the ignition

In this case, the number of tries is fixed in the program. After the fourth failure the PLC purges and stops, instead of sending gas again and again. In a real gas burner, the certified burner control sets the retries and the purge before each one.

Relays for the 220 V loads

The pump, the fan, the transformer and the gas valve are on relay outputs. Each relay of the ESP32 PLC 19R switches up to 4 A at 230 Vac with a resistive load. Motors and coils are inductive: use contactors for the motors and add RC snubbers.

Many boilers, one point

The case says you can replicate the system on several boilers, with one PLC each. All of them connect to the Panel PC and the web server, so you control the network from one point.

SIMILAR BOILER?

**Tell us your boiler and your sequence.
An engineer will answer.**

Tell us the type of boiler and burner, the sensors you have, the loads you switch and where the alerts must go. We will tell you which controller fits and how to wire it.

READ IT ONLINE

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