

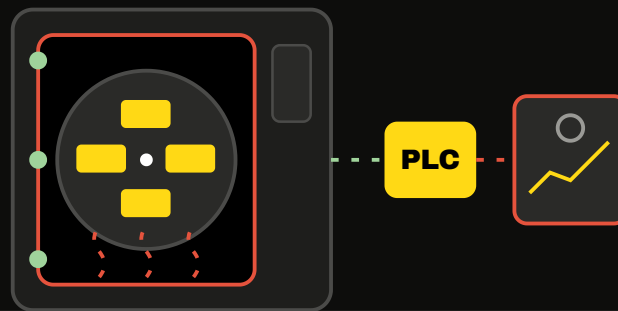
BAKERY · ARDUINO PLC RETROFIT

The ovens still bake well. Now they also report.

A retrofit of rotary bakery ovens with an Arduino based PLC and a Panel PC.

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

Rotary oven



temperature, rotation and trays

Schematic illustration

2

critical values under control: temperature and rotation speed

6

parts of the retrofit, from the sensors to the fans

2

tray alarms: an empty oven running, full trays waiting

1

operator screen with temperature, bakes and consumption per oven

THE CHALLENGE

Bake more, in less time, with less energy.

The bakery wanted more productivity from its ovens: shorter baking times, lower energy consumption and better control of the other indicators that drive the cost of each bake. The goals of the project: avoid human error, increase the daily production, control the performance of each oven, cut the baking time and reduce the consumption.

01

Thermometers you could not trust

The ovens used irreversible thermometers. They failed, and they were not 100% reliable. The operator could not be sure of the real temperature inside the oven.

02

Two values decide the bake

Temperature and rotation speed. If both stay where they should, the bread comes out the same every time, and the operator spends less time supervising the oven.

03

Trays in the hottest zones

The trays sit in the extreme temperature areas of the oven. The system must know, with no contact, whether there are trays inside, and flag an oven running with empty trays or full trays with the oven off.

04

Heat that escapes

Heat that leaks through the door, or hot air that does not move, leaves cold spots inside the oven and an uneven bake.



Keep the ovens, add the data

The ovens were still in perfect condition, so replacing them was not the plan. The retrofit adds the functions they lacked, extends their life and gives a longer time to amortise them.

HOW IT WORKS

Three jobs: bake to a profile, watch the trays, record every bake.

Job 1 · Bake to a profile

One profile per bread. The PLC holds it.

The operator picks the profile for the bread. The PLC reads the temperature sensors placed around the oven and keeps the temperature and the rotation speed at the values of the profile. The fans drive the hot air and the sealed door keeps the heat in. Change the bread, stop the fans or open a leak in the seal.

- Temperature sensors in several parts of the oven
- Temperature and rotation speed set by the profile

Job 2 · Watch the trays

Trays seen without contact, in the hottest zones.

Inductive sensors detect the metal trays with no physical contact, in the extreme temperature areas of the oven. With them the PLC switches the oven on and off and raises two alarms: an oven running with no trays, and full trays waiting with the oven off. Load the trays, start a bake, or try it the wrong way round.

- Inductive sensors detect the trays
- On/off control of the oven from the trays

Job 3 · Record every bake

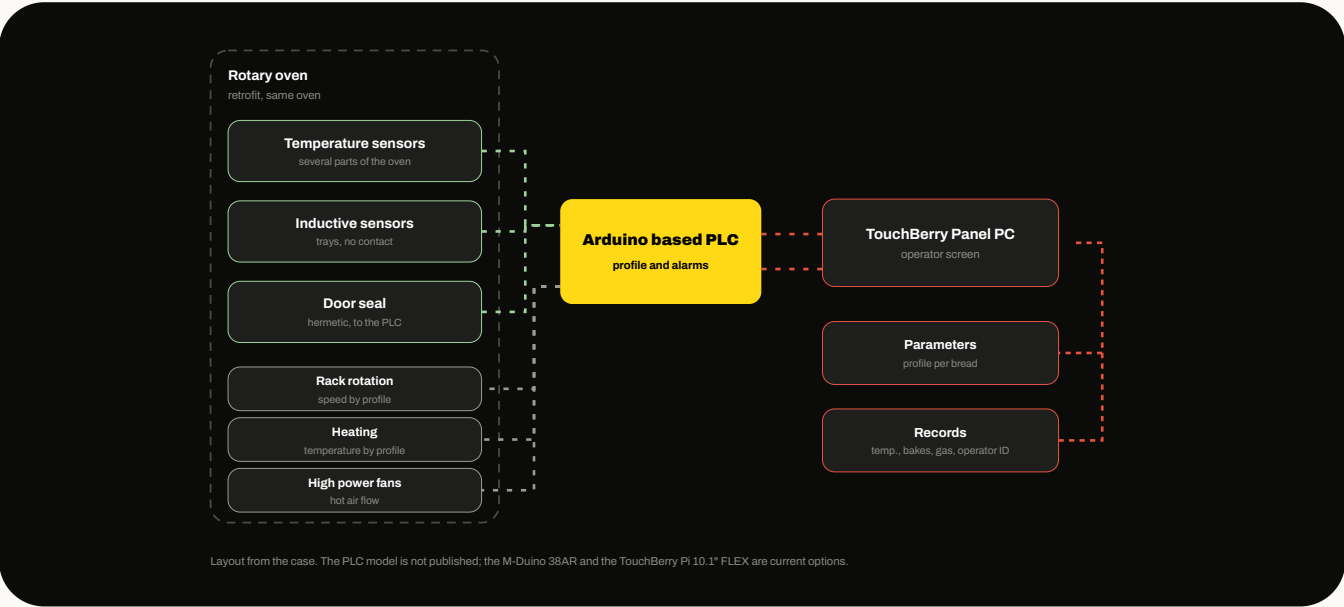
Temperature, bakes, gas and who was on shift.

The Panel PC shows each oven with its temperature and its number of bakes, the temperature log, the gas consumption and the ID of the operator. The operator opens and closes a report, and the data stays as a record of the production.

- Temperature and bakes per oven
- Temperature log and gas consumption

How do you add monitoring to an oven that already works?

Place temperature sensors in several parts of the oven, inductive sensors where the trays sit and a seal on the door, and wire them to the PLC. The PLC drives the rotation of the rack, the heating and the high power fans to the parameters of the selected profile, and raises the tray alarms. A Panel PC next to the ovens is the operator screen: it sets the parameters and shows the temperature, the bakes, the log and the consumption of each oven, with the ID of the operator. In this case the PLC is an Arduino based PLC from Industrial Shields and the screen is a TouchBerry Panel PC.



Signals and data

Signal	Between	Type	Purpose
Oven temperature	Sensors in several parts of the oven → PLC	Temperature sensors	Replace the old thermometers; real-time value for control and records
Rotation speed	PLC → rack rotation	Set by the profile	The second critical value of the bake
Tray presence	Inductive sensors → PLC	No contact, detects metal	On/off control of the oven and the two tray alarms
Door seal	Hermetic seal on the door → PLC	Connected to the PLC	Keeps the heat in for a stable bake
Hot air flow	PLC → high power fans	PLC output	Moves the heat; no cold spots inside the oven
Baking profile	Panel PC → PLC	Parameters per type of bread	Temperature, rotation speed and other functions
Production record	PLC → Panel PC	Temperature, bakes, log, consumption	Per oven, with the ID of the operator
Alarms	PLC → operator	On the Panel PC	Empty trays in a running oven, full trays with the oven off

HARDWARE USED

An Arduino based PLC and a TouchBerry Panel PC.



CURRENT OPTION

M-DUINO ETHERNET PLC ARDUINO 38AR

An industrial PLC built around an original Arduino Mega 2560, for DIN rail, programmed with the Arduino IDE.

Role in this design	Reads the oven sensors, holds the profile, raises the tray alarms
Inputs	19: 10 analog/digital (0-10 V, 10-bit), 9 digital optoisolated (5 to 24 Vdc), 4 with interrupt
Outputs	19: 6 analog/digital/PWM (0-10 V), 5 digital optoisolated, 8 relays (230 Vac 4 A / 24 Vdc 2 A, resistive)
Communications	Ethernet (W5500, RJ45), RS-485, RS-232, I2C, SPI
Built in	Real-time clock, microSD slot

The case names Arduino based PLCs from Industrial Shields and does not publish the model. The original page shows a product photo of an M-Duino 54ARA, which is not in the online shop today.

[See the M-Duino 38AR >](#)



CURRENT EQUIVALENT

TouchBerry Pi Panel PC 10.1" FLEX

The operator screen of the case is a TouchBerry Panel PC.

Role in this design	Operator screen, profiles, records and alarms
Screen	10.1", capacitive touch
Computer	Raspberry Pi 4
Network	Gigabit Ethernet

The case does not publish the model or the size of the TouchBerry. The current family has 7", 10.1" and 18.5" models.

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

More production

The case reports a significant increase in the daily production. Baking times went down, so the bakery makes more bread in the same time.

Less energy

The case reports a significant reduction in energy consumption, and lower operating costs with it. The case publishes no figures.

A more uniform bread

With the temperature and the rotation under control, the bread comes out with a more uniform texture and taste. Fans and a sealed door keep the heat even.

RETROFITTING OVENS OR OTHER PROCESS MACHINES?

Tell us about your ovens. An engineer will answer.

Tell us how many ovens you have, which values you want to see and control, and where the data must go. We will propose the PLC, the sensors and the screen.

READ IT ONLINE

industrialshields.com/case-study-bakery-rotary-oven-monitoring-arduino-plc

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