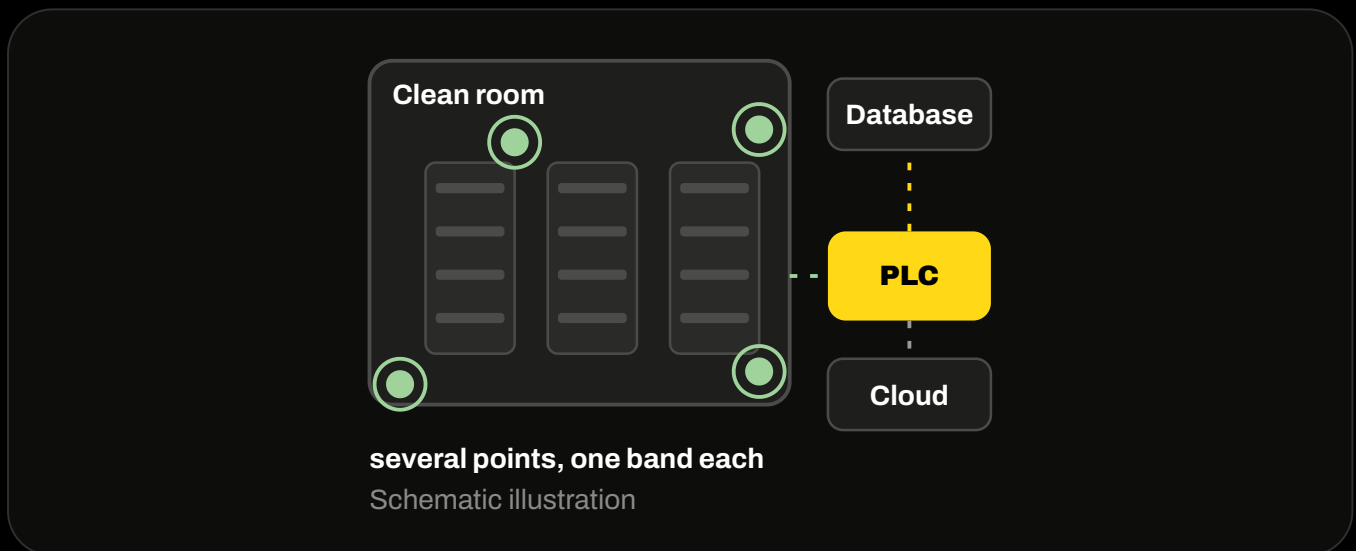


PROPOSED SYSTEM · M-DUINO 58

Wafers wait in a clean room. The PLC watches every corner.

Temperature, humidity and particles, point by point, with alarms.

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


22 °C

ideal room temperature,
inside a band of 18 to 26 °C

30-60 %

relative humidity band for
the stored wafers

80,000

particles at most in 0.028
m³ of air

2

copies of every reading: a
backup database and a
cloud server

THE CHALLENGE

The process is already strict. The storage room must be too.

Every step that makes a wafer already follows strict requirements. Before processing, the wafers wait in a clean room. The room must stay inside tight limits all the time: about 22 °C, between 18 and 26 °C, with 30 to 60 % relative humidity and a low particle count. A change in one corner of the room is enough to damage the products, and nobody should have to enter the room to check it.

01

Temperature at several points

One sensor near the door does not tell you what happens next to the racks. The room needs readings in different places.

02

Humidity and particles too

Humidity sensors and particle counters go around the room as well, so the results are reliable.

03

Alarms that someone sees

When a value leaves its band, the alarm must show on the panel outside the room and on the server that people watch from another place.

04

Data that is not lost

Every reading goes to a backup database server and to a cloud server, where it can be watched from another place.



Next step: the lights

The goals also include the lights of the room. A later option is to control them with a DALI system and switch them on and off on a schedule to use less energy.

HOW IT WORKS

Three jobs for one controller: measure, alarm, keep the data.

Job 1 · Measure

Several points, each with its own band.

Sensors in different places of the room read temperature and humidity. The PLC checks every point against the band of the case, not only the room average. When a door is held open, one point can leave the band while the average still looks fine. Pick a scenario and watch the four points. To run a full day of climate control with alarms in a closed room, open the [greenhouse climate simulator](#) and its mushroom room (it runs on ESP32 PLCs; the band logic is the same).

- Temperature and humidity at several points
- Each point checked on its own: 18 to 26 °C, 30 to 60 % RH
- An alarm when one point leaves its band

Job 2 · Alarm

A particle alarm that one spike does not trigger.

A particle counter reads the air. The limit of the case is 80,000 particles in 0.028 m³. The PLC raises the alarm only when the level stays above the limit, turns on a beacon, and tells the panel and the server. A person acknowledges it on the panel, outside the room. Move the level, add one spike, and acknowledge.

- Particle limit: 80,000 in 0.028 m³
- Confirmed over several samples
- Acknowledged from outside the room

Job 3 · Keep the data

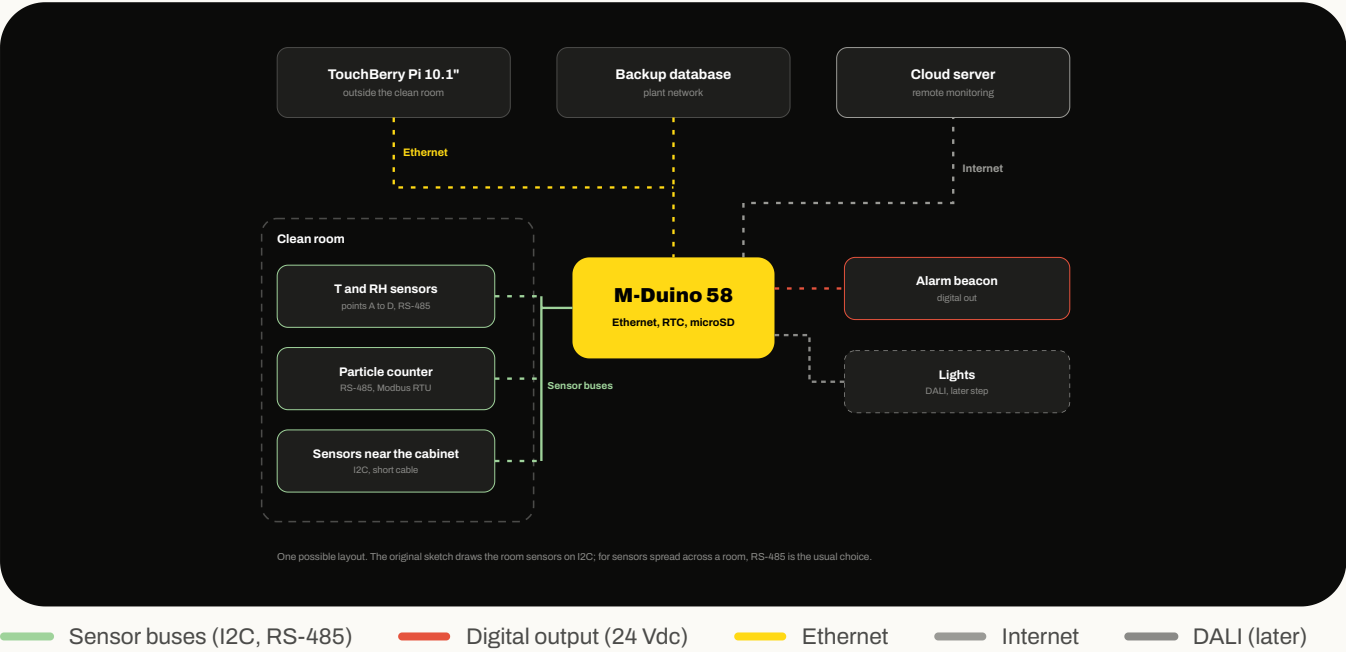
Two copies of every reading, even when a link is down.

The PLC sends every reading over Ethernet to a backup database server and to a cloud server, where the room can be watched from another place. If the cloud link or the whole network is down, the PLC keeps the records and sends them when the link is back. Cut the network or the cloud link and watch the counters.

- A backup database server on the plant network
- A cloud server for remote monitoring
- Records kept on microSD while a link is down

How do you monitor a semiconductor clean room with a PLC?

One industrial PLC is the master of all the sensors. Temperature, humidity and particle sensors go at several points of the room. The case chooses the bus by device and distance: I2C for sensors close to the controller, RS-485 with Modbus RTU for sensors spread across the room. A typical way to do it: a digital output drives an alarm beacon. A TouchBerry Pi panel outside the clean room shows the values and the alarms. Over Ethernet (the case also allows Wi-Fi), the PLC sends every reading to a backup database server and to a cloud server. DALI lights are a later step.



Signals and data (example)

Signal	Between	Type	Purpose
Temperature, points A to D	Sensors in the room → PLC	RS-485, Modbus RTU	Band of the case: 18 to 26 °C, ideal 22 °C
Relative humidity, points A to D	Sensors in the room → PLC	RS-485, Modbus RTU	Band of the case: 30 to 60 %
Sensors close to the cabinet	Sensors → PLC, short cable	I2C	Readings next to the controller. I2C is for short distances only
Particles	Particle counter → PLC	RS-485, Modbus RTU	Limit of the case: 80,000 particles in 0.028 m³
Alarm beacon and horn	PLC → beacon	Digital out	Local alarm when a value leaves its band
Operator screen	PLC ↔ TouchBerry Pi 10.1", outside the room	Ethernet	Values per point, alarms, acknowledge
Backup copy	PLC → database server	Ethernet	Every reading, with the time of the real-time clock
Remote copy	PLC → cloud server	Ethernet, Internet	Watch the room from another place
Lights (later step)	DALI version of the PLC → DALI bus → luminaires	DALI	Switch on and off on a schedule to use less energy

One controller for the sensors. One panel outside the room.



M-DUINO ETHERNET PLC ARDUINO 58

An industrial PLC built around an original Arduino Mega 2560, with 36 inputs and 22 outputs, Ethernet, RS-485, RS-232, I2C, a real-time clock and a microSD slot, for DIN rail. In this case it is the master of all the sensors, drives the alarm and sends the data.

Role	Master of the sensors, alarms, data to the database and the cloud
Inputs	36: 16 analog/digital (0-10 V, 10-bit), 20 digital optoisolated (5 to 24 Vdc)
Outputs	22: 8 analog/digital/PWM (0-10 V), 14 digital optoisolated (5 to 24 Vdc)
Comms	Ethernet 10/100 (W5500), RS-485, RS-232, TTL serial, I2C, SPI
Built in	Real-time clock, microSD slot

The original case shows pictures of the M-Duino 58 and the M-Duino 57R and does not name the exact model. The M-Duino 58 fits what the case asks for. The case sends the data over Ethernet or Wi-Fi. The M-Duino 58 has Ethernet on board; for Wi-Fi, the family has Wi-Fi & BLE versions (see the [M-Duino Wi-Fi & BLE family datasheet](#)), and for the DALI lights, DALI versions ([M-Duino DALI family datasheet](#)).

[See the M-Duino 58 >](#)



TouchBerry Pi Panel PC 10.1" FLEX

The touch screen outside the clean room: a Raspberry Pi 4 behind a 10.1" capacitive touchscreen, on Ethernet to the PLC. It shows the values of each point and the alarms, and people acknowledge the alarms here.

Role	Values per point, alarms, acknowledge, outside the room
Screen	10.1" IPS, 1280 x 800, capacitive, 900 nits
Front	IP20 or IP65 on the FLEX version
Software	Linux, preinstalled: Node-RED dashboard, Python or a browser
Comms	Gigabit Ethernet, 4 x USB, one serial port (RS-485, RS-232 or TTL)

The original case links to the 10.1" Panel PC. The current model is the TouchBerry Pi Panel PC 10.1" FLEX.

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

The right bus for each distance

I2C works on short cables next to the controller.
RS-485 with Modbus RTU reaches sensors across the room and beyond, many devices on one pair of wires. See a [Modbus RTU example on an M-Duino PLC](#).

A panel outside the room

People check the values and acknowledge alarms on the TouchBerry Pi panel, outside the clean room. They do not need to enter to read a sensor.

Code that you own

The PLC is programmed with the Arduino IDE and open source libraries. You get the code of the application, so you can check it and change it later.

MONITORING A CONTROLLED ROOM?

Tell us about your room and your limits. An engineer will answer.

Tell us the size of the room, the variables and their limits, how many points you want to measure and where the data must go. We will propose the buses, the controller and the panel.

READ IT ONLINE

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