



GIZMO^{IoT} INNOVATIONS LLP
SMART AUTOMATION SOLUTIONS

COLD ROOM & RIPENING CONTROL

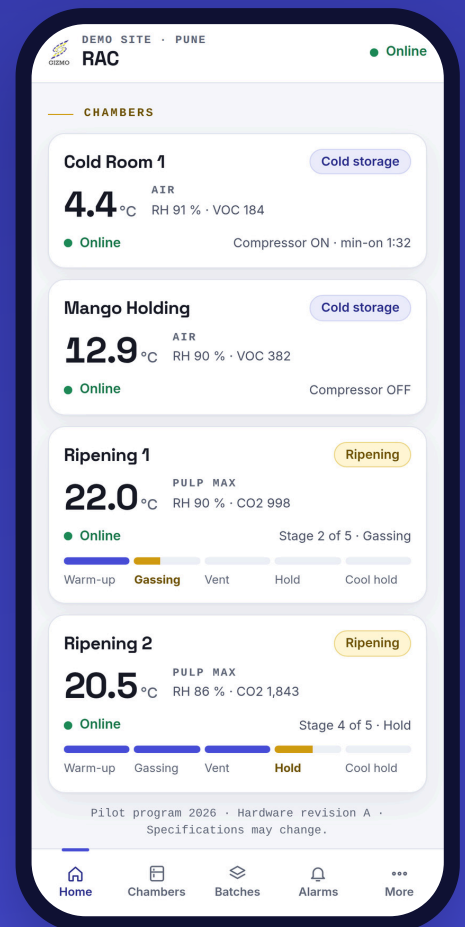
RAC

ROOM AUTOMATION CONTROLLER

Runs the room without you.
Records every ripening batch.

A wall-mounted controller that runs cold rooms and ripening chambers by itself, keeps running without internet, and keeps a tamper-evident record of every ripening batch.

One controller, two modes: cold storage and ripening. The controller decides every relay. The app only changes settings within limits.



Automatic

RUNS WITHOUT YOU

Protected

HARDWARE GAS CUT-OFF

Works offline

UP TO 30 DAYS

On record

TAMPER-EVIDENT BATCHES

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Pilot program 2026 · Hardware revision A · Specifications may change.

Your cold room, managed completely on its own

RAC watches temperature, humidity and VOC level, switches your compressor, fan, heater and humidity machines through contactors, and runs mango ripening as a recipe. The controller makes the decisions. The app is for viewing and for changing settings within limits.

Runs itself

Holds air temperature, humidity and VOC level by switching the machines. Each channel is independent: one sensor drives one machine, so a temperature change never touches the humidity machine.

Compressor protection

The minimum OFF time of 180 s is never skipped. After a power cut, machines restart 3 s apart so motors never start together.

Ripening by recipe

Warm-up, gassing, vent, hold and cool hold run as stages from a recipe. Mango recipes: Alphonso standard and Kesar standard.

Safe ethylene

Never above 100 ppm. No dose starts while a pulp probe reads above 24 °C, the gas-leak input is active or the door is open. An independent hardware timer closes the gas valve after about 2 minutes.

Works offline

Control keeps running when Wi-Fi or the internet is down. A signed 30-day lease is checked by the controller itself. Readings are buffered and sent when the connection returns.

Tamper-evident batch record

Every batch records lot number, variety and weight. Device events carry sequence numbers and a CRC chain; the server stores them insert-only with a daily hash chain.

COLD STORAGE

Switches compressor, dehumidifier or humidifier, heater and exhaust fan to hold temperature, humidity and VOC level. Example: compressor ON at 4.5 °C, OFF at 3.0 °C.

RIPENING

Runs mango ripening stage by stage, with pulp probes, a CO₂ sensor for venting and a metered ethylene dose. Example: Alphonso standard recipe.

Built for



Cold rooms

Cold storage mode



Ripening chambers

Ripening mode, mango recipes



Pack-houses

Cold storage or ripening mode



Traders

Lot, variety and weight on every batch



Farmer producer organisations

Customer role: view and set within limits

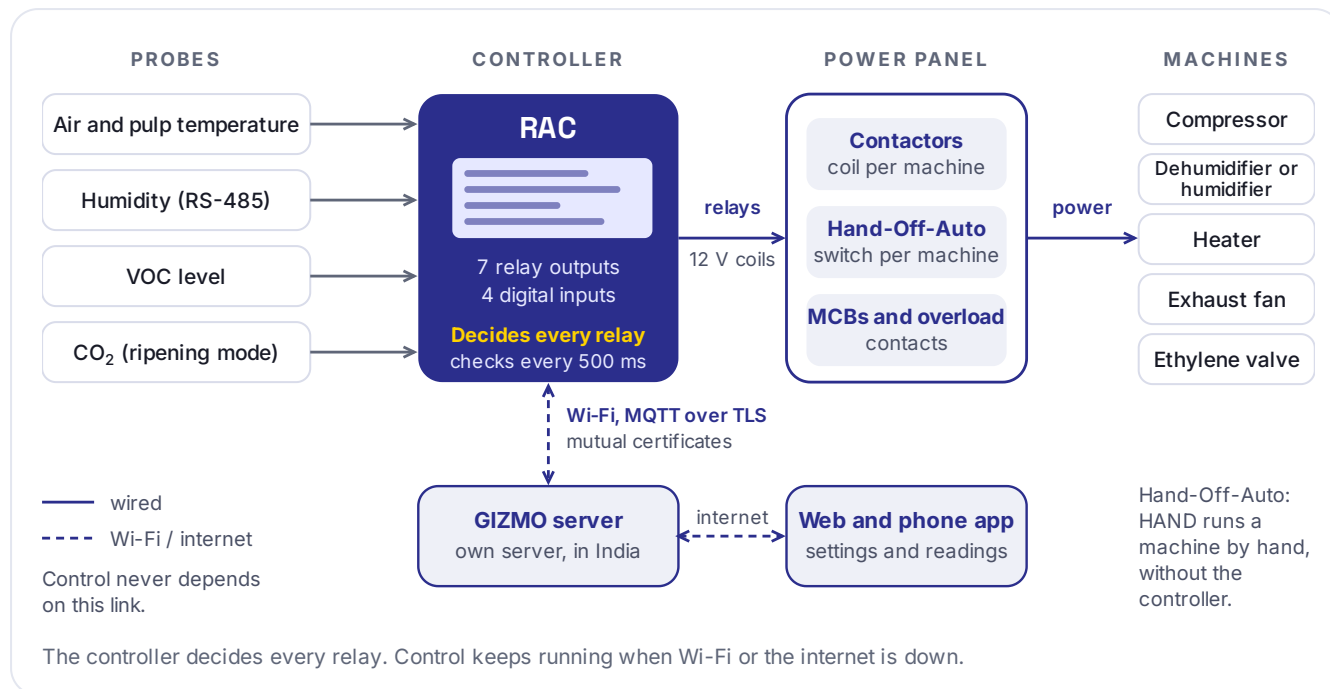


Refrigeration installers

Installer role: map sensors, relays and timing

From probe to machine, with the controller in charge

Probes report to the controller. The controller decides, and switches contactor coils in a power panel. The contactors start and stop your machines. The server and the app change settings; they never sit in the control path.



The Controller **DECIDES**

A wall-mounted box outside the chamber with a 20 × 4 character LCD and four buttons. **Decides every relay**, checking the rules every 500 ms. Its 7 relays switch contactor coils and valves only, never the compressor directly.



The Probes **MEASURE**

Stainless-steel digital temperature probes: air plus up to 2 pulp probes, with up to 10 m of cable. An RS-485 humidity probe and a VOC sensor, and in ripening mode a CO₂ sensor used for venting.



The Power Panel **SWITCHES**

Contactors, Hand-Off-Auto switches and MCBs. Each relay passes a Hand-Off-Auto switch and the compressor overload contact before the contactor coil. **HAND bypasses the controller**, so an operator can run each machine by hand.

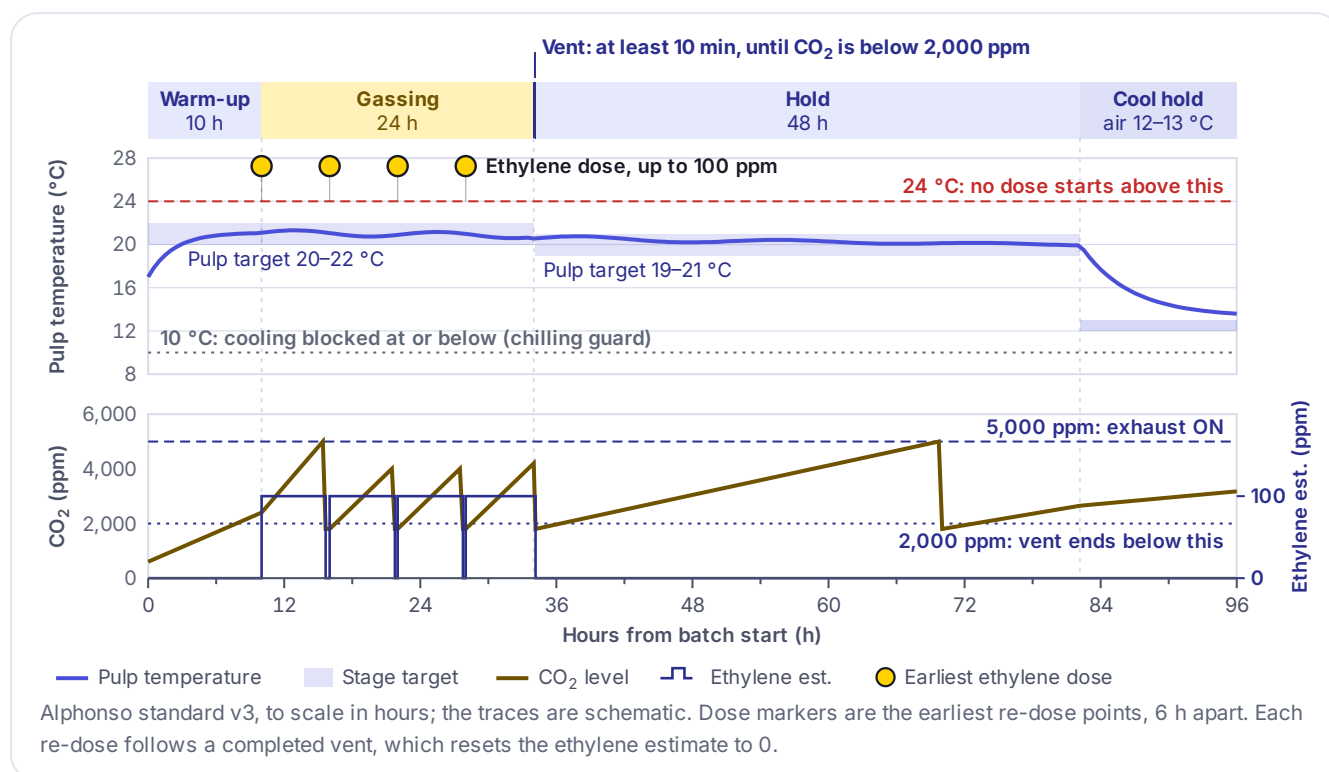


The App **SHOWS AND SETS**

A web app for desktop and phone browser: live readings, 24 h charts, machine states, set points, schedules, manual override, batches, recipes, alarms and reports. It changes settings within limits and never operates a relay itself.

Ripening, run by the controller

STAGE 1 Warm-up 10 h Pulp 20–22 °C RH 85–92 %	STAGE 2 Gassing 24 h Ethylene up to 100 ppm Pulp 20–22 °C RH 87–95 %	STAGE 3 Vent Until CO₂ < 2,000 ppm Exhaust on for at least 10 min	STAGE 4 Hold 48 h Pulp 19–21 °C	STAGE 5 Cool hold Air 12–13 °C RH 85–90 %
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Kesar standard, version 2

Stage	Duration	Pulp	RH
Warm-up	8 h	20–22 °C	85–90 %
Gassing	18 h	20–22 °C	85–90 %
Hold	36 h	19–21 °C	85–90 %

CO₂ venting and chilling guard

- ✓ Exhaust turns ON at 5,000 ppm.
- ✓ The vent completes below 2,000 ppm, after at least 10 min of exhaust.
- ✓ **Chilling guard:** cooling is blocked if pulp falls to 10 °C or below.

Ethylene rules

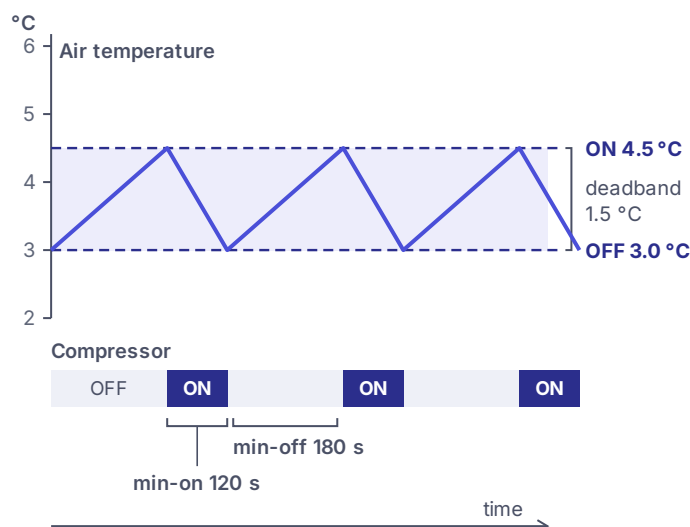
- ✓ **Up to 100 ppm.** Designed around FSSAI's 100 ppm ethylene limit.
- ✓ **Dose entry:** every pulp probe at or below 24 °C, gas-leak input inactive, door closed.
- ✓ **Re-dose** no sooner than 6 h after the previous dose start. A daily gas budget caps total gas.
- ✓ **Open-loop dosing** by valve time × flow rate: 5.0 L for 100 ppm in a 50 m³ chamber. The ppm shown is an estimate ("est.").

If the power fails mid-batch

- ✓ **Under 30 min:** the batch resumes.
- ✓ **30 min to 6 h during Gassing:** vent, then re-dose for the remaining gassing time.
- ✓ **Over 6 h:** Safe hold. No ethylene, hold temperature, vent by CO₂. Every resume is logged.

Cold storage control, channel by channel

Every channel pairs one sensor with one machine and has its own ON and OFF threshold. Machines are protected from short-cycling, and every override ends on its own.



Example set points for a cold room. Mango holding room: 12–13 °C.

Priority order

- 1 Admin deactivation
- 2 Critical limit
- 3 Manual override
- 4 Schedule
- 5 Sensor fault
- 6 Normal thresholds

Rules are checked every 500 ms in this fixed order.

Independent channels

One sensor drives one machine: compressor, dehumidifier or humidifier, heater, exhaust fan. A temperature change never touches the humidity machine.

ON / OFF with a deadband

Two thresholds per channel, with a minimum deadband, so machines do not flicker on and off.

Compressor protection

Minimum OFF time of 180 s is never skipped. Minimum ON time (example: 120 s). After power returns, machines restart 3 s apart.

Schedules

Up to 8 time windows per channel, overnight windows allowed. Per-device time zone, Asia/Kolkata by default.

An override that always expires

Manual override from the app or the panel ends on its own: 30 min by default, 8 h at most.

Sensor fault

That channel goes to its configured fault action and raises an alarm. Other channels keep running.

Critical limits

A critical limit forces a safe state. Example: VOC at 2,000 ppm forces the exhaust ON.

Humidity and VOC

Humidity (0–100 % RH) and VOC level are held the same way, each on its own channel. VOC is shown as a trend indicator, not a lab value.

Designed to fail safely.

Five rules, never broken.

Any electronic system can fail. These are the five rules the controller never breaks.

1

The controller decides every relay

The app and server only change settings within limits. Control keeps running when Wi-Fi or the internet is down. Relays switch contactor coils and valves only (max 2 A, through a panel MCB).

2

Ethylene never above 100 ppm

No dose starts while any pulp probe reads above 24 °C, while the gas-leak input is active, or while the door is open.

The batch screen lists every condition the controller checks before a dose: pulp temperature, gas leak, door, CO₂, the 6 h re-dose window, the 100 ppm estimate and the daily gas budget.

Dosing interlocks		Checked by the controller before every dose
NEXT DOSE Window opens in 2 h 29 min (6 h after the previous dose start)		
☒	All pulp probes at or below 24.0 °C	Max 21.9 °C
☒	No gas leak	Leak input normal
☒	Door closed	Closed
☒	CO ₂ below 5,000 ppm	997 ppm
☐	6 h since the last dose start	Opens in 2 h 29 min
☒	Ethylene est. + dose stays within 100 ppm	est. 0 + 100 = 100 ppm
☒	Daily gas budget left	20.0 of 30.0 L left (24 h)

Dosing interlocks in the app

3

A hardware timer cuts the gas

An independent timer circuit closes the ethylene valve after about 2 minutes (101–128 s) **no matter what the software does**. Software pulses are capped at 90 s, and the controller tests the cut-off at the start of every batch.

4

Compressor minimum OFF time is never skipped

The 180 s minimum OFF time is never skipped. After power returns, machines restart 3 s apart.

5

Every ripening batch leaves a tamper-evident record

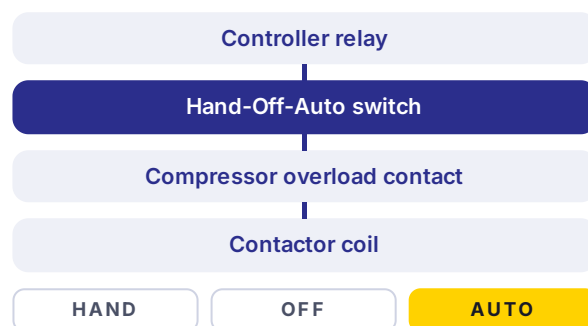
Device events carry sequence numbers and a CRC chain. The server stores them insert-only, with a daily hash chain.

Works offline

- ✓ **30-day signed lease**, checked by the controller itself, so it runs up to 30 days without internet.
- ✓ **7-day buffer** (design target) for readings and events, sent to the server when the connection returns.
- ✓ **Time comes only from the internet**. There is no clock-setting screen, so nobody can wind the clock back. An optional battery-backed clock chip keeps time through power cuts.
- ✓ If a subscription lapses or an admin deactivates the controller, cooling keeps running (AUTO) by default. The app becomes view-only.

Hand-Off-Auto

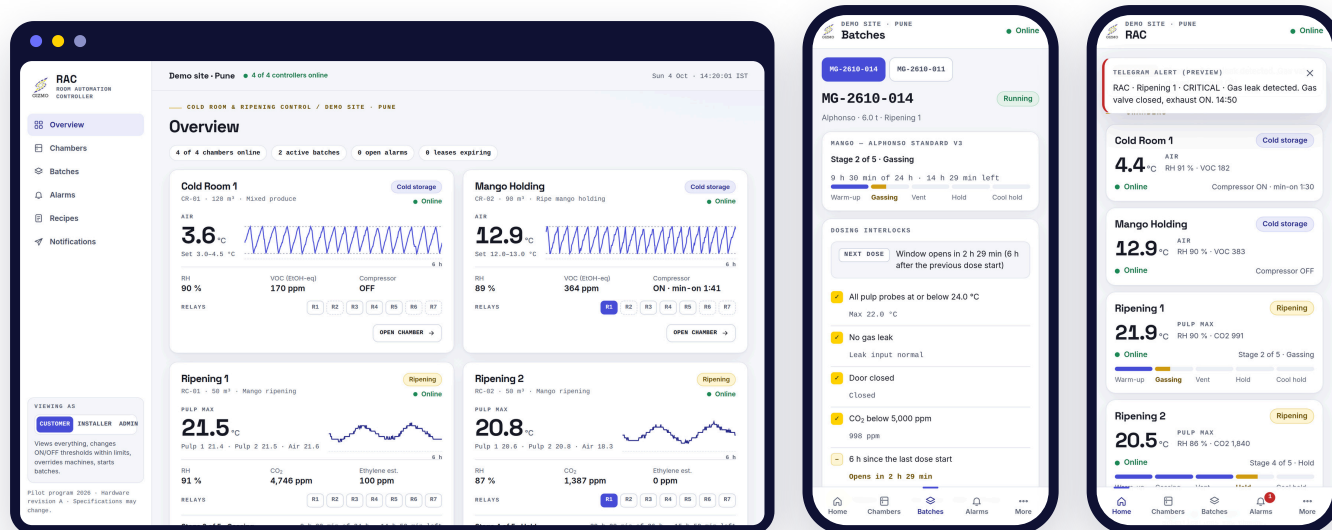
If the controller fails, the operator can run each machine by hand from the power panel. The signal path to each machine:



AUTO is normal operation. HAND bypasses the controller.

App, alerts and your data

One web app for desktop and phone browser: live readings, 24 h charts, machine states, set points, schedules, batches, recipes, alarms and reports. Telemetry arrives every 30 s and on every change.



Web dashboard: all chambers at a glance

Batch and stages

Alert preview

Three roles, enforced on the controller too

Role	What it can do
Customer	View everything. Change ON/OFF thresholds within limits, schedules and manual override. Start a ripening batch.
Installer	Everything a Customer can do, plus map sensors to relays, direction, timing, fault and critical actions. Pause, resume or abort a batch.
Admin (GIZMOIOT)	Everything an Installer can do, plus set limits and the minimum deadband, activate or deactivate, and manage subscriptions.

Alerts

Telegram

PILOT

WhatsApp

PLANNED

SMS

PLANNED

Alarms also appear in the app, where they are acknowledged.

Security and hosting

Own server, in India

Hosted on GIZMOIOT's own server. Customer data is not stored on third-party clouds.

Mutual-certificate TLS

Wi-Fi to the server over MQTT with TLS 1.2 and certificates from GIZMOIOT's own certificate authority.

Signed commands

Every command, setting and lease is digitally signed (ECDSA P-256), carries the device ID and an expiry, and repeats are ignored.

Own data only

Each controller can reach only its own data.

Encrypted backups

Off-site backups are encrypted.

Two-factor login

Password plus a two-factor code. Mandatory for GIZMOIOT admin staff.

Hardware, revision A.

Specifications and wiring

Item	Specification
Processor	Dual-core 240 MHz Wi-Fi microcontroller, 8 MB flash, external Wi-Fi antenna
Connectivity	Wi-Fi 2.4 GHz; RS-485 (Modbus) sensor bus
Display and keys	20 × 4 character LCD, 4 buttons (Up, Down, OK, Back), buzzer, status LED
Power	230 V AC, 50 Hz; industrial encapsulated 20 W power supply; worst-case draw about 5.2 W
Relay outputs	7 changeover power relays with 12 V coils: 5 machine channels, the ethylene valve, and a hardware gas-enable relay in series
Output duty	Contactors coils and solenoid valves, max 2 A per output via panel MCB
Digital inputs	4 opto-isolated inputs, 12 V wetting: gas leak (fail-safe), door, overload, spare
Temperature	Stainless-steel digital probes: air plus up to 2 pulp probes; -10 to +60 °C; ±0.5 °C; up to 10 m cable
Humidity	RS-485 Modbus probe: 0–100 % RH, ±1.8 % RH typical (lower accuracy above 90 % RH)
VOC	Metal-oxide VOC sensor, shown as "VOC (EtOH-eq)", 50–5,000 ppm, trend indicator (not a lab value)
CO ₂	CO ₂ sensor in ripening mode (used for venting)
Clock	Time from the internet; optional battery-backed clock chip
Enclosure	ABS, IP65, about 200 × 150 × 75 mm, mounted outside the chamber
Firmware	Signed firmware updates over the air with A/B fallback; secure boot and flash encryption in production

Installation notes

Controller

Mounted outside the chamber, in an IP65 enclosure.

Power panel

Contactors, Hand-Off-Auto switches and MCBs. Each relay passes its Hand-Off-Auto switch (AUTO) and the compressor overload contact before the contactor coil.

Cable lengths

Temperature: up to 10 m, shielded.
Humidity: RS-485, 5 m twisted pair.
VOC: 5 m, shielded.

GET STARTED

Join the pilot

Pilot program open for cold rooms and ripening chambers. Tell us the chamber type (cold or ripening), number of chambers, chamber volume (m³), city, your name, company and phone.

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