CE TECHNICAL FILE

Refrigerated Rack Cabinets – T-RACKS Series

Electronic Control and Supervision System

Rev. 1.0 – 2026

1. MANUFACTURER DETAILS

Field	Details
Company Name	Cybertechno Group S.r.l.
Registered Office	Via dei Mille, 59 – 80121 Naples (NA), Italy
VAT Number	IT08357401218
CEO	Andrea Iaquinto
CTO / Technical Manager	Giulio Avella / Marcello Cozzolino
Phone	[Insert]
Email	[Insert]

2. PRODUCT DESIGNATION

Field	Details
Product	T-RACKS
Type	Refrigerated rack cabinets
Brief Description	Integrated system for temperature and humidity control inside technical cabinets through refrigeration and electronic supervision.

3. GENERAL SYSTEM DESCRIPTION

The T-RACKS series cabinets are designed to maintain controlled environmental conditions inside technical racks.

Integrated Components:

- Commercial refrigeration unit (Rivacold)
- Control system based on Raspberry Pi
- Command relay module
- DS18B20 temperature sensors
- DHT11 temperature & humidity sensor
- Dew point calculation system
- 24V LED internal lighting
- Sheet metal cabinet structure manufactured by STI S.r.l.

System Objectives:

- Temperature control
- Relative humidity control
- Condensation prevention
- Data supervision and logging

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4. FIELD OF APPLICATION

Environment	Notes
Industrial environments	Installation in protected areas
Server rooms	Racks for ICT equipment
Technical rooms	Automation panels / PLC enclosures
Automation applications	Process environmental control

> ⚠️ The system is designed to operate exclusively in protected indoor environments.

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5. CABINET STRUCTURE AND THERMAL INSULATION

The T-RACKS cabinet is built with a metal structure supplied by STI S.r.l., featuring:

5.1 Airtight Seal and Insulation

- **Insulated walls:** The entire structure is insulated with thermal panels to ensure heat isolation
- **Airtight construction:** Designed to be completely sealed, preventing external air infiltration

- **Doors and access panels:** Equipped with perimeter gaskets to guarantee sealing integrity

5.2 Cable Entries

Feature	Description
Entry system	Cable glands / cable entries with sealing gasket
Insulation	Integrated insulating foam in cable passages
Function	Prevents air exchange with the outside, maintains airtight integrity

5.3 Ventilation

> ⚠️ **Only controlled opening:** The upper section of the cabinet, where the Rivacold refrigeration unit is installed, is equipped with ventilation grilles to ensure proper cooling system operation.

All other cabinet surfaces are fully closed and insulated.

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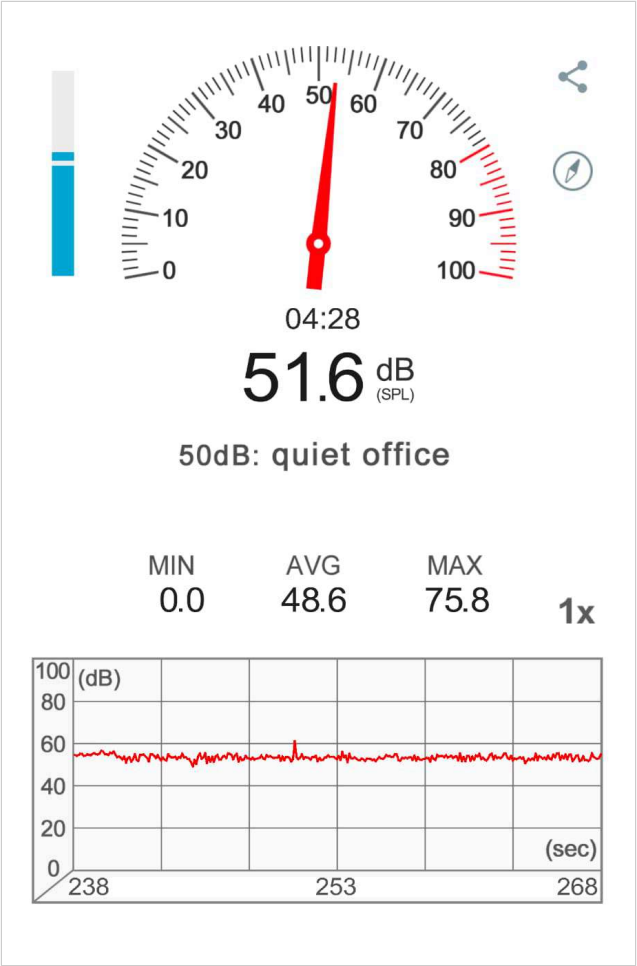
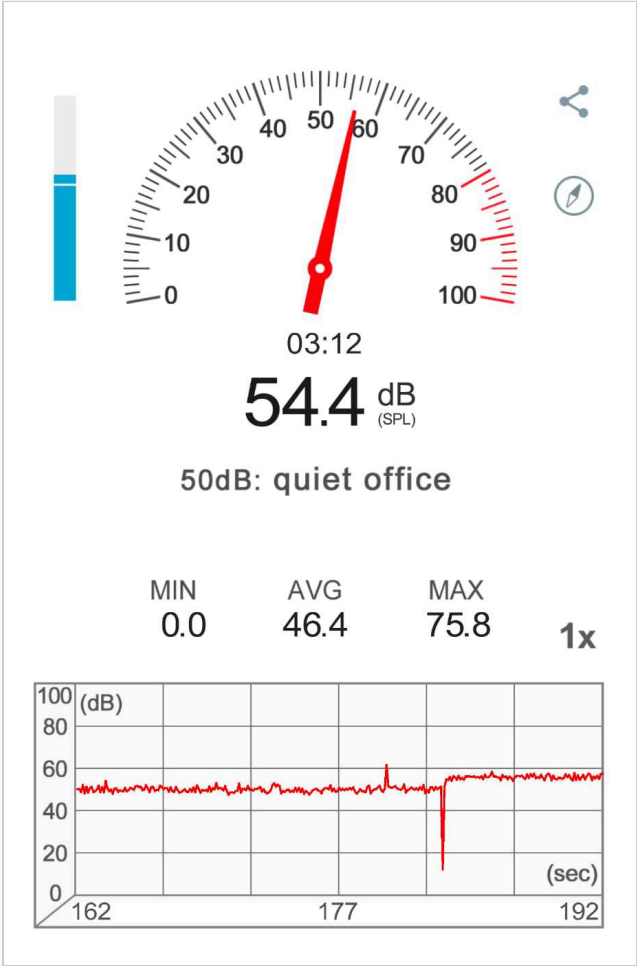
6. NOISE EMISSIONS

The T-RACKS system is designed to ensure **low noise levels**, making it suitable for installation in indoor environments such as offices, server rooms, and technical areas.

6.1 Measured Sound Pressure Levels

Measurement Distance	dB(A) Level	Average Value	Reference
3 meters	51.6 dB(A)	48.6 dB(A)	Environment: quiet office
1 meter	54.4 dB(A)	46.4 dB(A)	Environment: quiet office

6.2 Photographic Documentation of Measurements

Measurement at 3 meters	Measurement at 1 meter
	
Measured level: 51.6 dB(A) – Average: 48.6 dB(A)	*Measured level: 54.4 dB(A) – Average: 46.4 dB(A)*

6.3 Measurement Conditions

- **Instrumentation:** Calibrated digital sound level meter (Ok Sigma App)
- **Environment:** Controlled indoor setting
- **Regulatory reference:** Measurements taken under normal refrigeration unit operating conditions
- **Reference level:** 50 dB(A) = quiet office

> ✅ **Note:** The measured noise levels are compatible with indoor workplace installation and do not require additional acoustic protection measures.

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7. ELECTRICAL STRUCTURE AND POWER SUPPLY

The system features two separate and independent power lines.

7.1 Refrigeration Unit Power Line

- Direct power supply to the Rivacold unit
- No modifications to original protections
- Guaranteed autonomous operation

7.2 Electronic Systems Power Line

Powers: Raspberry Pi, relay module, sensors, 24V LED lighting.

7.3 Isolation / Switching

Requirement	Implementation
Isolators	Independent per line
Circuit identification	CEI-compliant labeling
Access	Restricted to qualified personnel

7.4 Electrical Protection

Live parts are protected by:

- PETG panel
- PETG insulating enclosures
- Access restricted to qualified personnel

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8. COMPONENT PROTECTION

Component	Enclosure	Functions
Raspberry Pi	Dedicated PETG enclosure	Electrical insulation, mechanical protection, maintenance safety
Relay board	Dedicated PETG enclosure	Electrical insulation, mechanical protection, maintenance safety

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9. CONNECTIONS AND MAINTENANCE

Feature	Description
Connector type	Quick-release plug-in connectors

Advantages	Tool-free replacement, simplified maintenance, reduced operational errors
Accessibility	Designed for fast and safe interventions

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10. SYSTEM OPERATION

The system operates through:

- Temperature acquisition (DS18B20)
- Humidity acquisition (DHT11)
- Dew point calculation
- Relay control
- Continuous monitoring
- Data logging

✅ The refrigeration unit retains all original safety protections.

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11. CONTROL SOFTWARE

Feature	**Details**
Platform	Raspberry Pi
Type	Proprietary software developed in-house
Functions	Sensor reading, dew point calculation, relay management, data logging, system supervision
Safety	The software **DOES NOT interfere** with the refrigeration unit's safety devices. Fail-safe logic integrated.

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12. OPERATION IN CASE OF FAILURE

Scenario	**System Behavior**
Electronic system failure	Manual control of refrigeration unit available
Cooling continuity	Refrigeration unit continues to operate autonomously
Original protections	All active and unaltered

Loss of dew point control	**DOES NOT** create hazardous conditions. Results only in reduced performance.

13. RISK ASSESSMENT

Ref.	Risk Description	Mitigation Measures	Status
R1	Electrical hazard	Insulation, PETG protections, controlled access	✅ Mitigated
R2	Thermal hazard	Continuous monitoring, ventilation	✅ Mitigated
R3	Mechanical hazard	Adequate structure, certified fastenings	✅ Mitigated
R4	Handling of insulated panels	Use of PPE, two-person handling	✅ Mitigated
R5	Condensation / wet surfaces	Humidity monitoring, dew point calculation, environmental control	✅ Mitigated
R6	Noise	Sound levels below 55 dB(A), compatible with workplaces	✅ Mitigated

14. ATTACHED TECHNICAL DOCUMENTATION

N.	Document	Format	Revision	Status
01	T-RACKS Cabinet CAD Drawings	DWG / PDF	Rev. [ ]	✅ Attached
02	Single-Line Electrical Diagram – Power Supplies	PDF	Rev. [ ]	✅ Attached
03	Block Diagram – Thermostat/Control System	PDF	Rev. [ ]	✅ Attached
04	CE Declaration of Conformity – Rivacold Refrigeration Unit	PDF	Original	✅ Attached
05	Component Manuals (Raspberry Pi, sensors, relays)	PDF	[ ]	✅ Attached
06	Assembly Photographic Documentation	JPG / PDF	[ ]	✅ Attached
07	Noise Emissions Measurement Report	PDF	[ ]	✅ Attached

15. APPLIED DIRECTIVES AND STANDARDS

European Directives

Reference	Title	Field of Application
2014/35/EU	Low Voltage Directive (LVD)	Electrical equipment safety
2014/30/EU	Electromagnetic Compatibility (EMC)	Immunity and emissions
2011/65/EU	RoHS	Restriction of hazardous substances
2000/14/EC	Noise Emissions	Equipment noise levels

Technical Standards

Standard	Title	Reference in Technical File
EN 60204-1	Safety of machinery – Electrical equipment	Sec. 7
EN ISO 12100	Risk assessment	Sec. 13
EN 60529	Degrees of protection (IP Code)	Sec. 7.4
EN 61439	Low-voltage switchgear and controlgear assemblies	Sec. 7, 8
ISO 3744	Determination of sound power levels	Sec. 6

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16. SYSTEM CLASSIFICATION

The T-RACKS system is classified as:

- 🔹 **Integration system of CE-marked components.**

It does not constitute a standalone machine under the Machinery Directive. Integration respects intended use limits and does not alter the original safety conditions of the components.

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17. TECHNICAL FILE RETENTION

This technical file shall be retained for a minimum period of:

📦 **10 years** from the date of last market placement.

It is available upon request by competent authorities.

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18. SIGNATURE AND VALIDATION

Field	Details
Place	Naples, Italy
Date	_____
Signature of Technical Manager (CTO)	Giulio Avella / Marcello Cozzolino _____
Signature of Legal Representative (CEO)	Marcello Cozzolino _____
Company Stamp	[Reserved space]

Document generated to support CE compliance. Final validation remains the responsibility of the manufacturer or competent body according to applicable directives.