Freezing Tunnel Automation Use Case

High-capacity automated freezing tunnels with MQTT integration for meat processing facilities.
Industry: Food & Beverage (Meat Processing)

Quick Facts

Attribute	Value
Capacity	Up to 20,000 kg/h
Temperature	Down to -40°C rapid freezing
I/O Points	7,000-13,000 per tunnel
Tags	10,000-16,000 internal tags
HMI Screens	20 operator interfaces
Cameras	~10 Hikvision CCTV per installation
Deployments	50+ tunnels (Brazil and international)
PLC	Allen-Bradley with Ethernet/IP

The Challenge

Challenge: Food processing facilities required advanced freezing tunnel systems capable of handling high-volume production (up to 20,000 kg/h) while maintaining strict quality standards for texture, color, flavor, and nutrients.

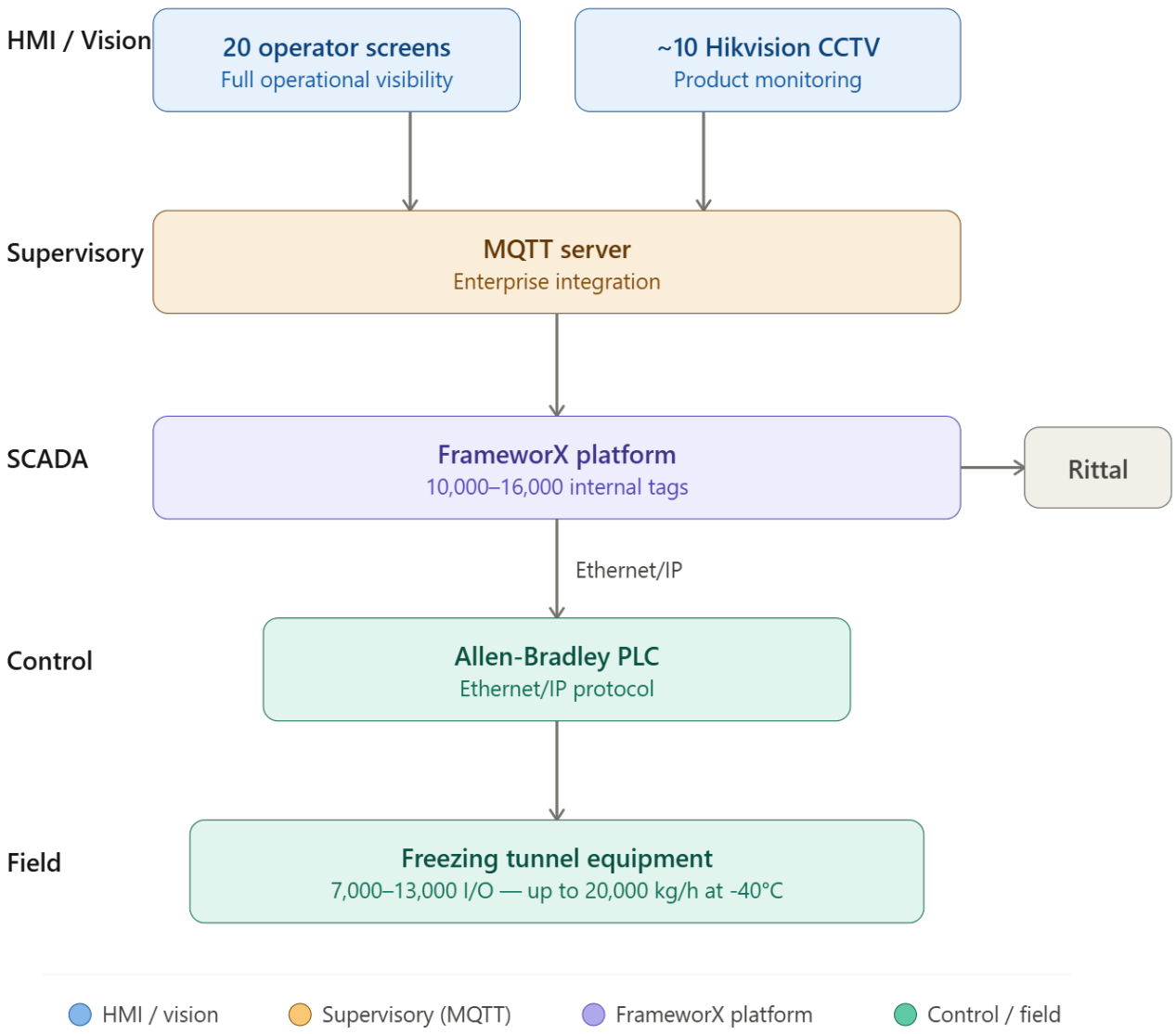
Specific pain points:

- Traditional freezing systems lacked automation, flexibility, and monitoring capabilities
- Need to adapt to different products (poultry, pork, beef) and packaging types (cardboard, plastic)
- Compliance with food safety regulations required
- Complete operational visibility needed across large I/O counts
- Rapid freezing to -40°C required to preserve product quality

Impact: Without advanced automation, facilities could not achieve required throughput while maintaining quality standards and regulatory compliance.

The Solution

Architecture



Tier	Component	Capabilities
Field	Freezing tunnel equipment	7,000-13,000 I/O points
Control	Allen-Bradley PLC	Ethernet/IP protocol, central control
SCADA	FrameworX Platform	10,000-16,000 internal tags
Supervisory	MQTT Server	Enterprise integration
HMI	20 operator screens	Complete operational visibility
Vision	Hikvision CCTV (~10 cameras)	Real-time product monitoring
Electrical	Rittal panels	Infrastructure integration

Scale

Metric	Value
I/O Points per Tunnel	7,000-13,000

Internal Tags	10,000-16,000
Operator Screens	20
CCTV Cameras	~10 per installation
Processing Capacity	Up to 20,000 kg/h
Temperature Range	Down to -40°C
Deployed Systems	50+ tunnels

Connectivity

Protocol	Application
Ethernet/IP	Tunnel-level real-time control
MQTT	Supervisory-level integration

Products Handled

- Poultry
- Pork
- Beef
- Cardboard containers
- Plastic containers

Key Enablers

FrameworX capabilities that made this solution possible:

Capability	Application
High-Density I/O Management	Efficient handling of 7,000-13,000 points per tunnel
Multi-Protocol Architecture	Ethernet/IP for control, MQTT for supervisory
Scalable Tag Structure	10,000-16,000 tags supporting complex process logic
Integrated Vision System	CCTV cameras for real-time product monitoring
Flexible Product Handling	Adaptable to various products and packaging
Comprehensive HMI Design	20 screens providing complete visibility

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The Results

- **50+ Deployments** — Successfully deployed automated freezing tunnels in Brazil and international markets
- **20,000 kg/h Capacity** — Achieved high-volume processing with consistent quality standards
- **Quality Preservation** — Maintained texture, color, flavor, and nutrients through rapid -40°C freezing
- **Flexible Operations** — Adaptable to different products and packaging requirements
- **Regulatory Compliance** — Met stringent food safety and quality regulations through automated control
- **Complete Visibility** — Integrated SCADA and CCTV systems provide full operational monitoring

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This case demonstrates high-capacity freezing tunnel automation with multi-protocol architecture and integrated vision systems for meat processing.

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