Natural Refrigerant Training Summit

Building a Sustainable Workforce

Micro Thermo® Alliance

Application, Navigation, Tools, Case Control Tuning

Charlie Cunliffe - MicroThermo

Parker Hannifin – Sporlan Division

NORTH AMERICAN Sustainable Refrigeration Council

Natural Refrigerant Training Summit

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Who We Are

A 501c3 nonprofit working to create a sustainable future for supermarket refrigeration by removing barriers to natural refrigerant adoption.

160+
member companies

55K+
food retail locations

Goals

- Build a sustainable technician workforce
- Increase funding for natural refrigerant equipment
- Improve technology options, education, and awareness

What are Natural Refrigerants?

CO_2	C_3H_8	NH_3
R744 Carbon Dioxide	**R290** Propane	**R717** Ammonia

NORTH AMERICAN
Sustainable Refrigeration Council

What is Micro Thermo Alliance?

- State-of-the-art facility management software platform
- Control, monitoring, information, historical graphs and data
- More than just control or monitoring…a true management tool
- Windows® based graphical format

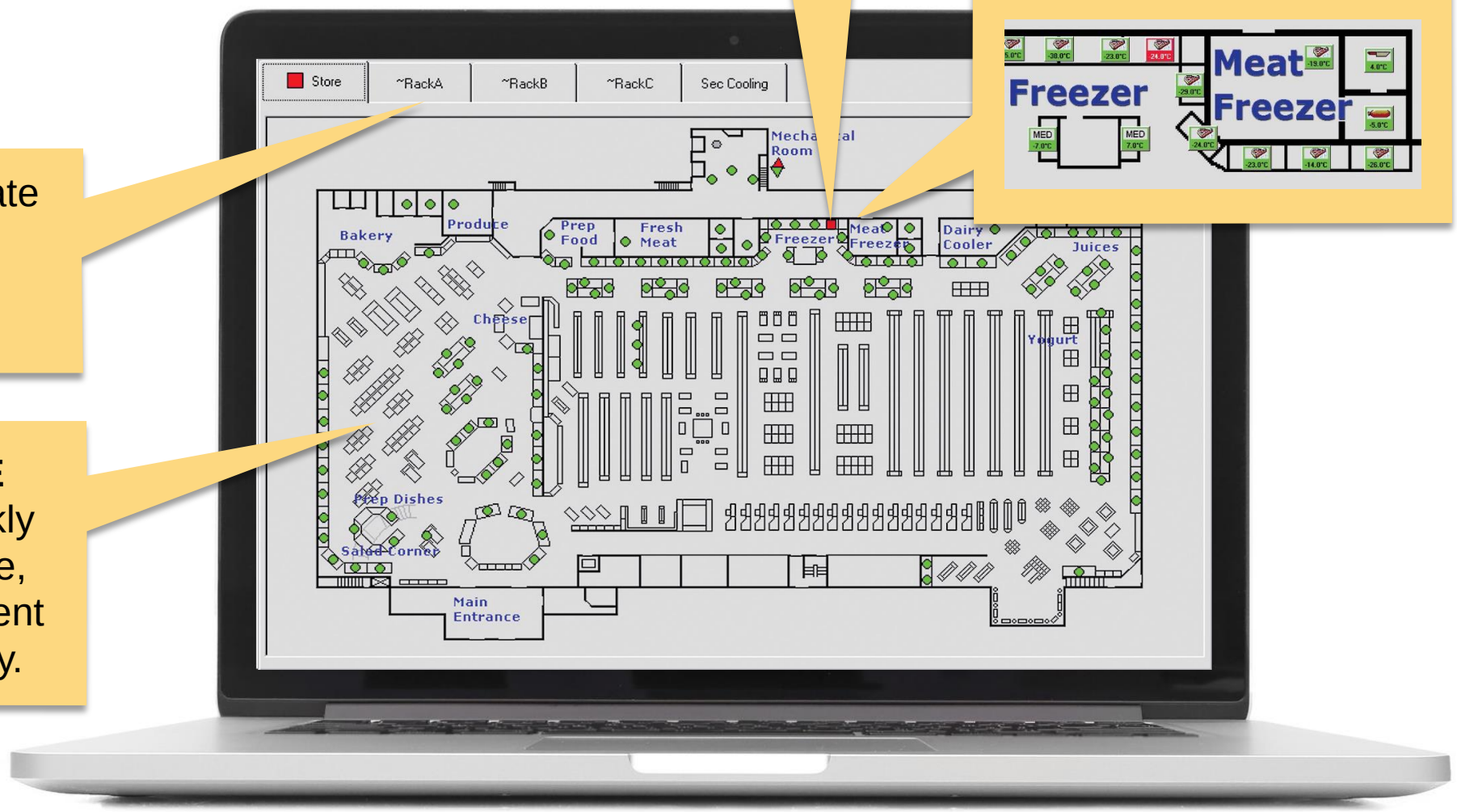
It’s All Connected

MENU TABS - Navigate to other screens to monitor your entire refrigeration system.

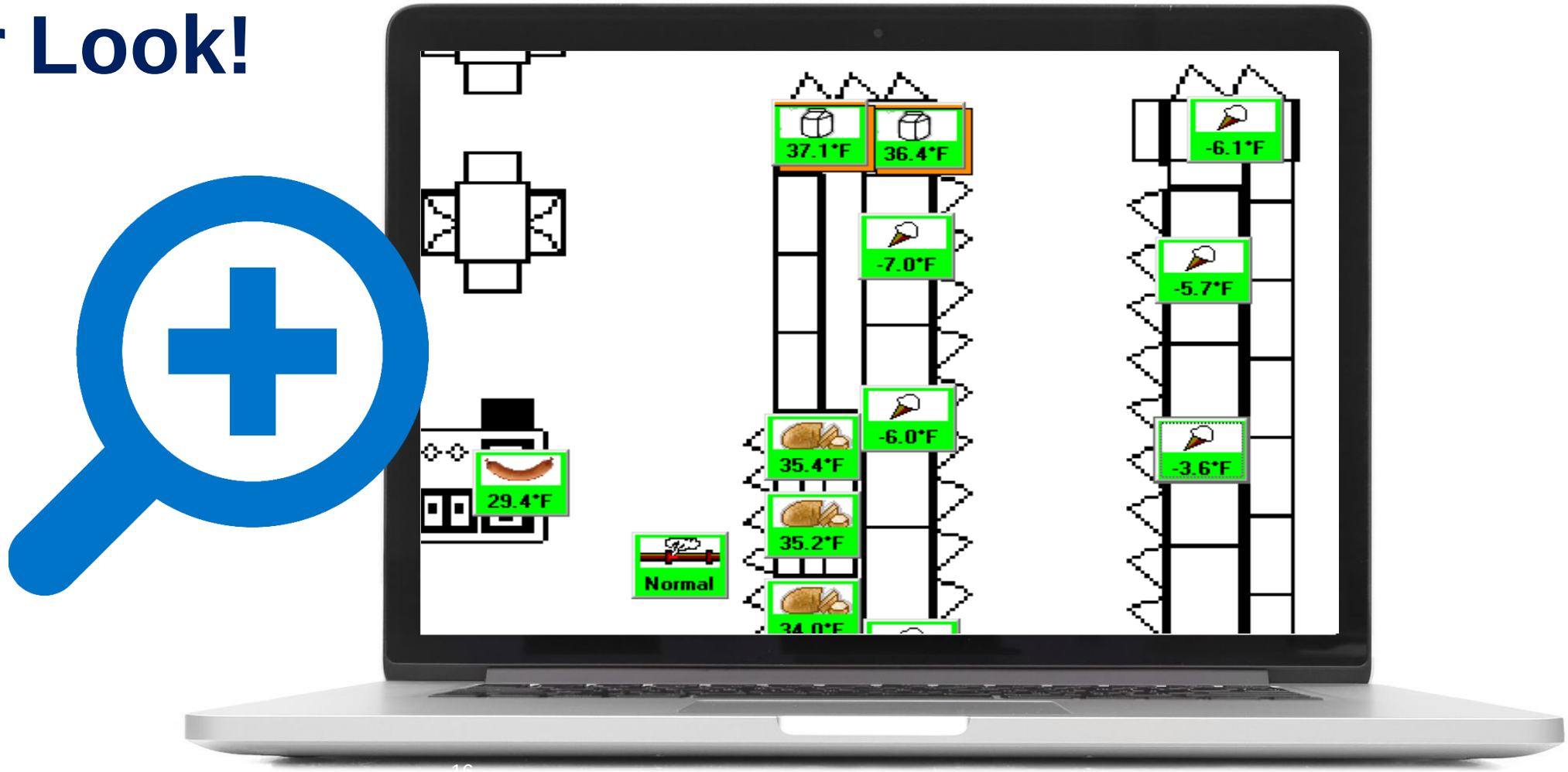
COMPREHENSIVE OVERVIEW - Quickly scan the entire store, see that all equipment is operating properly.

COLOR-CODED INDICATORS - Identifies alarm situations.

ZOOM IN - For detailed, real-time operating data.

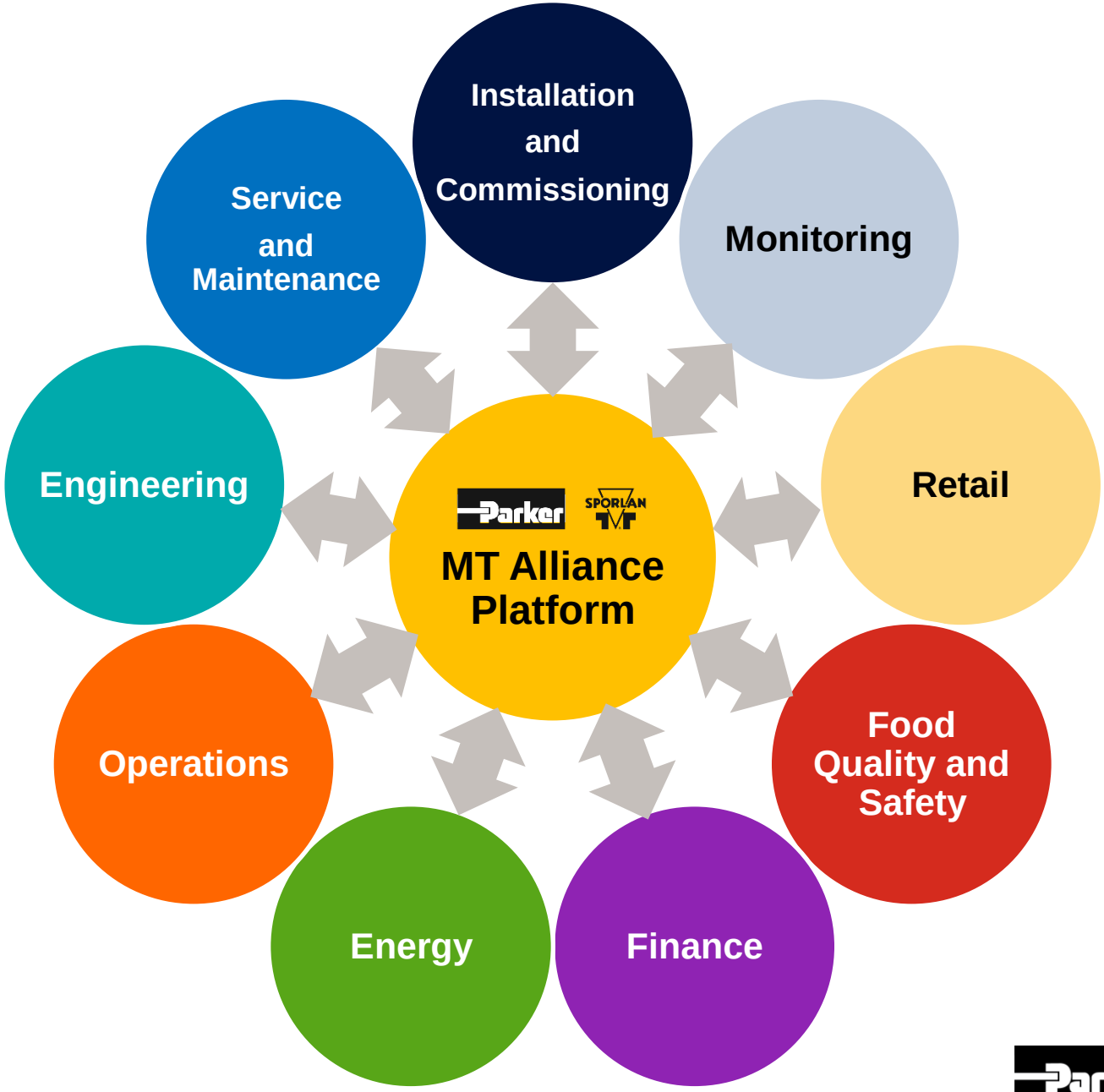


Zoom In for a Closer Look!



Micro Thermo Alliance

The power of information!



FACILITY Control

- Supermarkets
- 300+ CO_2 installations in North America
- Frozen and refrigerated warehouses
- Ice skating rinks
- Marine refrigeration
- Food processing and preparation facilities
- Ice cream processing and production
- Pharmaceutical process and storage

MICRO THERMO ALLIANCE

Graphical User Interface Front End

Information

Subsystems are linked into one platform

Leak Detection

Energy

Refrigeration

Tº Monitoring

VFD

Generation

HVAC

Lighting

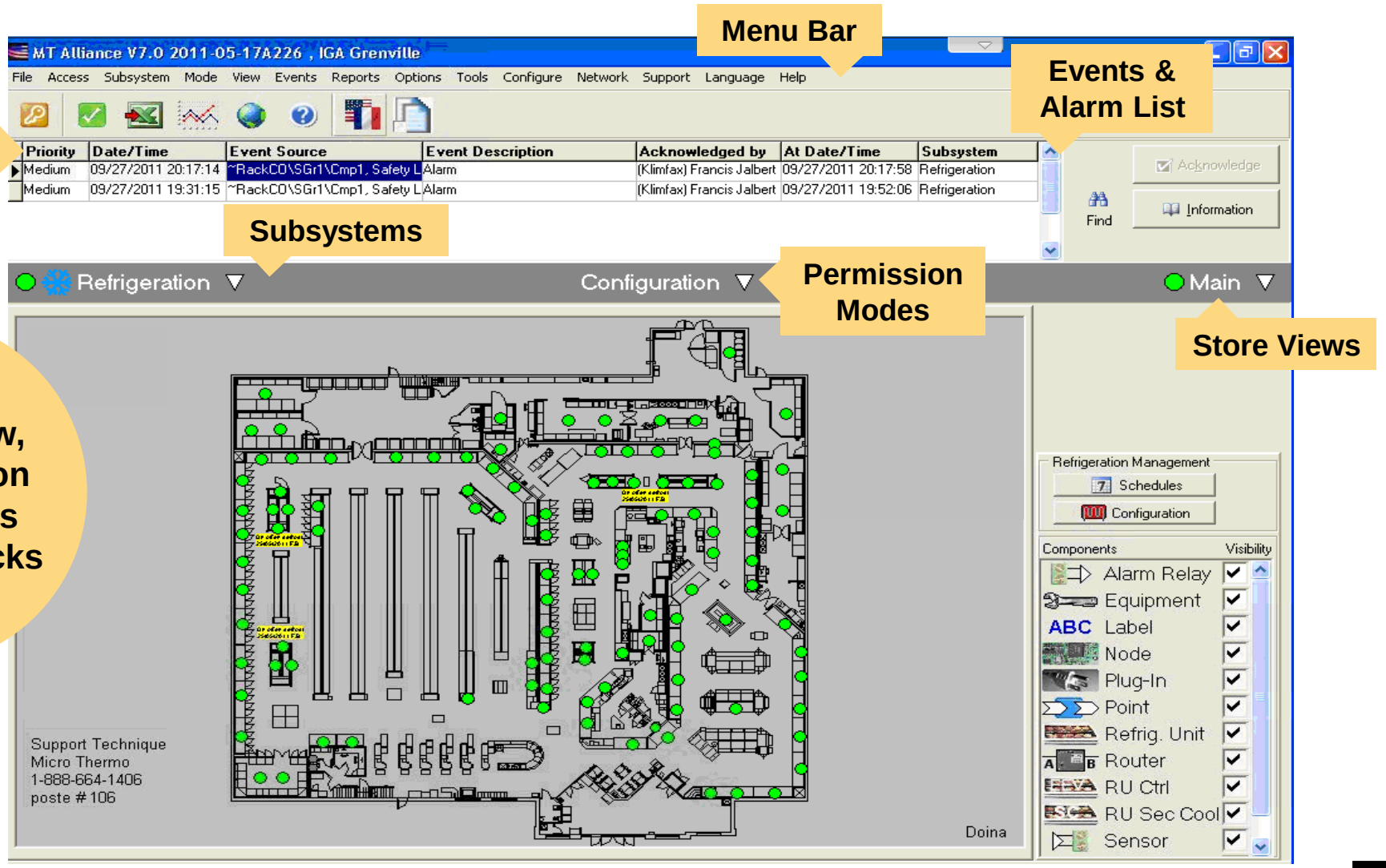
MICRO THERMO ALLIANCE

Accountability · Traceability · Security

- ✓ **Access Accountability**
  - Requires individual username and password
- ✓ **Individual Security**
  - Different levels of access for Technicians and End-Users
- ✓ **Individual Traceability**
  - Activity and history is tracked and retained
- ✓ **No back-door usernames or generic passwords**
- ✓ **Eliminates Re-commissioning**
  - Prevents the Energy Profile of a store degrading over time
- ✓ **Eliminates Unauthorized Set-Points changes, component jump-out, device disabling**

MICRO THERMO ALLIANCE

Menus



From the main window, every function of Alliance is just a few clicks away!

MICRO THERMO ALLIANCE

Color Codes

- **RED SQUARE**
  TAKE ACTION
  - Active Alarm

- **YELLOW DIAMOND**
  CAUTION
  - Alarm in Recall

  - Node not fully commissioned

- **GREEN CIRCLE**
  All Systems GO
  - Temps and Nodes OK

- **ORANGE**
  Fixture or Circuit in **DEFROST**

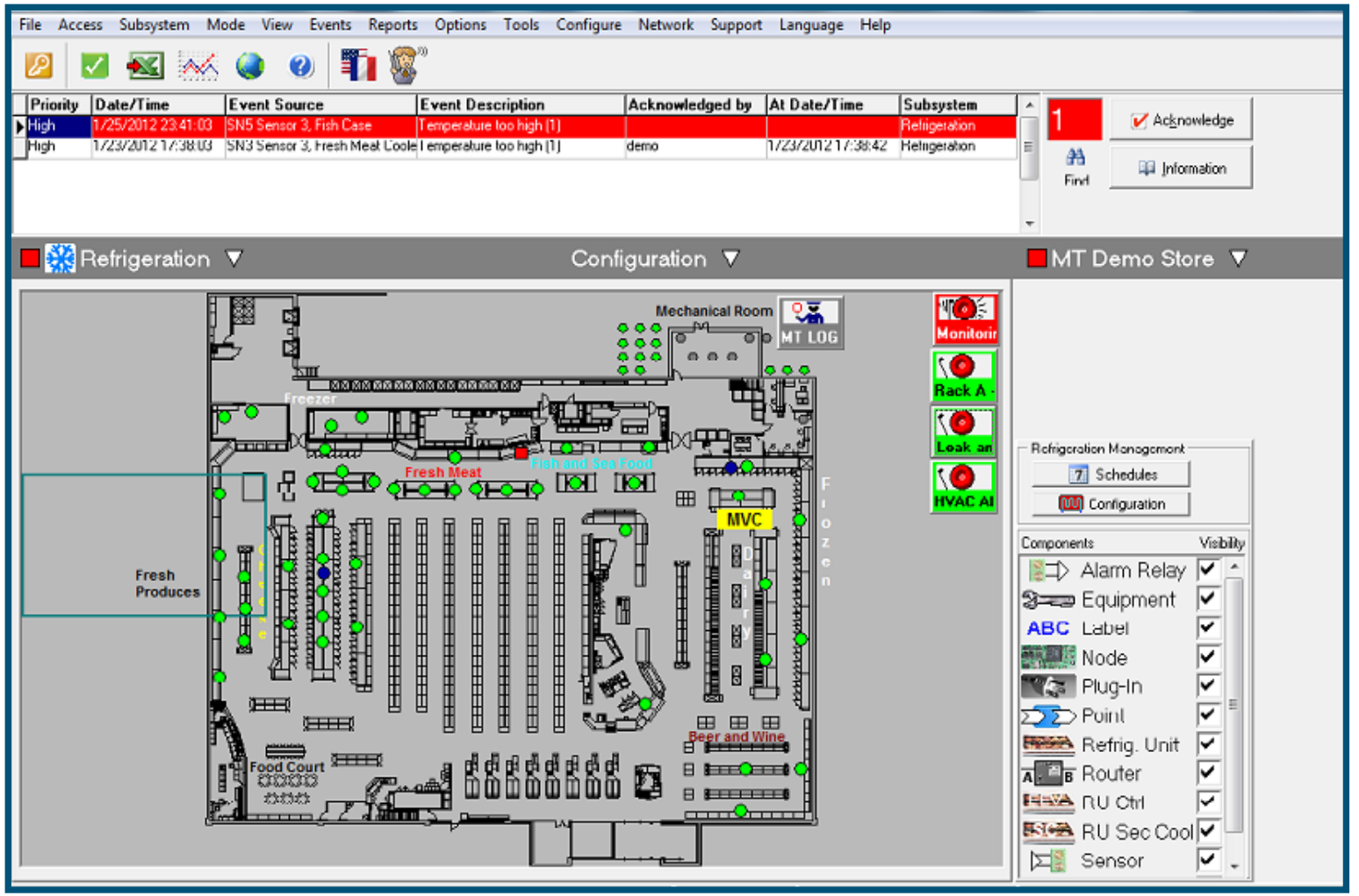
- **TEAL**
  Fixture, Fan, Valve,
  Compressor in **OVERRIDE**

- **WHITE**
  UNCONFIGURED
  - Not commissioned

- **BLACK**
  Node **OFFLINE**

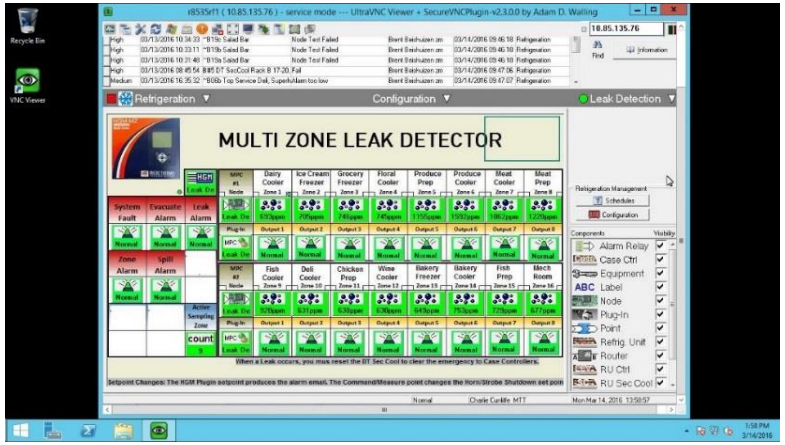
MICRO THERMO ALLIANCE

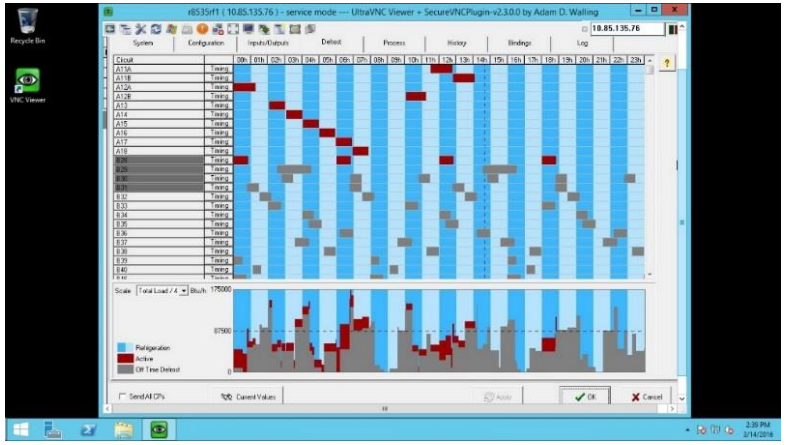
Alarm Acknowledgement and Resolution

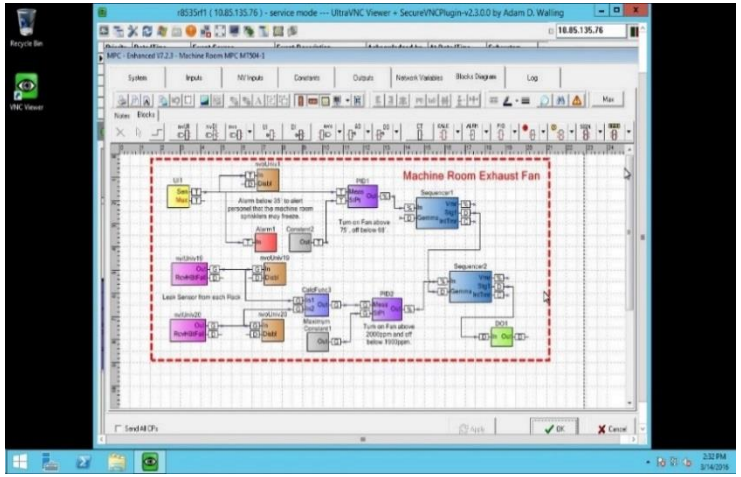


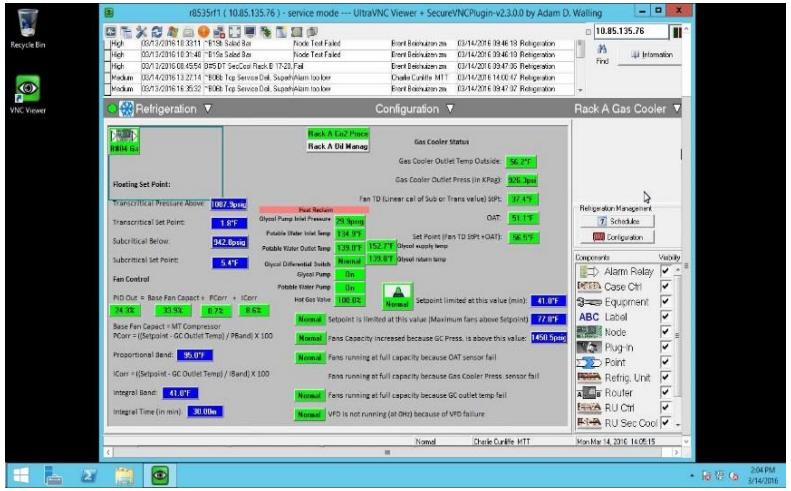
MICRO THERMO ALLIANCE

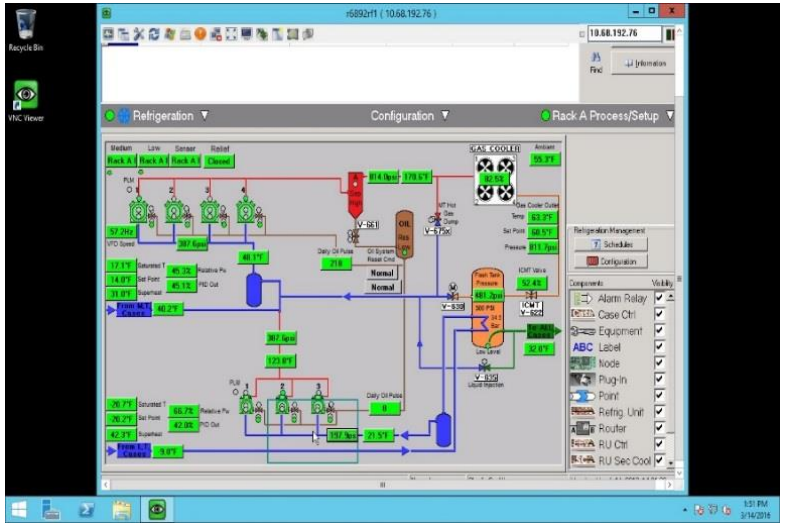
Subsystem Access











MICRO THERMO ALLIANCE

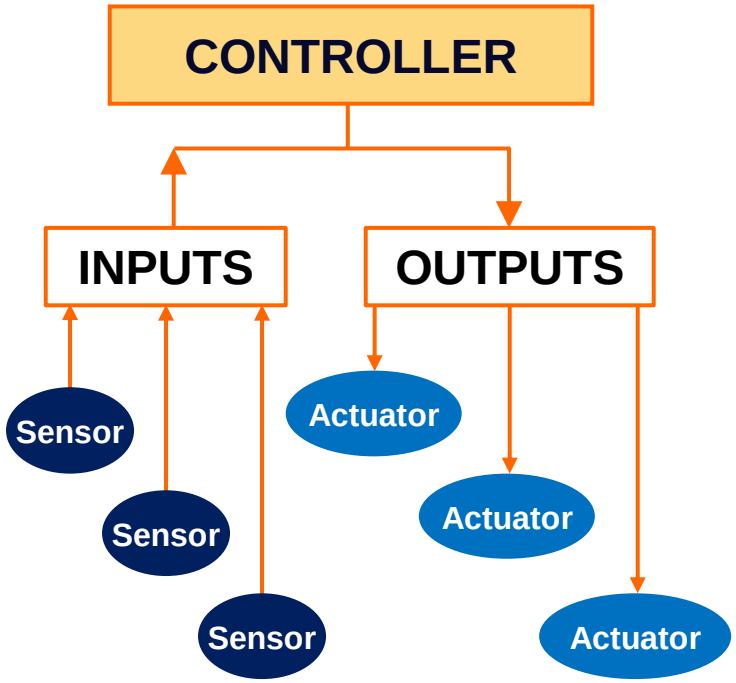
The Power of Information

- ✓ **Intelligent Distributed Control**
- ✓ **Intuitive Windows® based graphical user interface**
- ✓ **Up to 8 Workstations per store**
- ✓ **History retains system data up to 5 years**
- ✓ **CO2 control, both Transcritical & Subcritical; 300+ North America installations in last 8 years**
- ✓ **Integrated subsystems managed through an integrated front-end**
- ✓ **Colorful visual indicators enable facility management at-a-glance**
- ✓ **Customizable icons and templates make set-up and commissioning easy**
- ✓ **Open standard LonWorks communications - free topology**

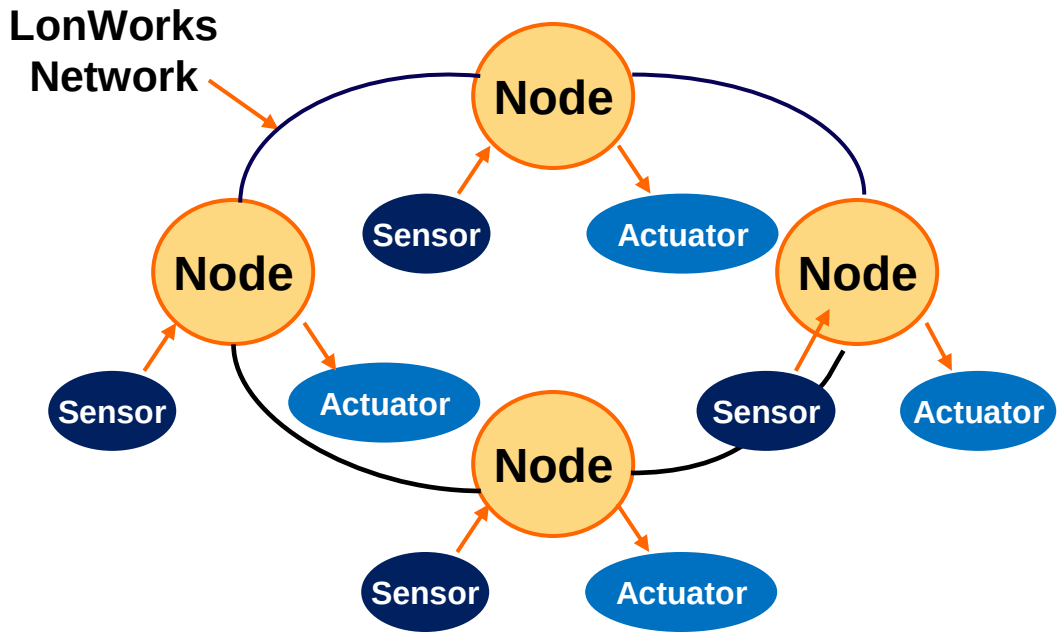
MICRO THERMO ALLIANCE

Distributed Control

CENTRALIZED CONTROL



DISTRIBUTED INTELLIGENT CONTROL

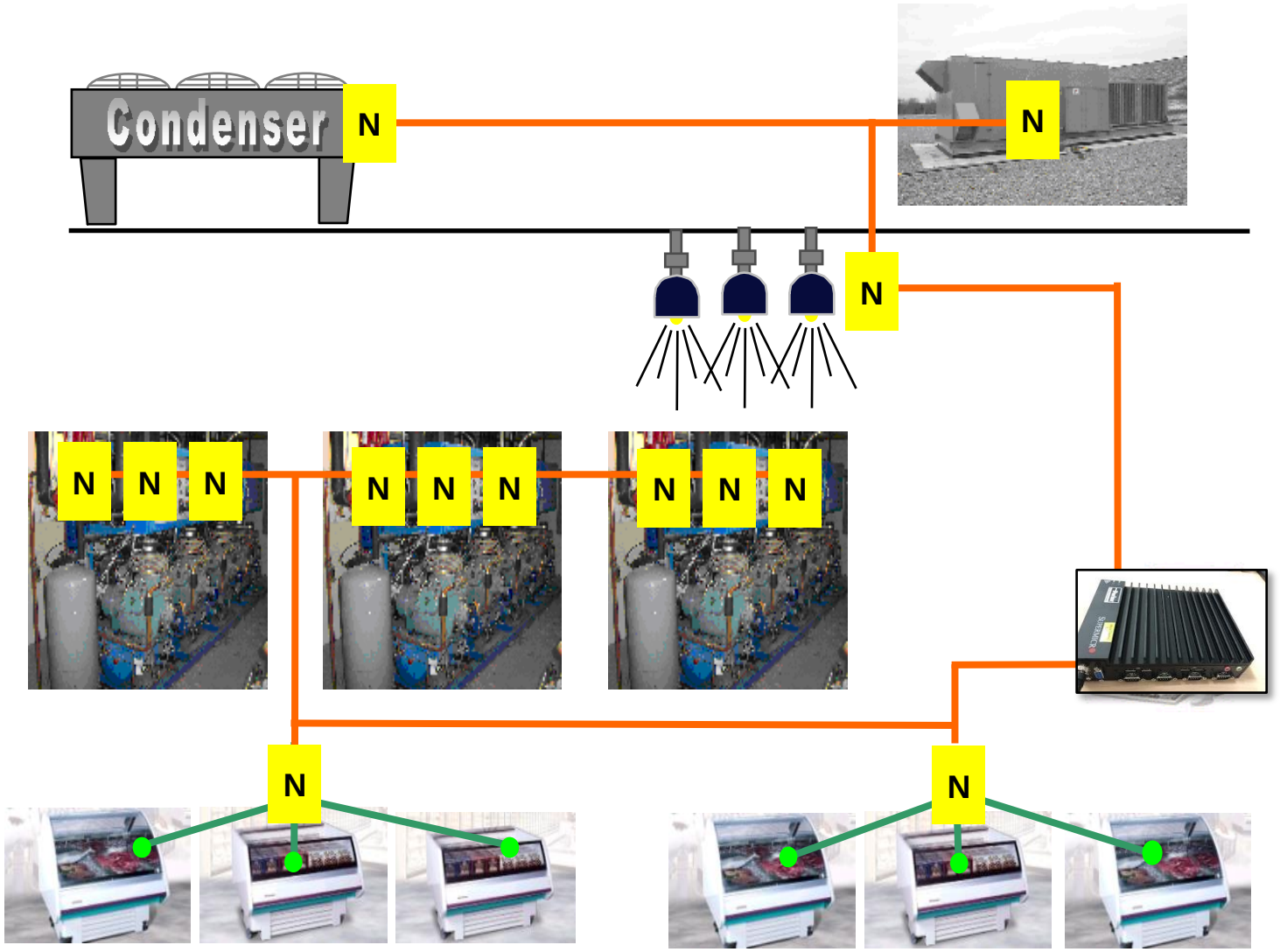


Open and flexible

Distributed Control System

MICRO THERMO DISTRIBUTED NETWORK

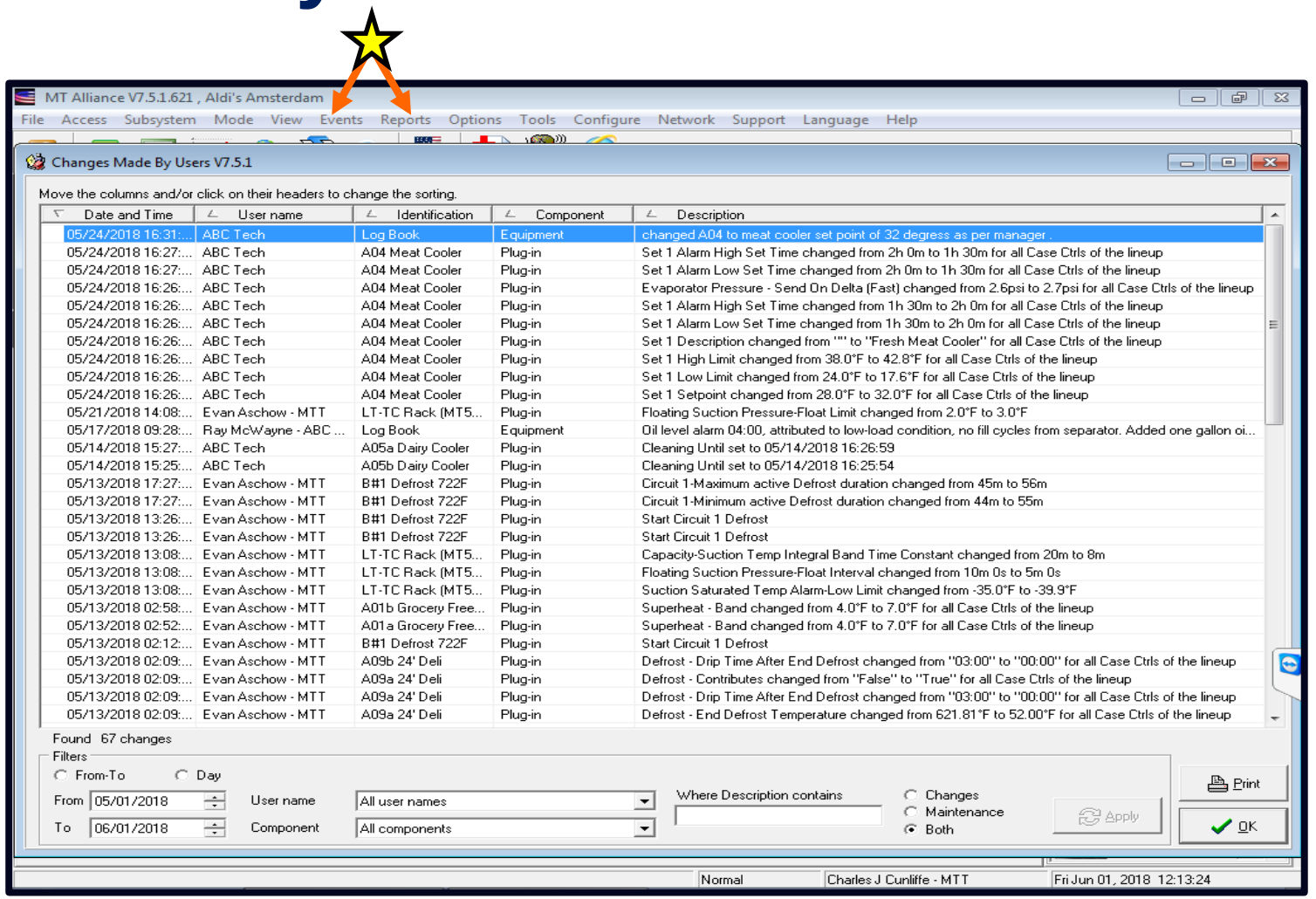
- *Simplified system integration*
- *Intelligent LonWorks* ***Smart Nodes***
- *Open LonWorks network*
- *Simplified wiring*
- *Simplified 3rd Party Integration*



ALLIANCE
On-Board Tools & Reports

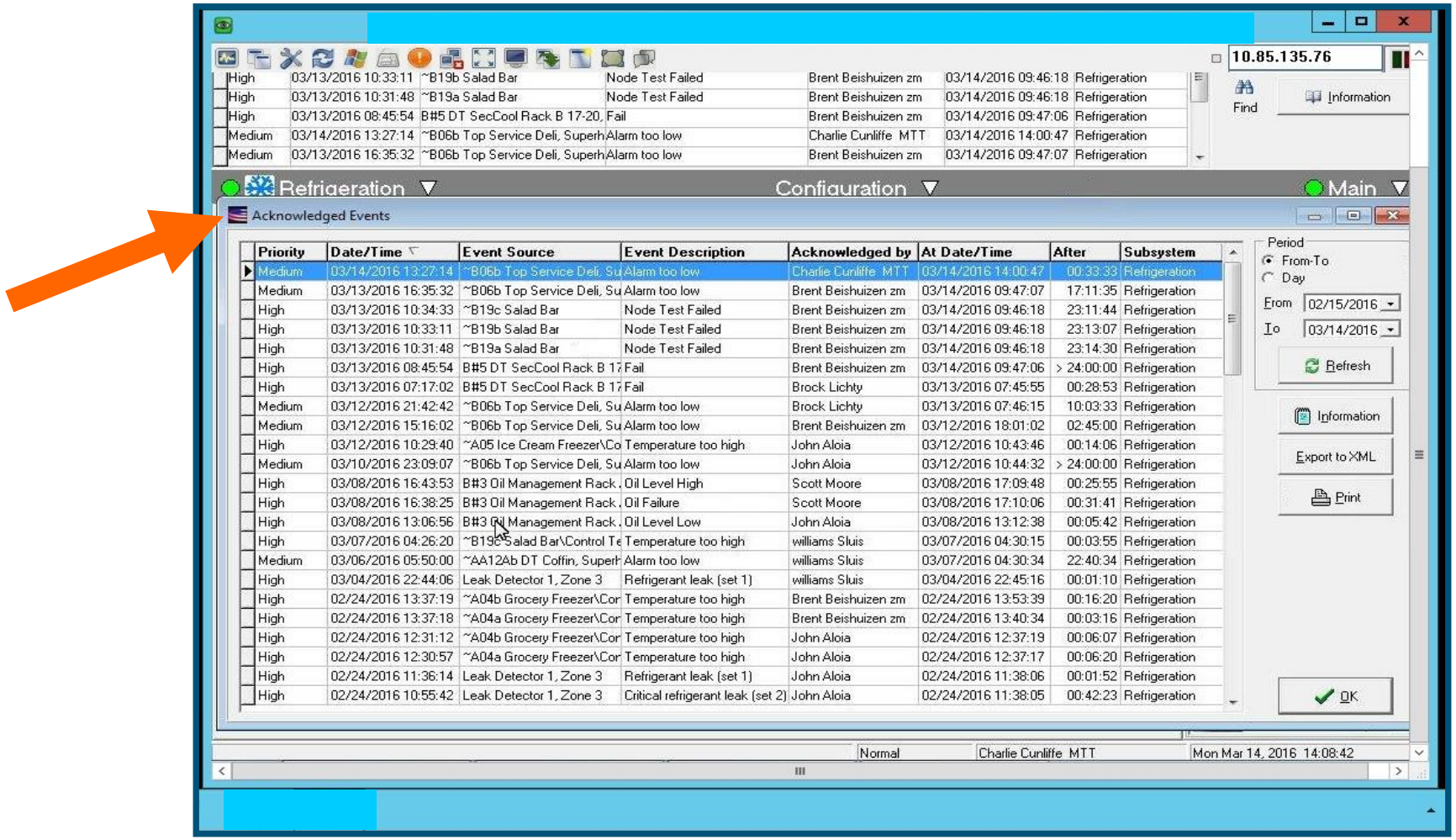
FACILITY MANAGEMENT

Changes Made by Users

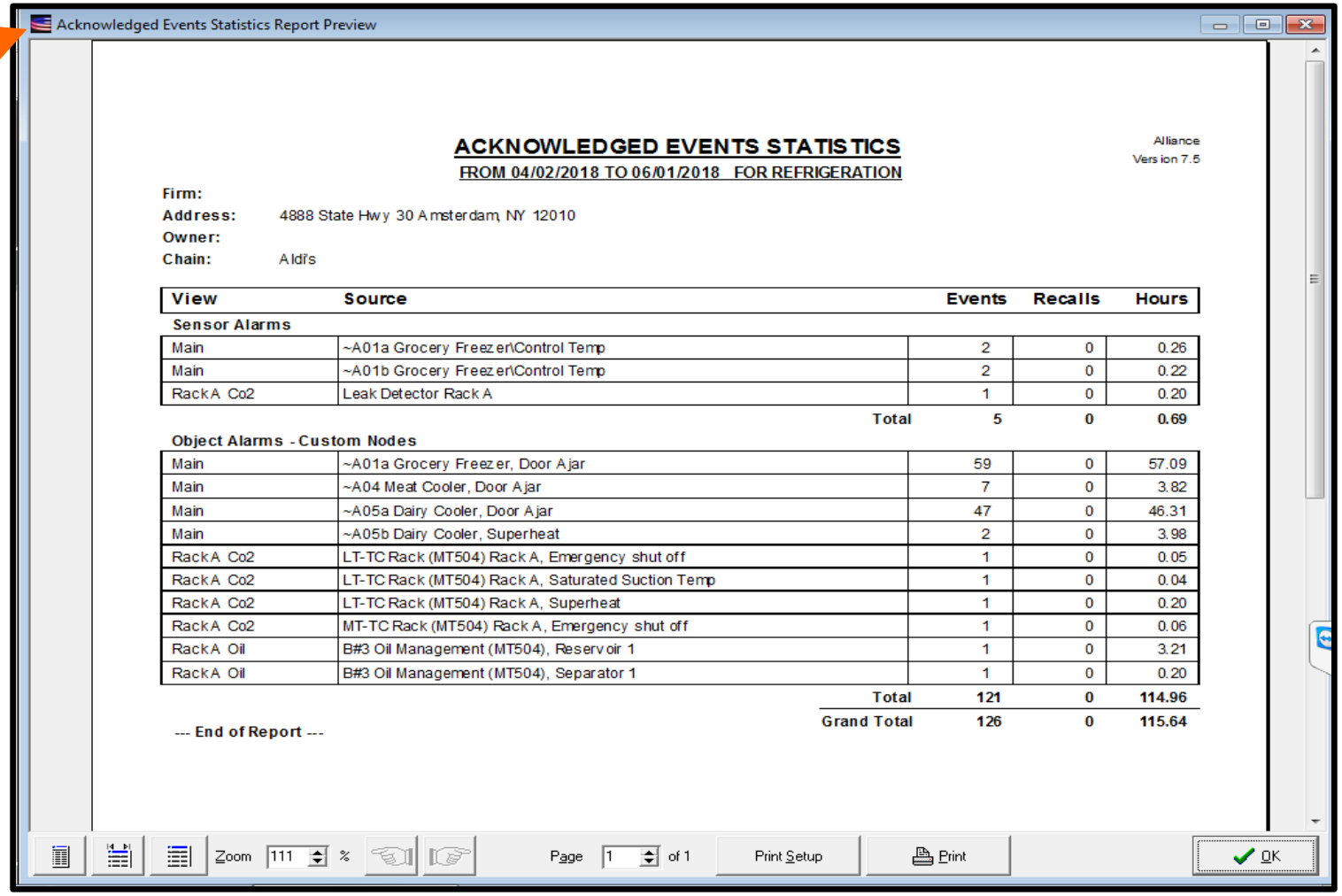


FACILITY MANAGEMENT

Acknowledged Events



Acknowledged Events Statistics



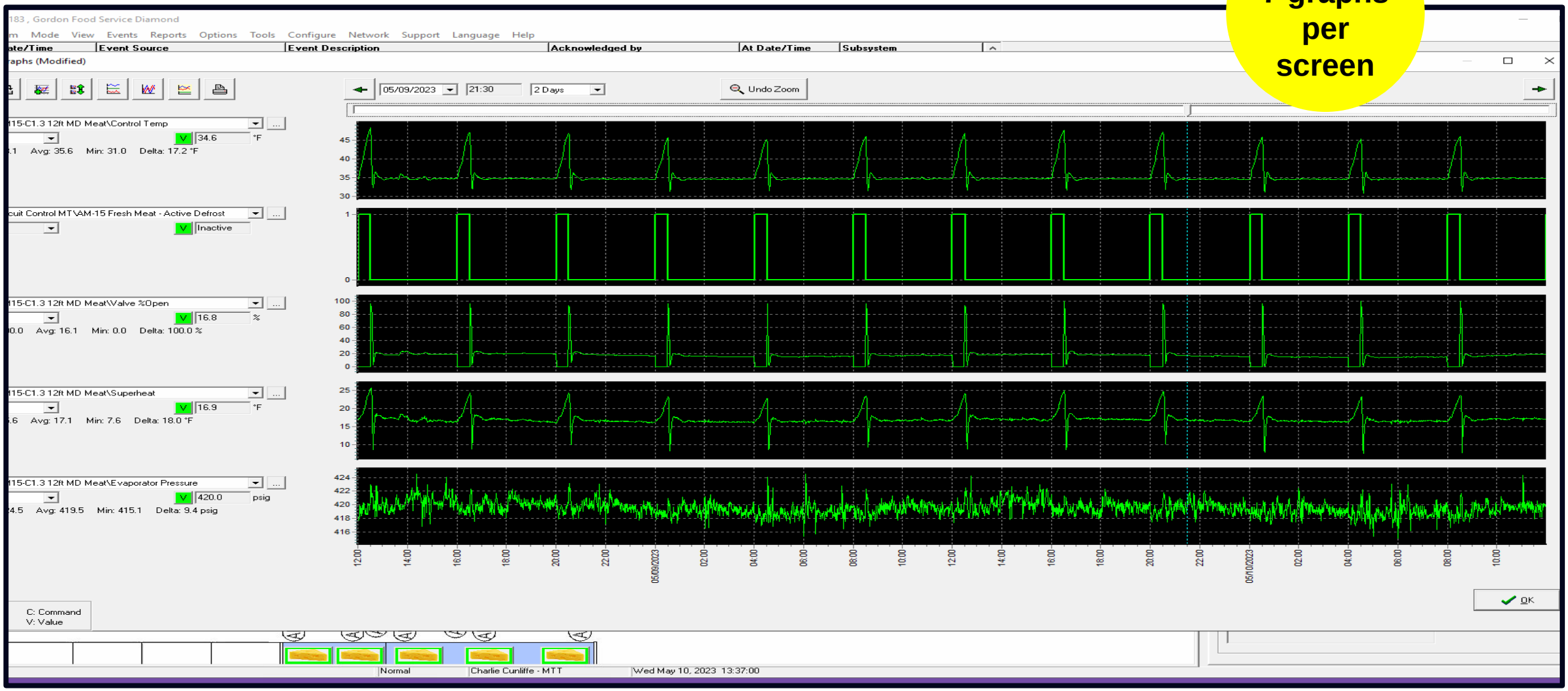
View	Source	Events	Recalls	Hours
Sensor Alarms				
Main	~A01a Grocery Freezer\Control Temp	2	0	0.26
Main	~A01b Grocery Freezer\Control Temp	2	0	0.22
Rack A Co2	Leak Detector Rack A	1	0	0.20
	Total	**5**	**0**	**0.69**
Object Alarms - Custom Nodes				
Main	~A01a Grocery Freezer, Door Ajar	59	0	57.09
Main	~A04 Meat Cooler, Door Ajar	7	0	3.82
Main	~A05a Dairy Cooler, Door Ajar	47	0	46.31
Main	~A05b Dairy Cooler, Superheat	2	0	3.98
Rack A Co2	LT-TC Rack (MT504) Rack A, Emergency shut off	1	0	0.05
Rack A Co2	LT-TC Rack (MT504) Rack A, Saturated Suction Temp	1	0	0.04
Rack A Co2	LT-TC Rack (MT504) Rack A, Superheat	1	0	0.20
Rack A Co2	MT-TC Rack (MT504) Rack A, Emergency shut off	1	0	0.06
Rack A Oil	B#3 Oil Management (MT504), Reservoir 1	1	0	3.21
Rack A Oil	B#3 Oil Management (MT504), Separator 1	1	0	0.20
	Total	**121**	**0**	**114.96**
	Grand Total	**126**	**0**	**115.64**

--- End of Report ---

FACILITY MANAGEMENT

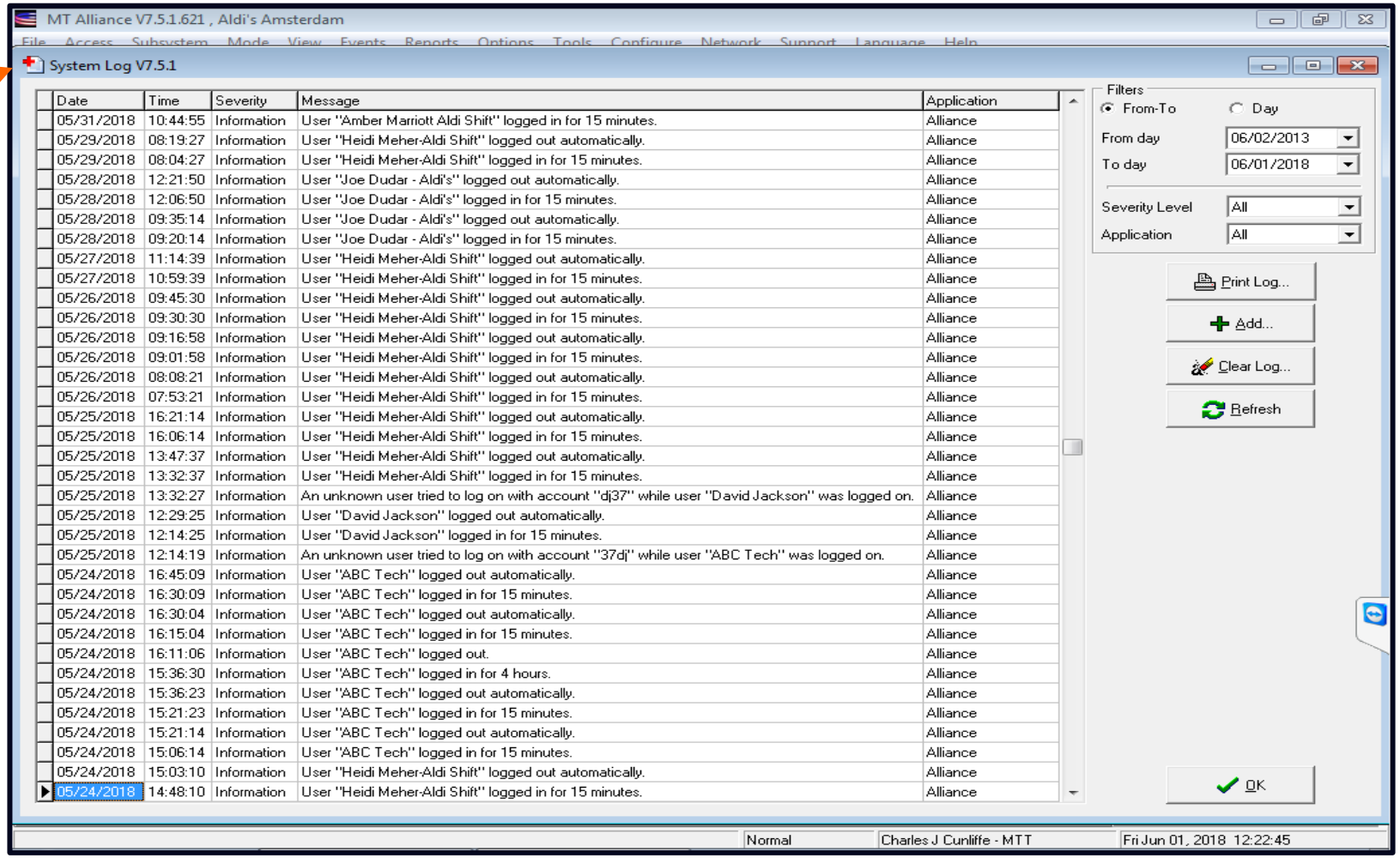
Trend Graphs

Max. 7 graphs per screen



FACILITY MANAGEMENT

System Log (Operating System)

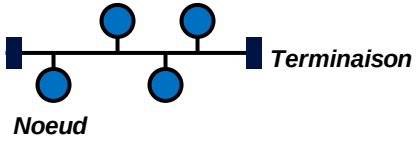


Date	Time	Severity	Message	Application
05/31/2018	10:44:55	Information	User "Amber Marriott Aldi Shift" logged in for 15 minutes.	Alliance
05/29/2018	08:19:27	Information	User "Heidi Meher-Aldi Shift" logged out automatically.	Alliance
05/29/2018	08:04:27	Information	User "Heidi Meher-Aldi Shift" logged in for 15 minutes.	Alliance
05/28/2018	12:21:50	Information	User "Joe Dudar - Aldi's" logged out automatically.	Alliance
05/28/2018	12:06:50	Information	User "Joe Dudar - Aldi's" logged in for 15 minutes.	Alliance
05/28/2018	09:35:14	Information	User "Joe Dudar - Aldi's" logged out automatically.	Alliance
05/28/2018	09:20:14	Information	User "Joe Dudar - Aldi's" logged in for 15 minutes.	Alliance
05/27/2018	11:14:39	Information	User "Heidi Meher-Aldi Shift" logged out automatically.	Alliance
05/27/2018	10:59:39	Information	User "Heidi Meher-Aldi Shift" logged in for 15 minutes.	Alliance
05/26/2018	09:45:30	Information	User "Heidi Meher-Aldi Shift" logged out automatically.	Alliance
05/26/2018	09:30:30	Information	User "Heidi Meher-Aldi Shift" logged in for 15 minutes.	Alliance
05/26/2018	09:16:58	Information	User "Heidi Meher-Aldi Shift" logged out automatically.	Alliance
05/26/2018	09:01:58	Information	User "Heidi Meher-Aldi Shift" logged in for 15 minutes.	Alliance
05/26/2018	08:08:21	Information	User "Heidi Meher-Aldi Shift" logged out automatically.	Alliance
05/26/2018	07:53:21	Information	User "Heidi Meher-Aldi Shift" logged in for 15 minutes.	Alliance
05/25/2018	16:21:14	Information	User "Heidi Meher-Aldi Shift" logged out automatically.	Alliance
05/25/2018	16:06:14	Information	User "Heidi Meher-Aldi Shift" logged in for 15 minutes.	Alliance
05/25/2018	13:47:37	Information	User "Heidi Meher-Aldi Shift" logged out automatically.	Alliance
05/25/2018	13:32:37	Information	User "Heidi Meher-Aldi Shift" logged in for 15 minutes.	Alliance
05/25/2018	13:32:27	Information	An unknown user tried to log on with account "dj37" while user "David Jackson" was logged on.	Alliance
05/25/2018	12:29:25	Information	User "David Jackson" logged out automatically.	Alliance
05/25/2018	12:14:25	Information	User "David Jackson" logged in for 15 minutes.	Alliance
05/25/2018	12:14:19	Information	An unknown user tried to log on with account "37dj" while user "ABC Tech" was logged on.	Alliance
05/24/2018	16:45:09	Information	User "ABC Tech" logged out automatically.	Alliance
05/24/2018	16:30:09	Information	User "ABC Tech" logged in for 15 minutes.	Alliance
05/24/2018	16:30:04	Information	User "ABC Tech" logged out automatically.	Alliance
05/24/2018	16:15:04	Information	User "ABC Tech" logged in for 15 minutes.	Alliance
05/24/2018	16:11:06	Information	User "ABC Tech" logged out.	Alliance
05/24/2018	15:36:30	Information	User "ABC Tech" logged in for 4 hours.	Alliance
05/24/2018	15:36:23	Information	User "ABC Tech" logged out automatically.	Alliance
05/24/2018	15:21:23	Information	User "ABC Tech" logged in for 15 minutes.	Alliance
05/24/2018	15:21:14	Information	User "ABC Tech" logged out automatically.	Alliance
05/24/2018	15:06:14	Information	User "ABC Tech" logged in for 15 minutes.	Alliance
05/24/2018	15:03:10	Information	User "Heidi Meher-Aldi Shift" logged out automatically.	Alliance
05/24/2018	14:48:10	Information	User "Heidi Meher-Aldi Shift" logged in for 15 minutes.	Alliance

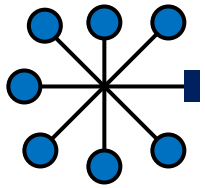
ALLIANCE
Echelon Network

Network Topologies & Transceivers

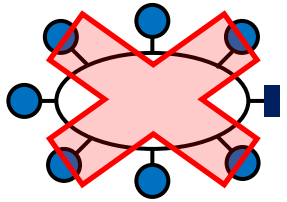
Bus



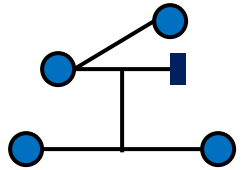
Star



Loop



Free



Types	Speed	Topology	Nodes	Distance
TPT/XF1250	1.25 Mbps	Bus	64	500 Meters
FTT-10	78 Kbps	Bus	64	2200 Meters
FTT-10	78 Kbps	Free & Star	64	500 Meters
Radio	19.5Kbps	RF		50 Meters
PLT-21	5 Kbps			

MICRO THERMO ALLIANCE

Echelon Communication Cable

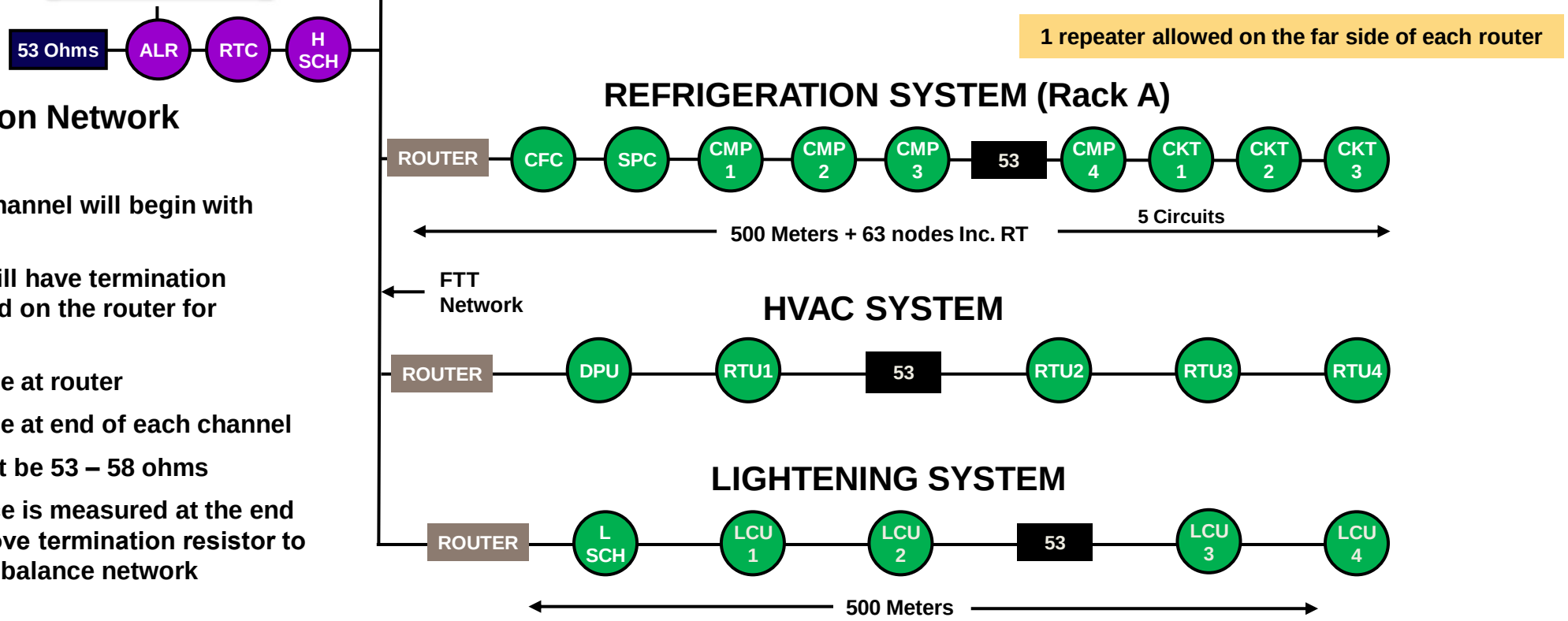
2 Wire Twisted Pair, NO Shield

- **BELDEN - #16 8471**
  - *Use for main Echelon communication drop for each channel home run to Data Logger*
- **BELDEN - #16 8471**
  - *Use for Node to Node Communication within each Echelon Channel*

LARGE SUPERMARKETS

Network – Backbone and Channels

Total 315 Nodes
(Inc. PC & RTC)
2.5 Kilometers



Special Echelon Network Requirement

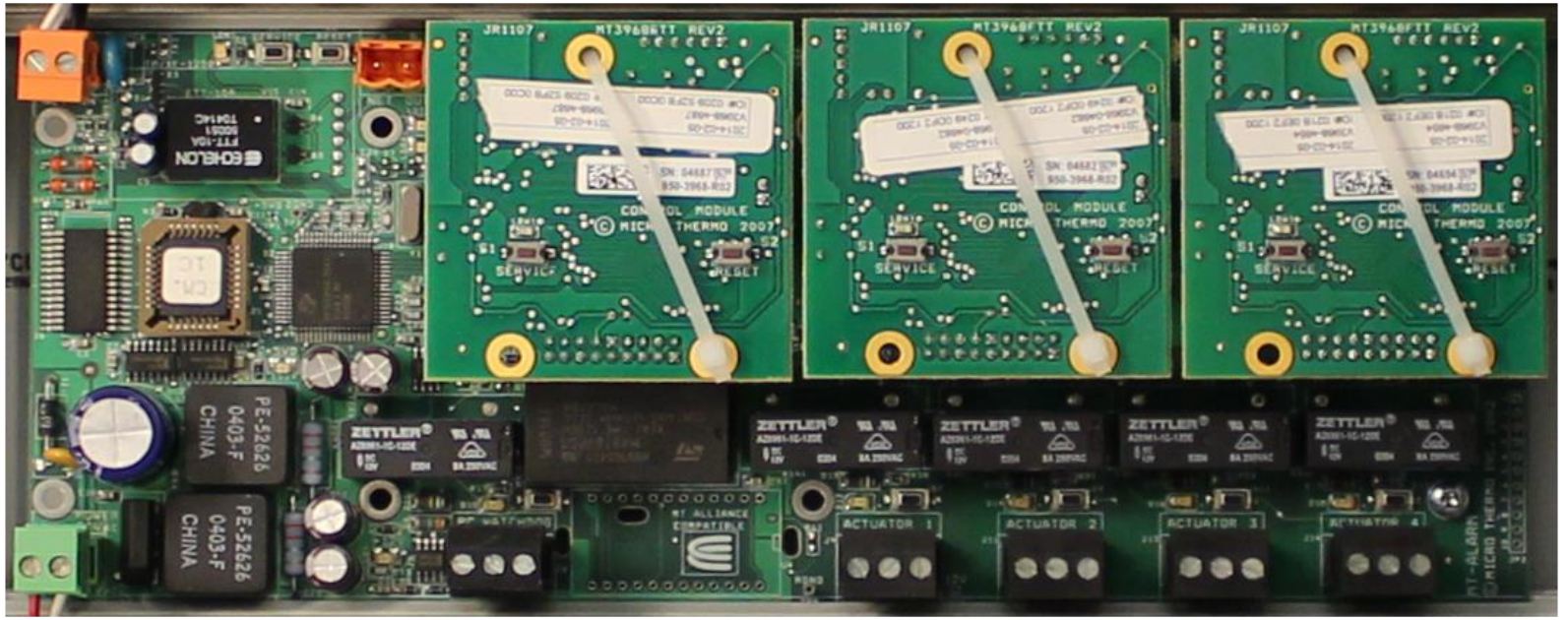
- Each network channel will begin with router/repeater
- Each channel will have termination resistor mounted on the router for shipping
- Check resistance at router
- Check resistance at end of each channel
- Resistance must be 53 – 58 ohms
- If high resistance is measured at the end of channel….move termination resistor to best location to balance network resistance

MICRO THERMO ALLIANCE

Industrial Computer

MICRO THERMO ALLIANCE

Backbone Components



MICRO THERMO ALLIANCE

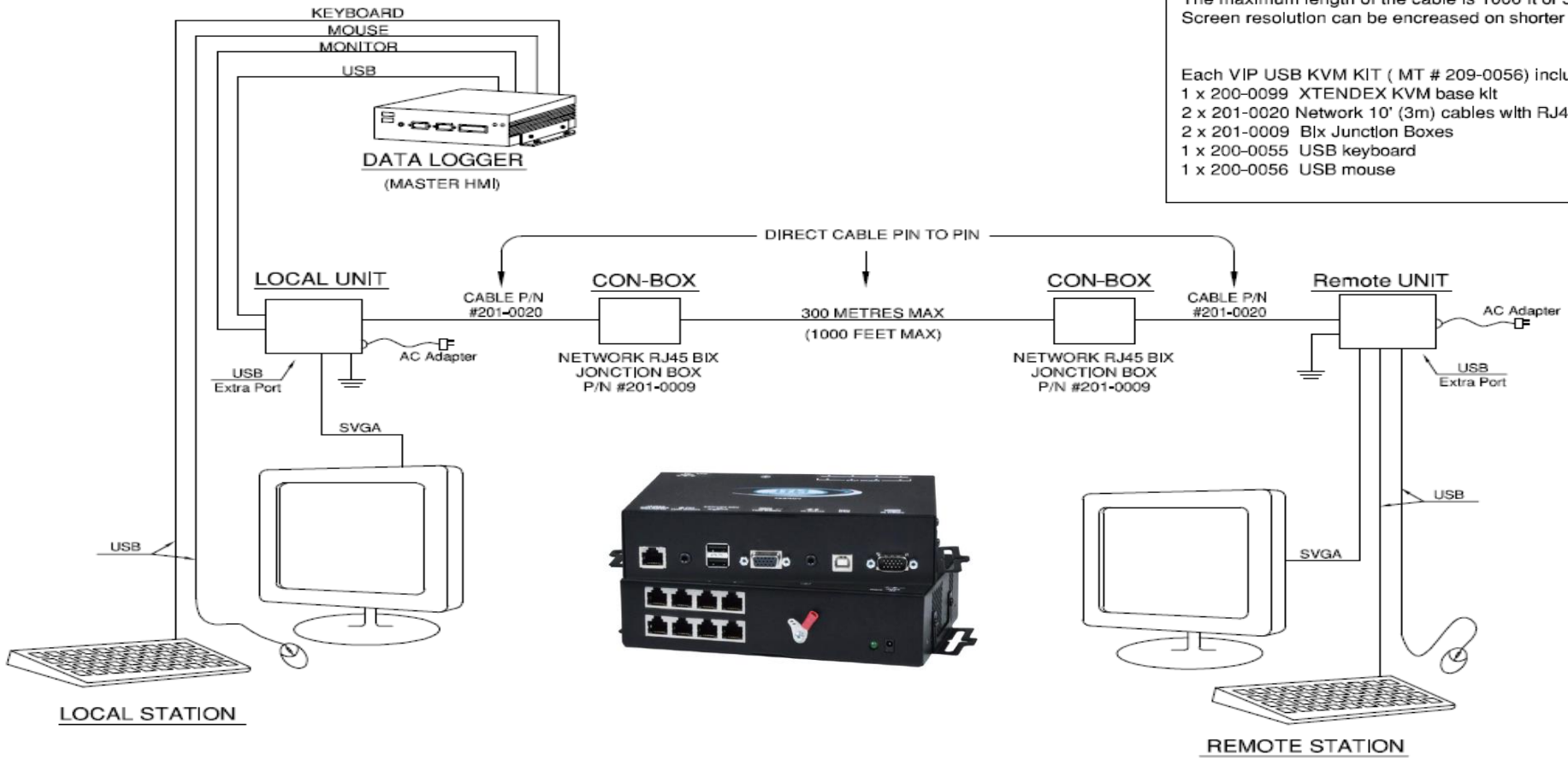
Industrial Computer with KVM

The XTENDEX (NTI) KVM base kit (MT # 200-0099) allows access to a computer system from an additional remote console (keyboard, monitor and mouse). It includes a local unit, a remote unit (URKVM),1cable kit and two power adapters.
This kit does not include the required additional cable, mouse, keyboard and monitor.

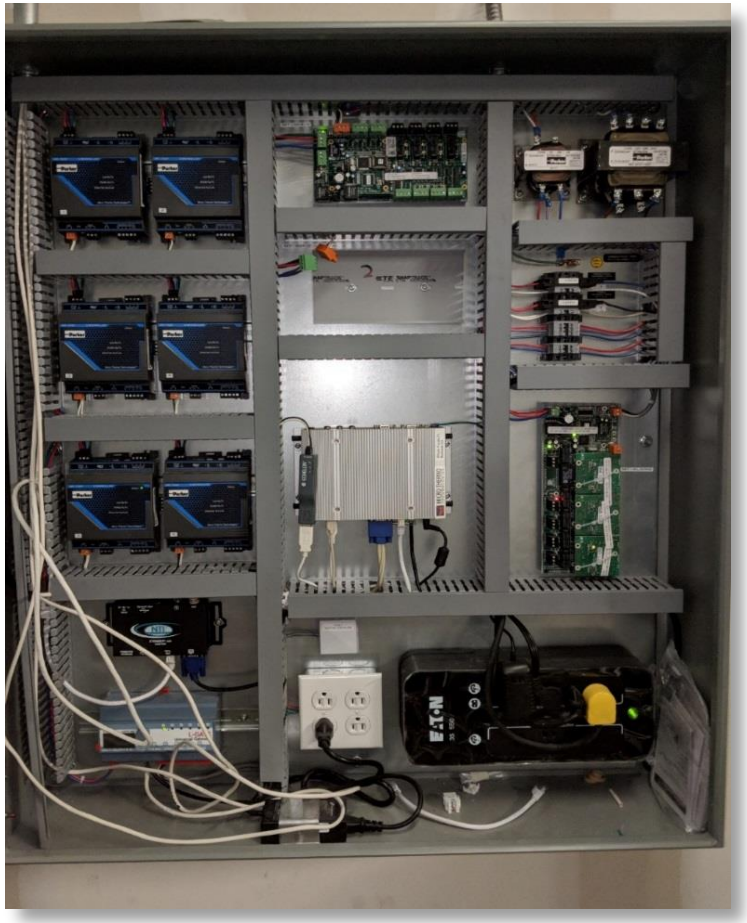
Cascading XTENDEX KVM is not possible. For multiple remote station use the 4 or 8 port local unit and remote unit sold separately.

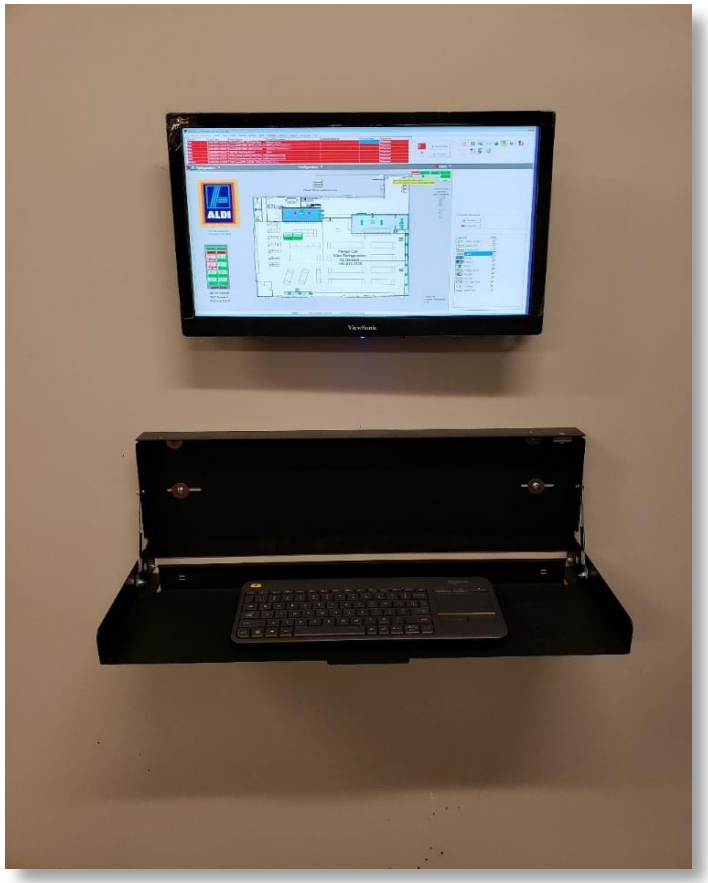
The cable used to interconnect the two control units must be of Category 5 UTP (MT # 600-0050). (4 pairs of wires connected to RJ45 connectors, pin to pin).
The maximum length of the cable is 1000 ft or 300 meters away.
Screen resolution can be encreased on shorter distance.

Each VIP USB KVM KIT (MT # 209-0056) includes the following :
1 x 200-0099 XTENDEX KVM base kit
2 x 201-0020 Network 10' (3m) cables with RJ45 connectors
2 x 201-0009 Bix Junction Boxes
1 x 200-0055 USB keyboard
1 x 200-0056 USB mouse



MICRO THERMO ALLIANCE





Application of ALLIANCE

MICRO THERMO ALLIANCE

Intelligent Refrigeration Controls

Suction Group Control

- **PID control for suction pressure**
- **Floating suction pressure**
- **Optimized algorithms for reducing compressor cycling**
- **Disregards faulty compressors in refrigeration control strategies**

Compressor Control

- **Fail-safe switch back**
- **Equalized Run Time**
- **Supports 2 un-loaders per compressor**
- **Supports VFD**
- **Digital Discus & Digital Scroll**
- **Inputs**
  - Safety Line Monitoring
  - Proof-of-running
  - Xproof-of-running

MICRO THERMO ALLIANCE

Intelligent Controllers

Condenser Control

- PID or Sequential Control
- Air Cooled or Evaporative
- Fixed or Variable Speed Fans
- VFD application
- Split Logic on Outdoor Temp, Heat Reclaim or both
- Automatic fail-safe
- Floating Head strategies adaptable

Circuit Control

- Controls refrigeration, defrost, off-time and drip cycle
- Integrated scheduler for each refrigeration circuits
- Defrost types supported :Hot Gas, Electric, Off Cycle, Pulse, Warm Fluid
- Defrost termination on time or temperature

MICRO THERMO ALLIANCE

Intelligent Controllers

HVAC

- **Controls a wide variety of HVAC units**
  RTU's, AHU's, DPU's, Make-up air, VAV's, Custom applications, connectivity to 3rd Party LON Devices
- **Humidity or Dew Point control**
- **Built-in Load Shed functions**
- **Heat Reclaim**
  - Reheat – Space Heat – Hot water
  - Monitored to prove application

MICRO THERMO ALLIANCE

Anti-Sweat Control

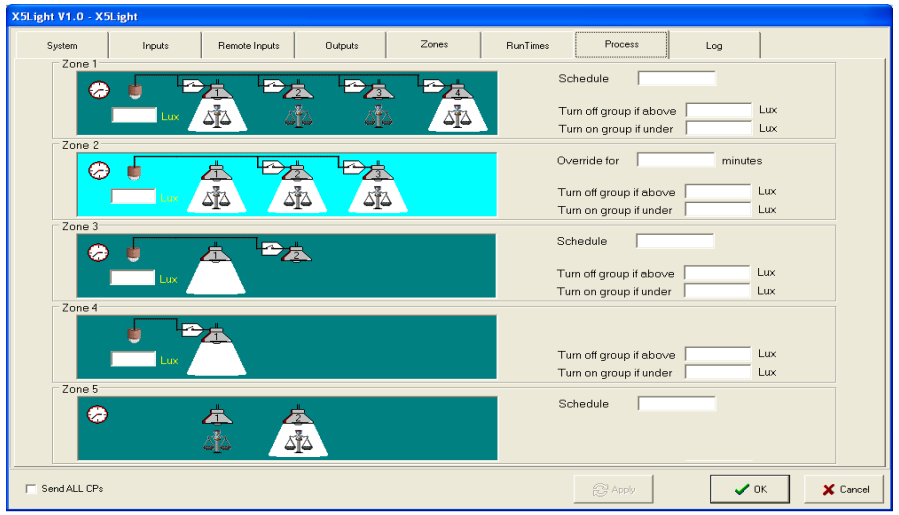
- **Modulation of anti-sweat heaters based on store Dew-point T° or RH%**
- **Built-in Load Shed functions**

MICRO THERMO ALLIANCE

Intelligent Controllers

Lighting

- **Controls a wide variety of applications**
  - Dimmable lighting
  - Daylight harvesting
  - Multiple zone controls
- **Corporate scheduling capabilities**
- **Built-in Load Shed functions**
- **Astronomical clock**



ALLIANCE
Smart Nodes – MT-700

MICRO THERMO

NEW MT-700 Smart Nodes

Customizable… adaptable …intelligent

- Each Smart-Train starts with MT-722G Brain
- Connect up to TEN additional Smart Nodes
- MT-784V
- MT-708R
- MT-748A
- MT-766A
- MT-716UI*

MICRO THERMO

Case Controller – MT-700 Series

- **Easily configurable from a Windows® based front end**
- **Optimized for CO2 Control**
- **Smart Fan Control**
- **True P/T Superheat Control**
- **Case Temperature Control**

MICRO THERMO

Case Controller

- **3 sets of temperature alarms**
  - Cumulative Alarm for improved food safety and reduced product shrinkage
- **Process model used with custom PID and intelligent algorithm**
  - Controls valve position based on evaporative load and predictive load along with smart fan control

MICRO THERMO ALLIANCE

Temperature Monitoring

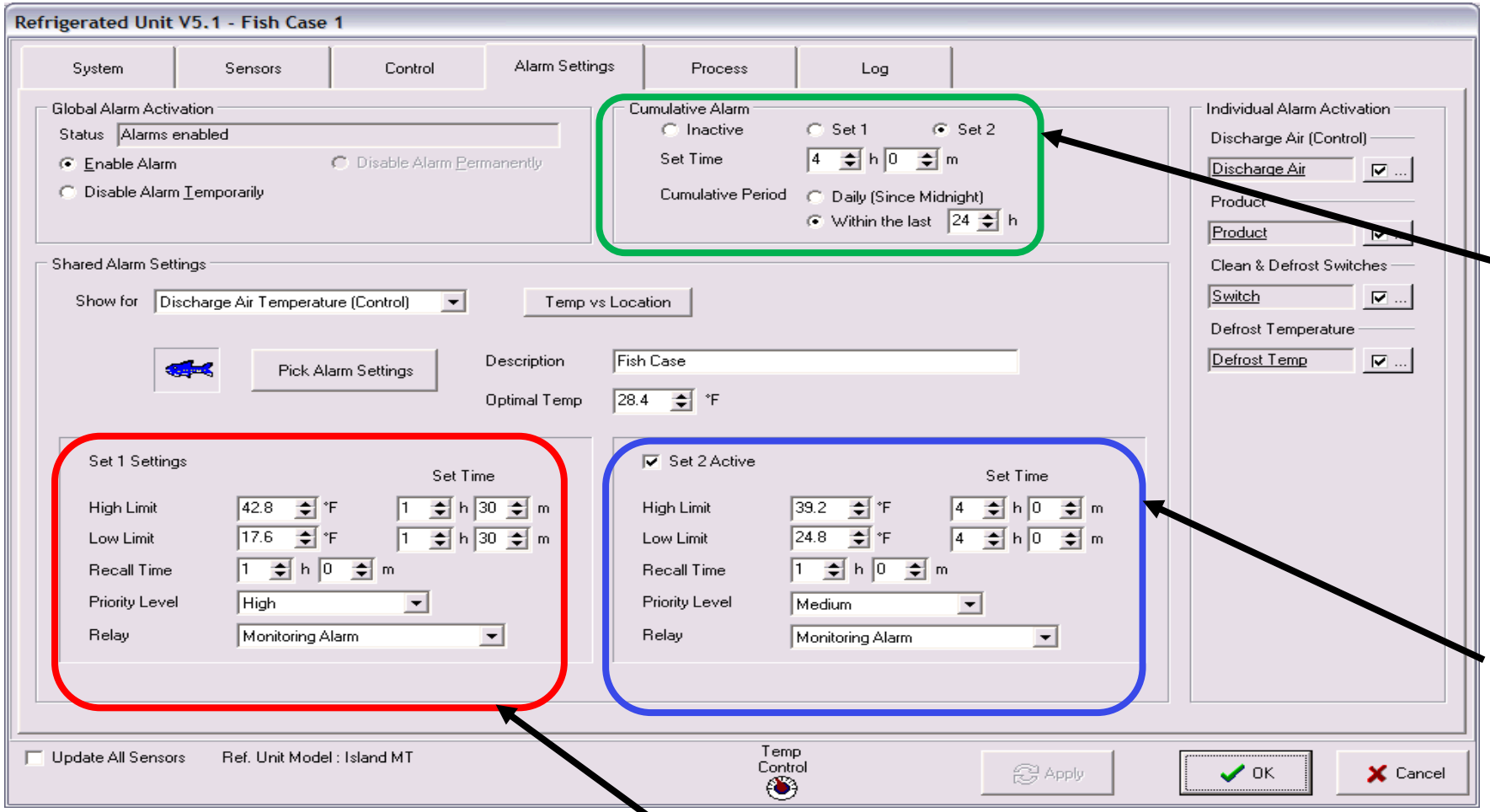
- **Case Tº Monitoring with alarm capabilities**
- **Multiple sets of alarms from one temperature input point**

SET 1 PRIMARY ALARM – Basic
- High and low set points
- User defined priority

SET 2 SECONDARY ALARM – Efficiency & Food Quality
- High and low set points
- User defined priority

SET 3 CUMULATIVE ALARM – Food Safety
- User defined alarm priority

Food Safety, Food Quality and Monitoring



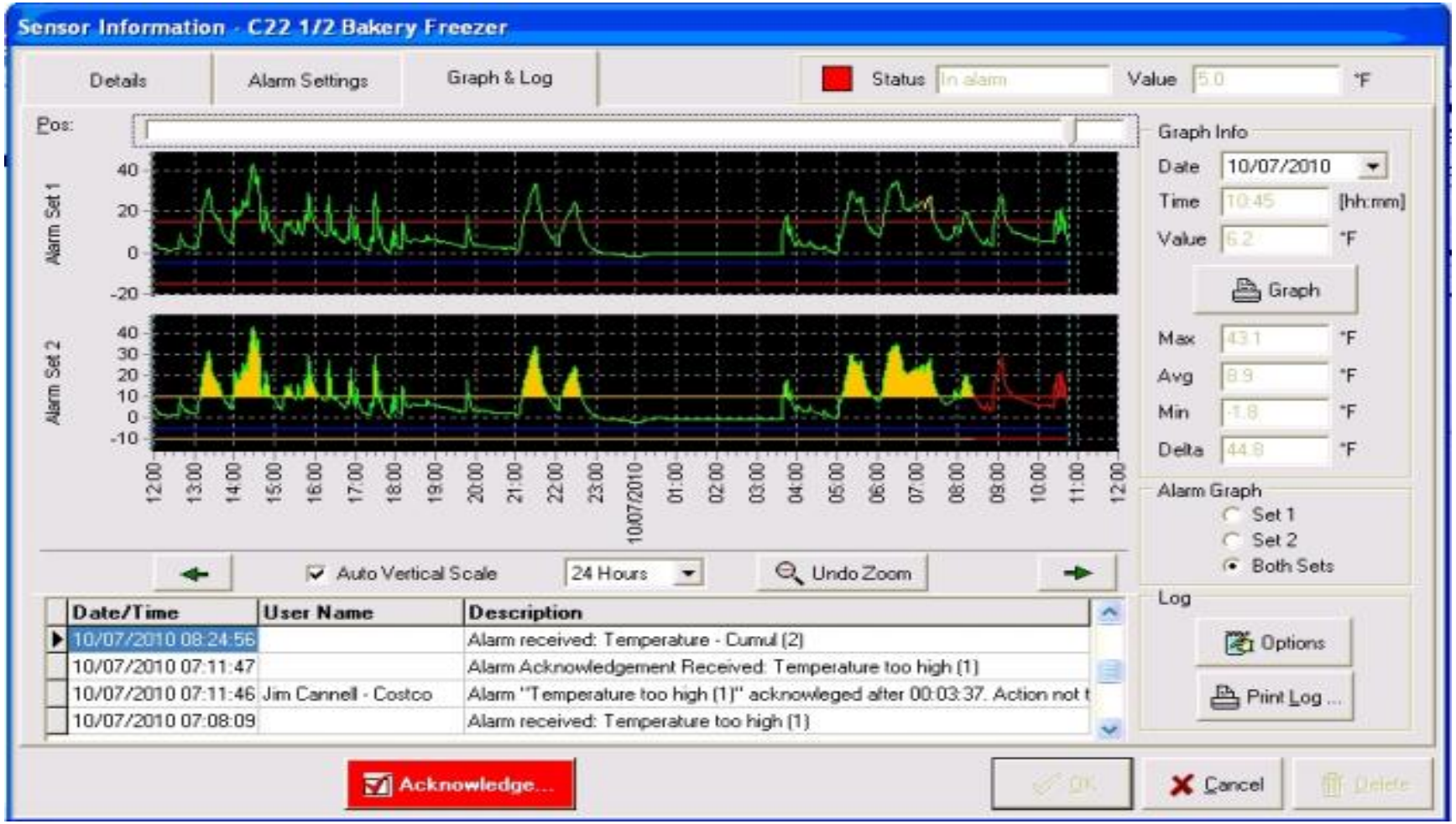
Food Safety with Cumulative Alarm function…

Food Quality and process efficiency with second set of alarm function…

Basic alarming and monitoring capabilities…

MICRO THERMO ALLIANCE

Food Safety



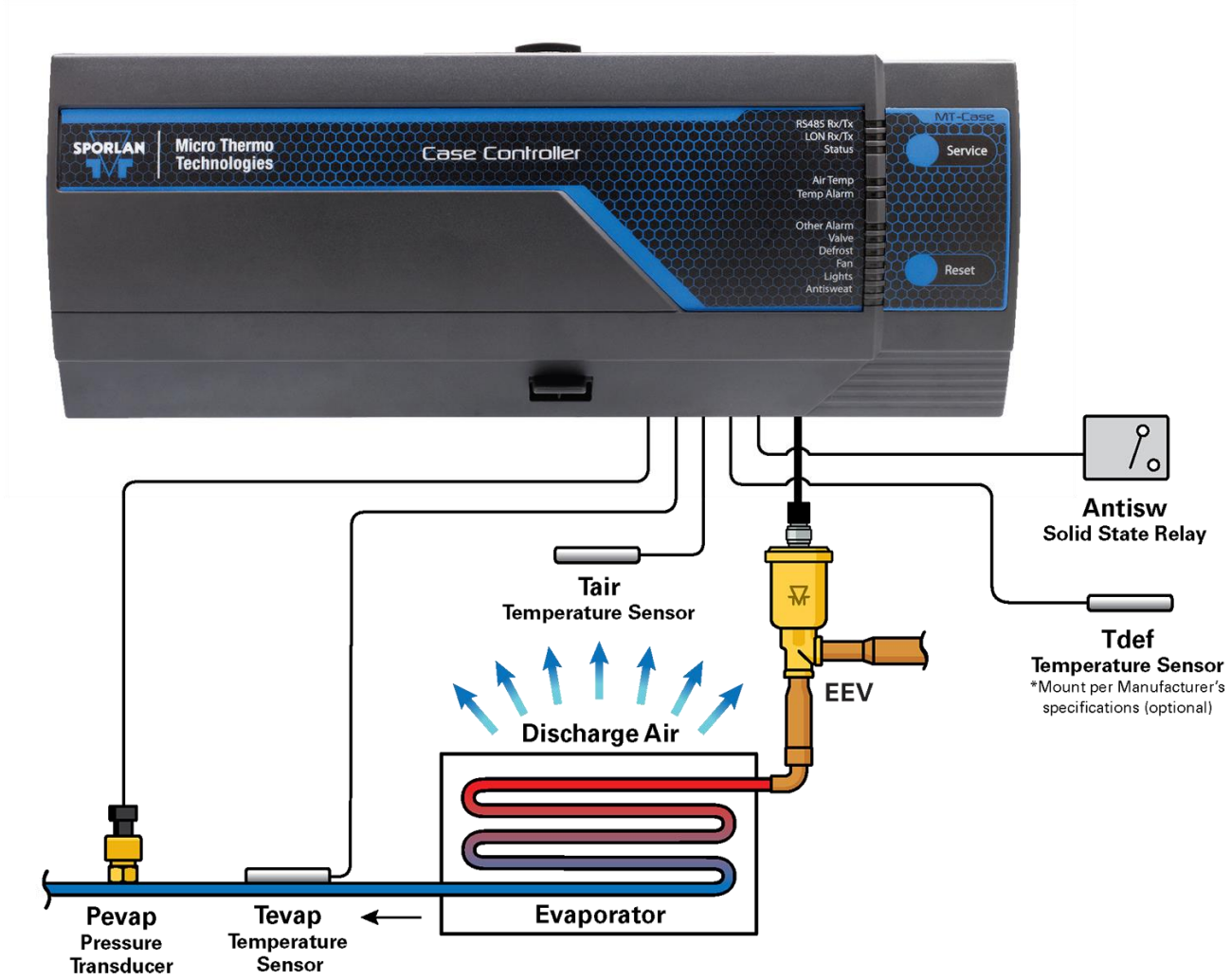
MICRO THERMO

Case Controller

- **Temperature Control with Superheat limit**
- **Superheat Control with temperature limit**
- **Superheat Control priority**
- **Temperature Control priority**
- **Fans – Lights – Anti-sweat – Defrost**

MICRO THERMO CASE CONTROLLER

System Schematic - Example



MICRO THERMO

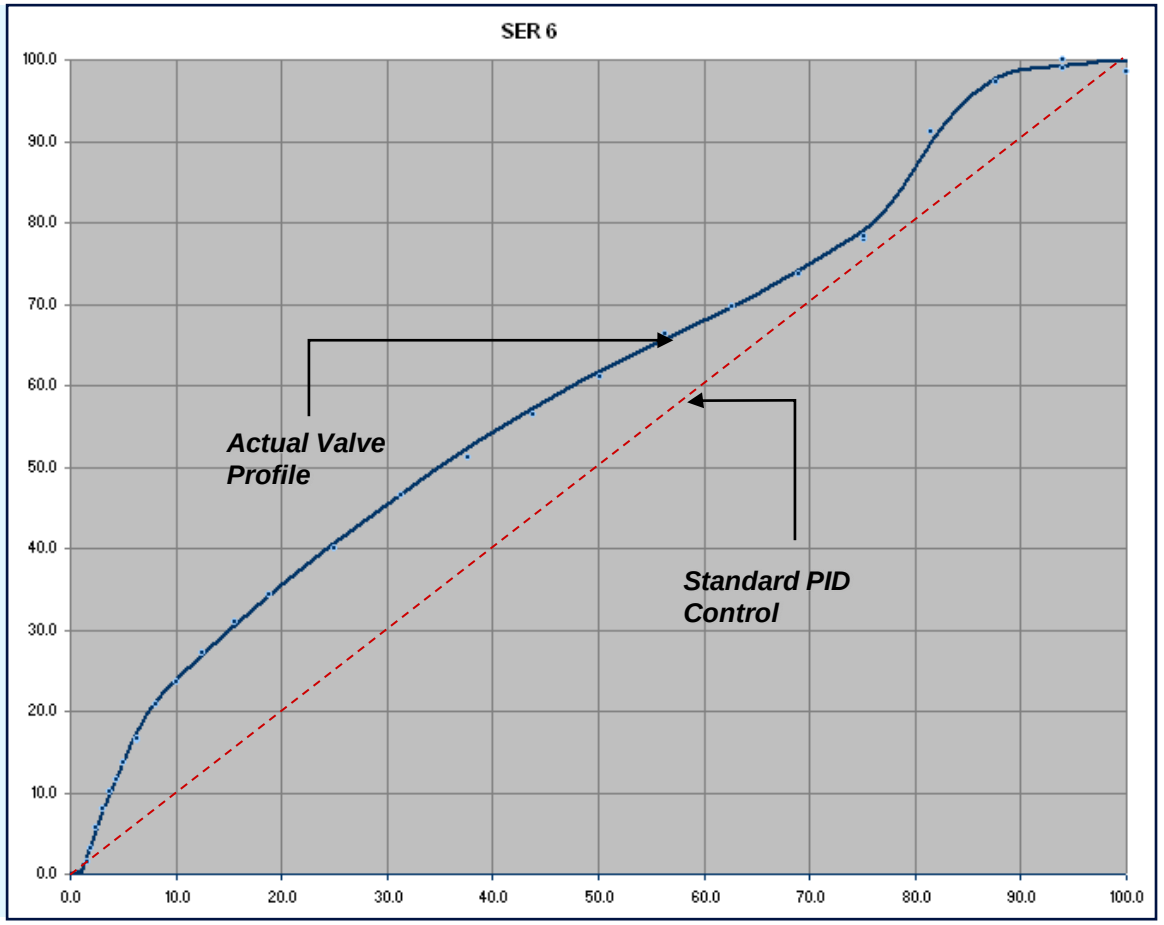
EEV Case Control

- ✓ Stepper or P W M valve
- ✓ Trend Graph Analysis
- ✓ Optimized for Fixture
- ✓ Optimized by Valve Type
- ✓ Base Value Correction
- ✓ Maximum % OPEN
- ✓ Pulldown Correction
- ✓ Delayed Opening After Defrost
- ✓ Liquid Temperature Correction
- ✓ Pressure Drop Correction
- ✓ Flow Direction Correction*…..axial…radial
- ✓ Ambient Correction

MICRO THERMO

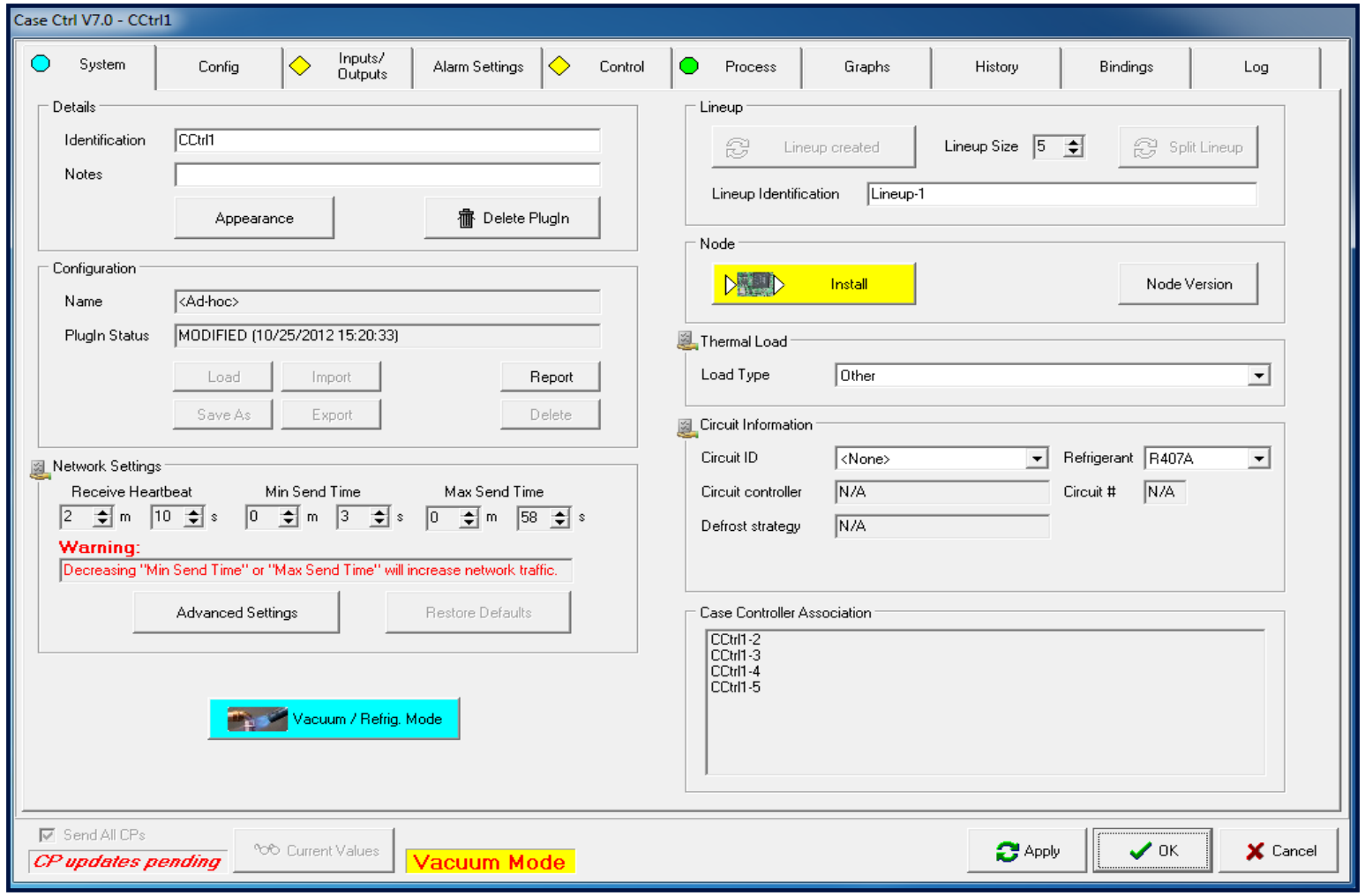
EEV Superheat Control

SER 1.5
SER 6
SER 11
SER 20
SER C
SER G
SER J
SER K
SEI 30
SEI 50
SEH 100
SEH 175



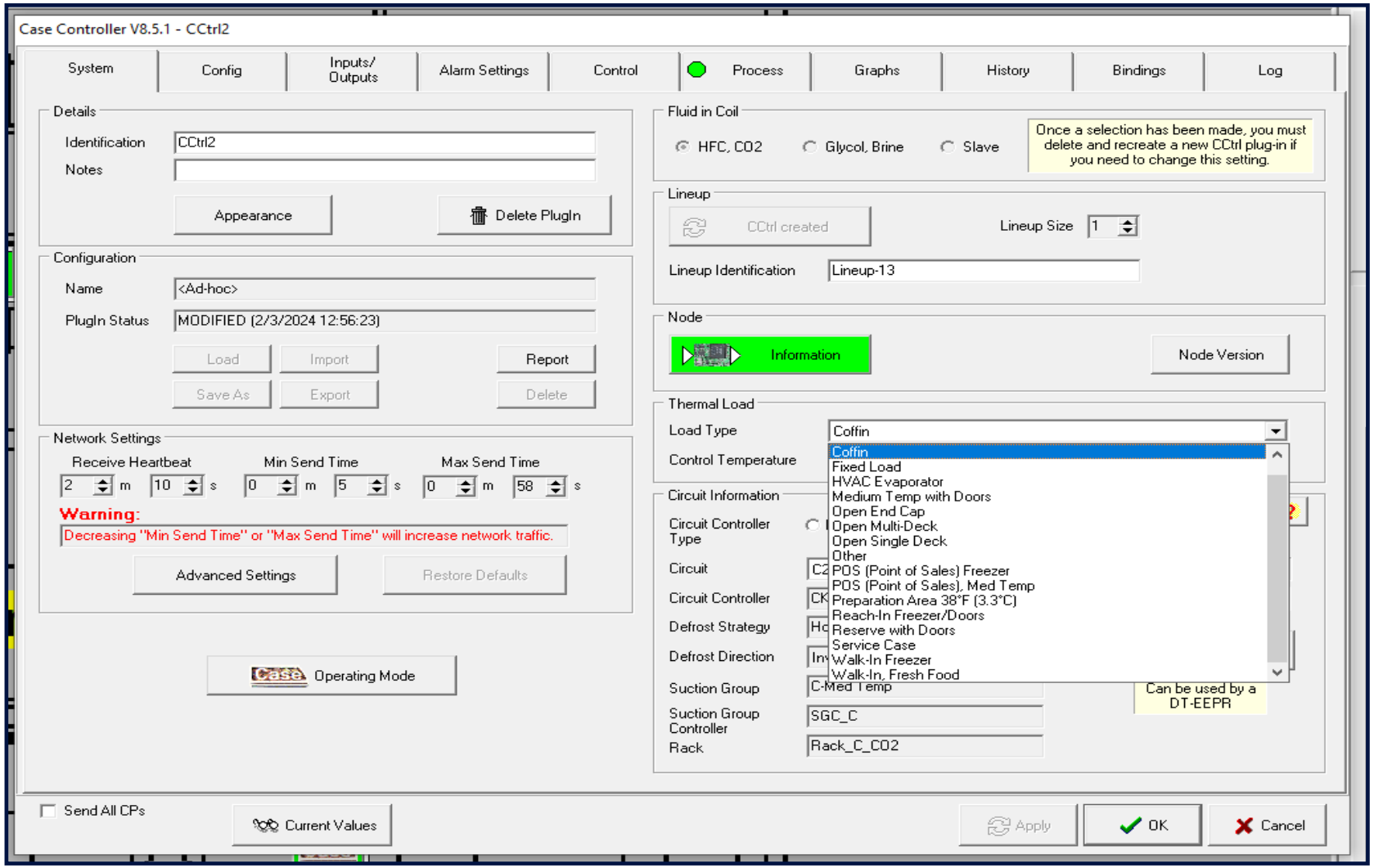
MICRO THERMO CASE CONTROLLER

System Tab



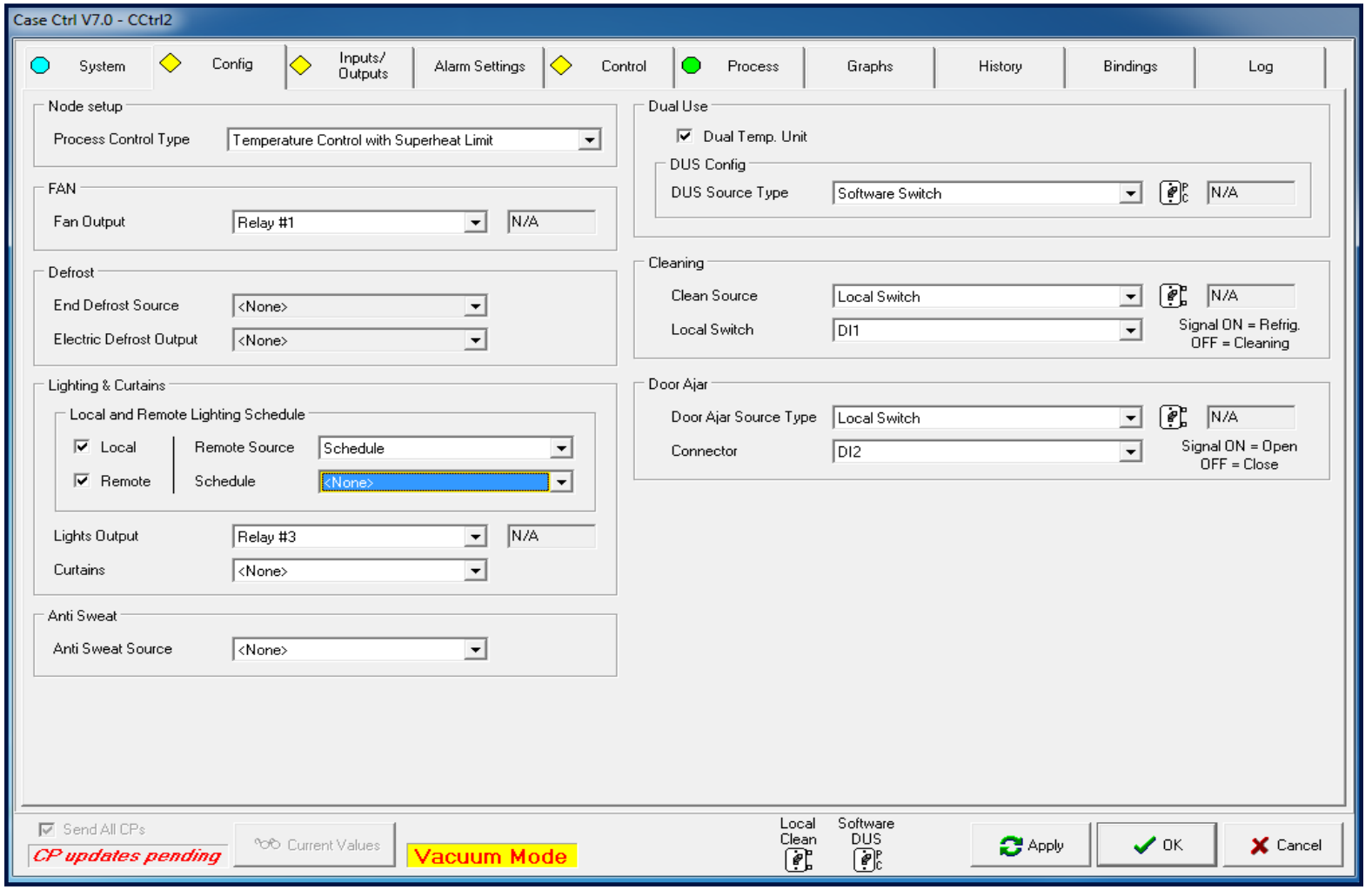
MICRO THERMO CASE CONTROLLER

System Tab – *LOAD TYPE*



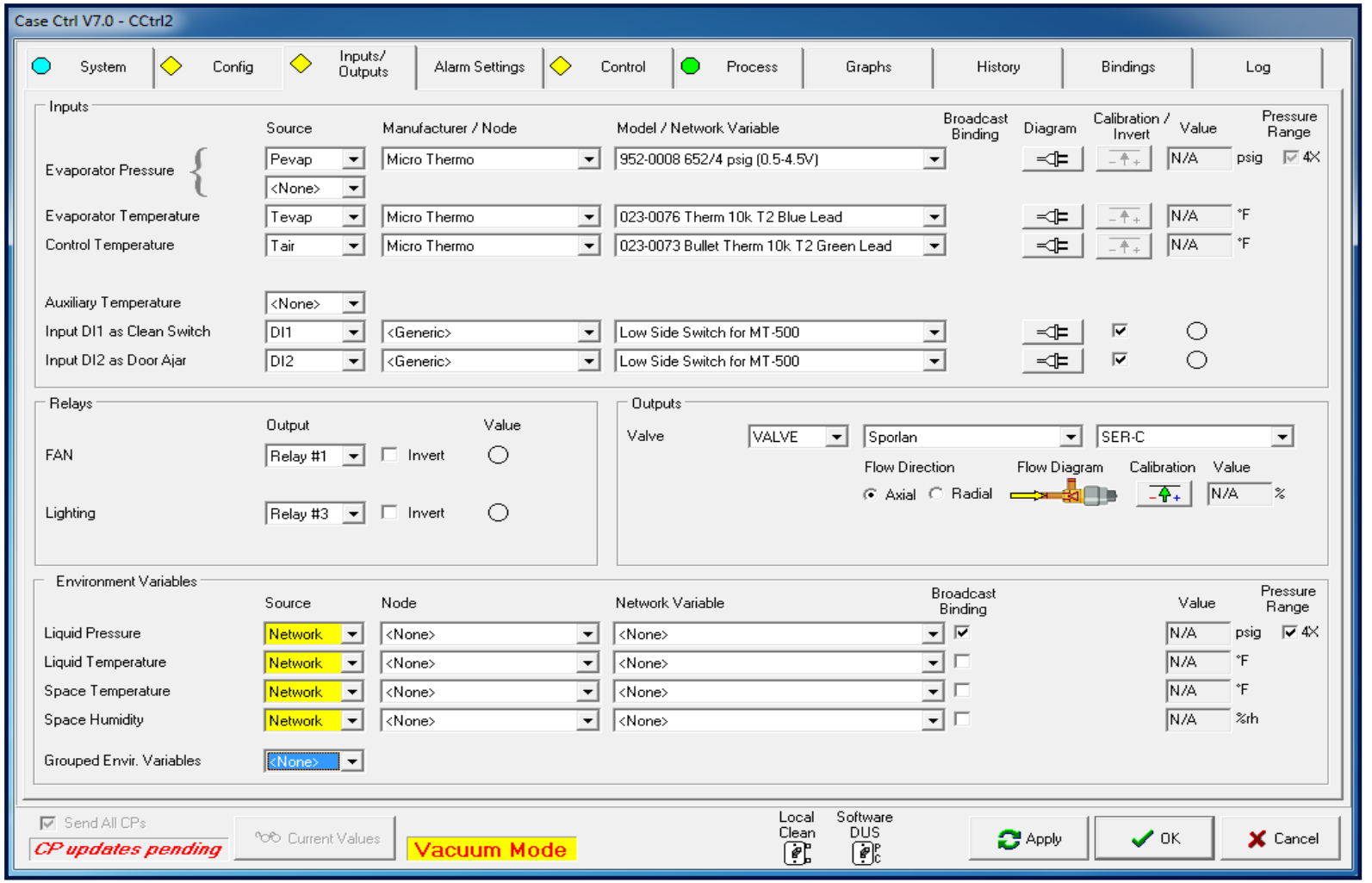
MICRO THERMO CASE CONTROLLER

Configuration Tab



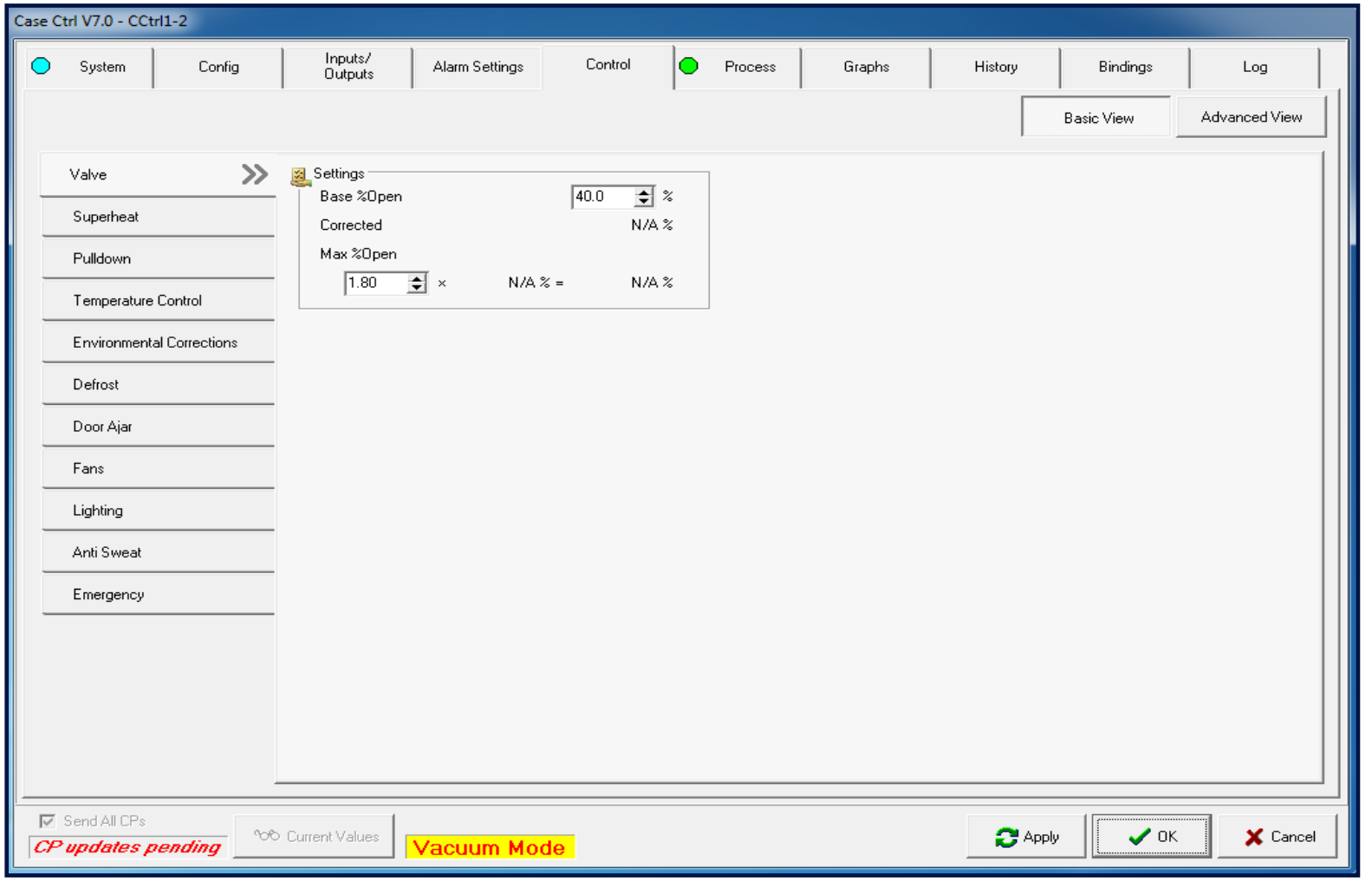
MICRO THERMO CASE CONTROLLER

Inputs / Outputs Tab



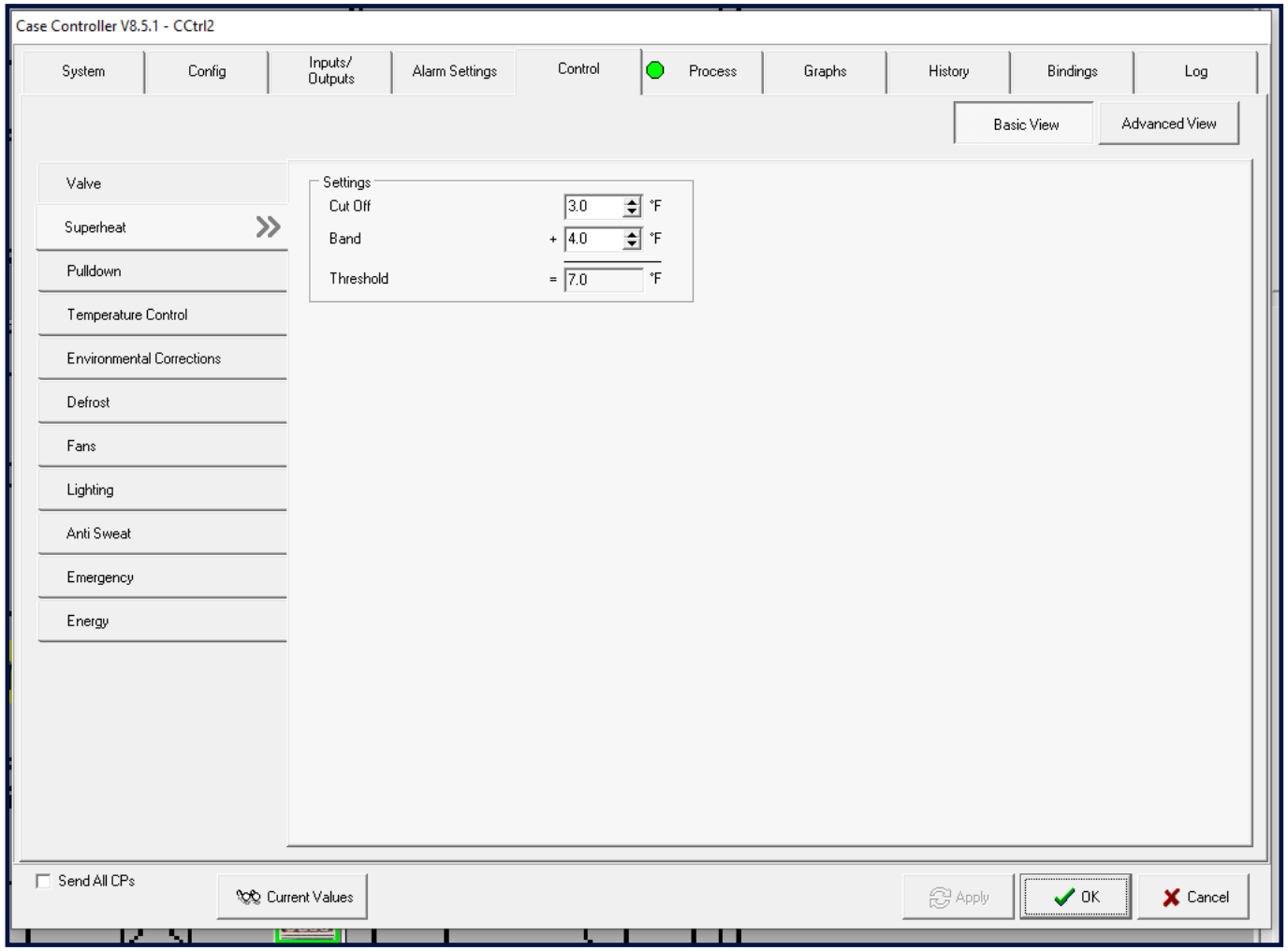
MICRO THERMO CASE CONTROLLER

Control Tab



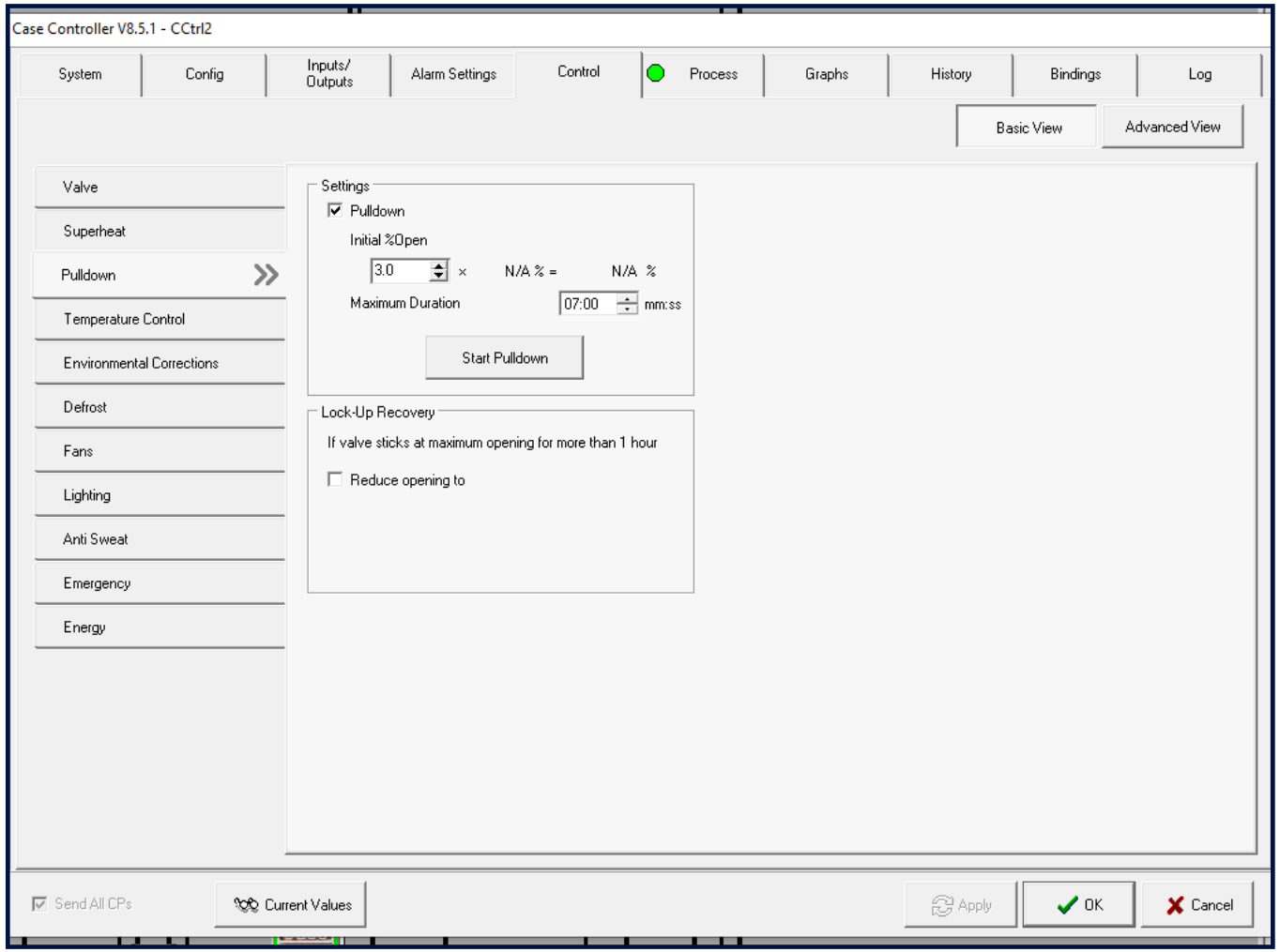
MICRO THERMO CASE CONTROLLER

Control Tab



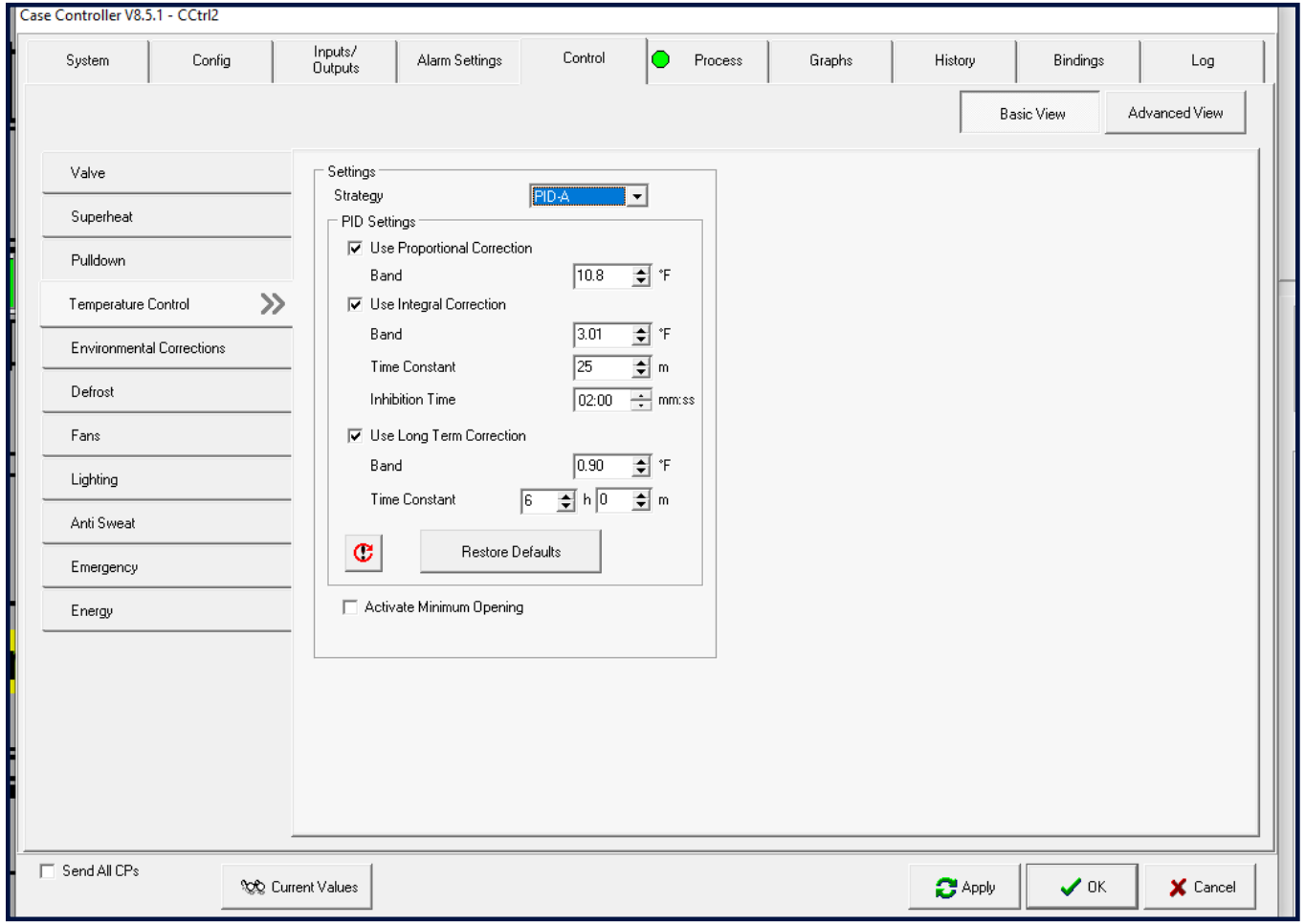
MICRO THERMO CASE CONTROLLER

Control Tab



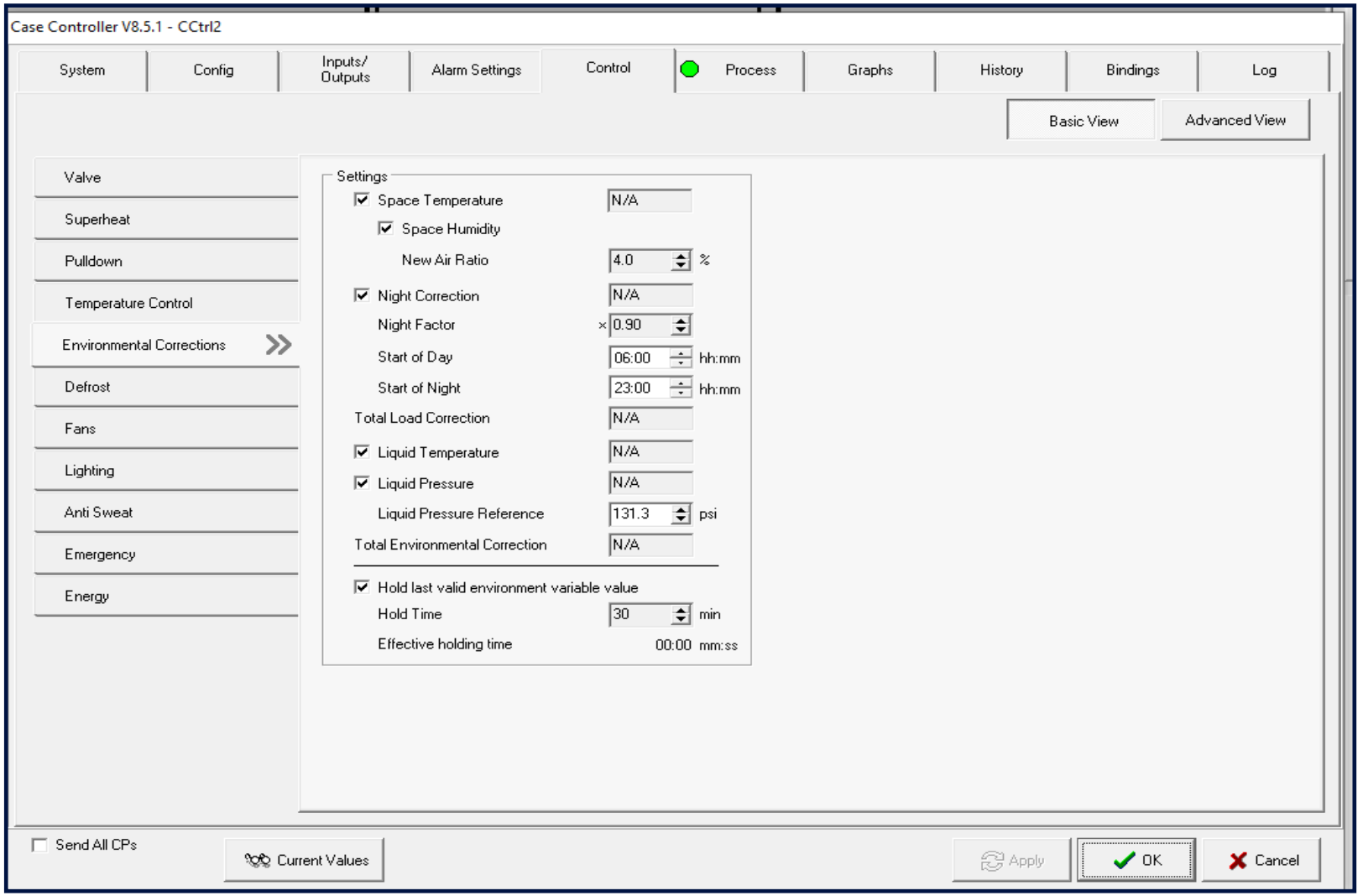
MICRO THERMO CASE CONTROLLER

Control Tab



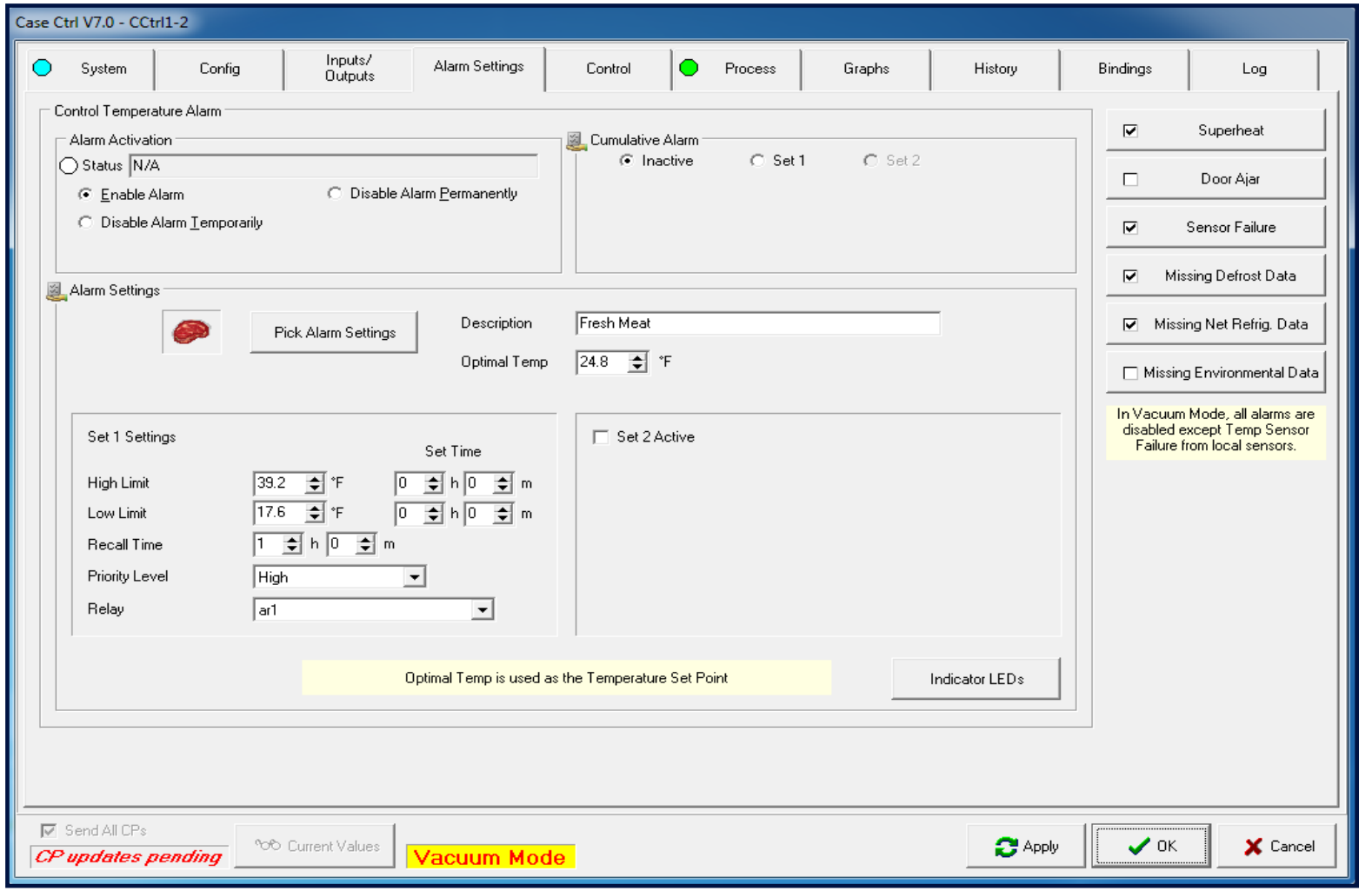
MICRO THERMO CASE CONTROLLER

Control Tab



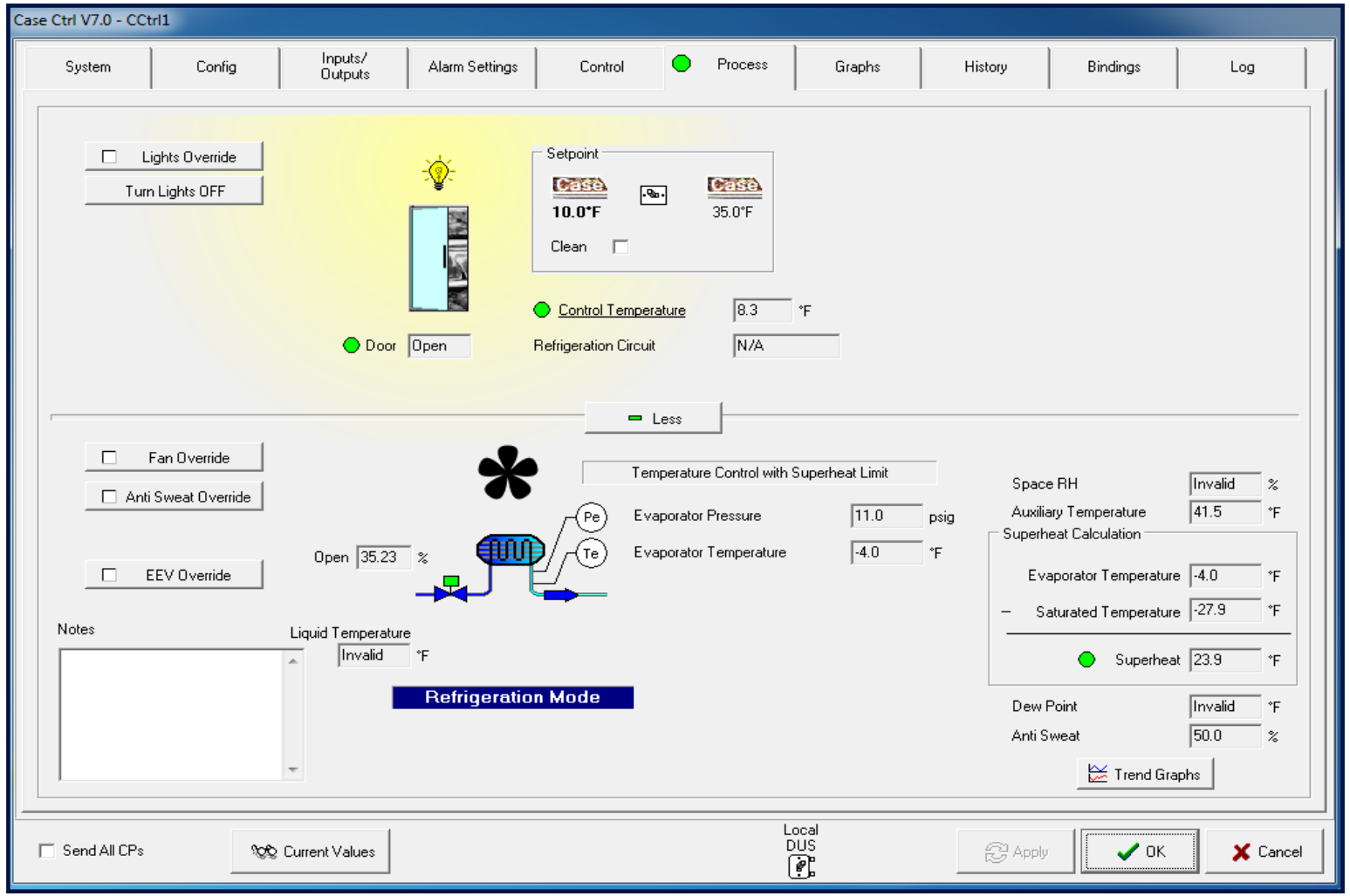
MICRO THERMO CASE CONTROLLER

Alarms Tab



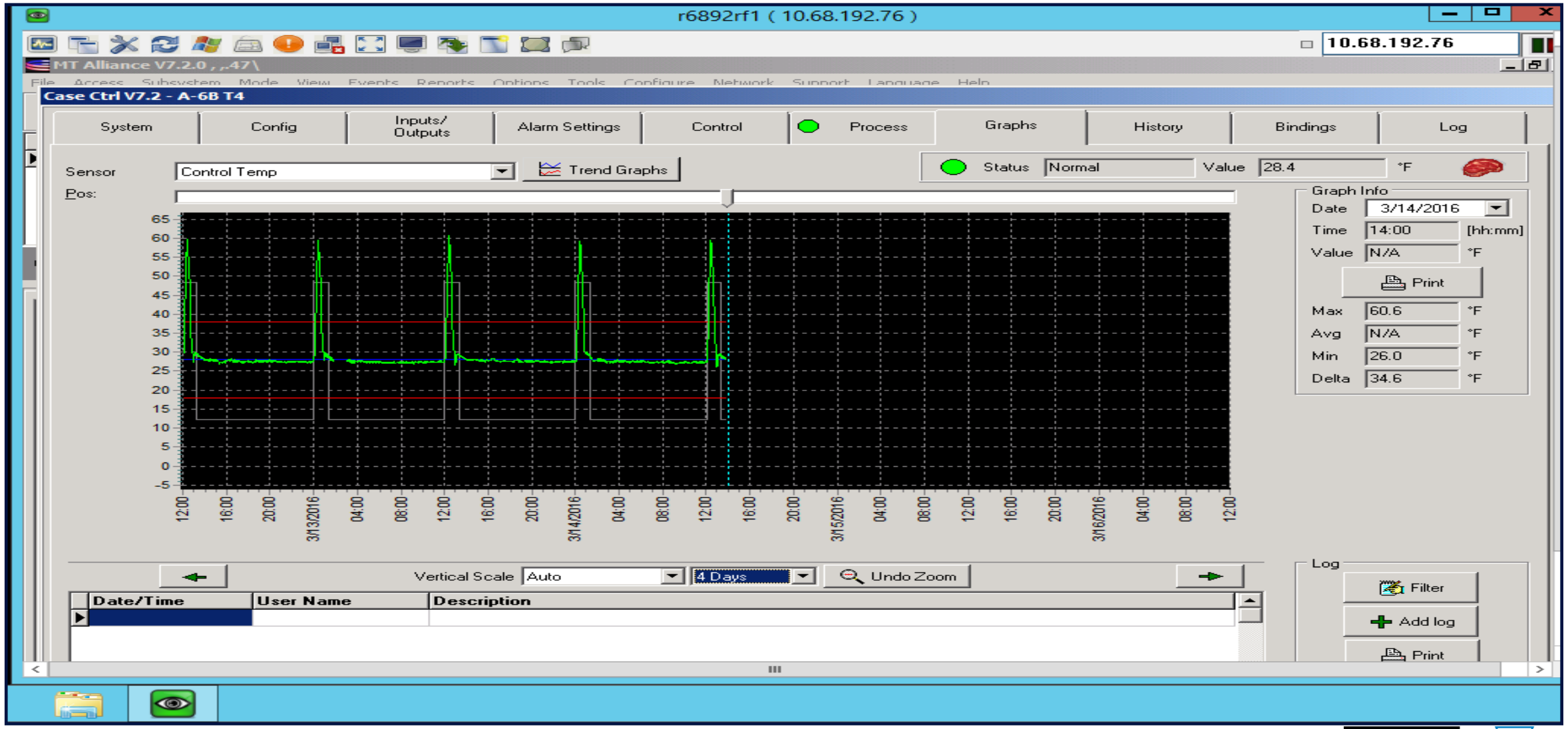
MICRO THERMO CASE CONTROLLER

Process Tab



MICRO THERMO CASE CONTROLLER

Graphs Tab



MICRO THERMO CASE CONTROLLER

INITIAL SETUP

- ✓BASE VALUE
- ✓REFRIGERATION RANGE
- ✓SUPERHEAT
- ✓PULLDOWN
- ✓TEMPERATURE CONTROL
- ✓ENVIRONMENTAL CONDITIONS

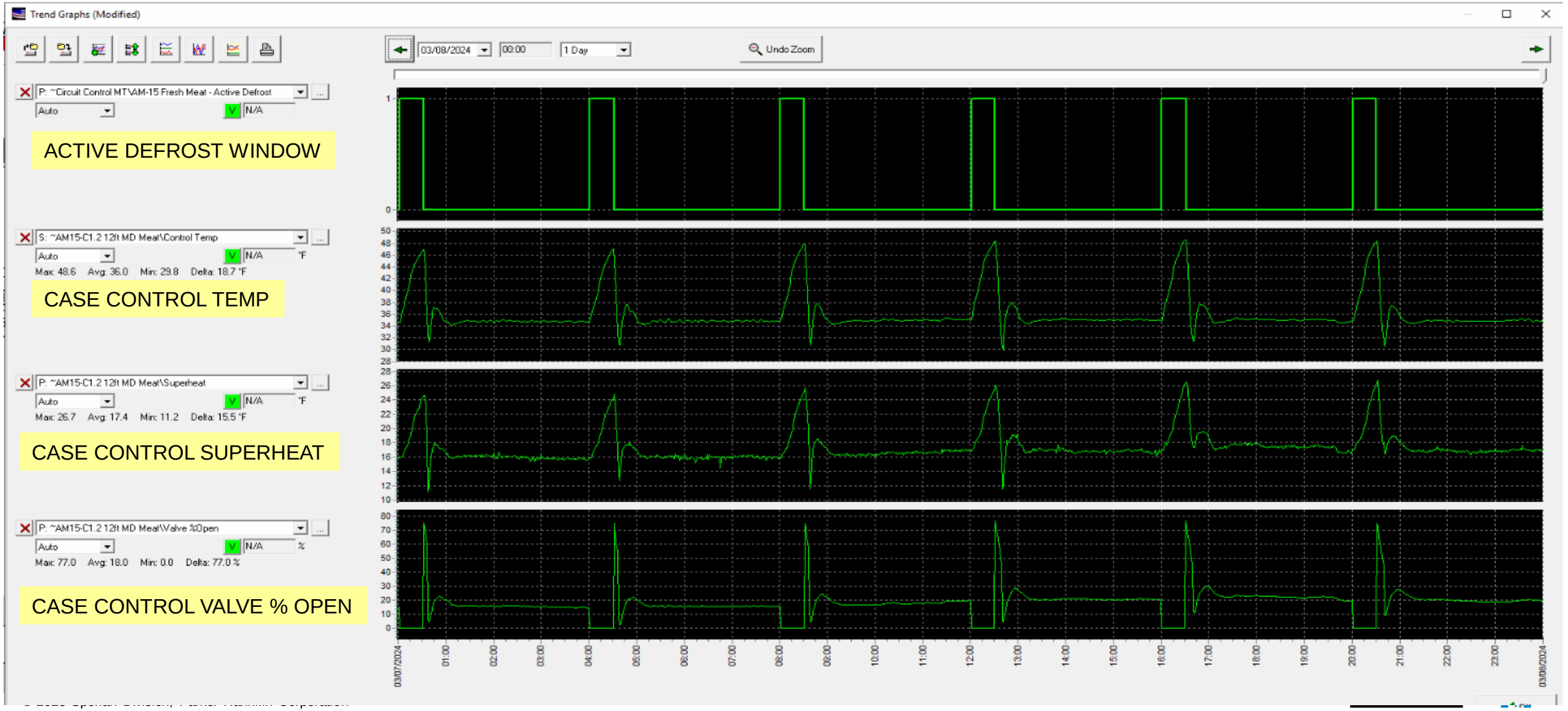
MICRO THERMO CASE CONTROLLER

INITIAL SETUP

- ✓ REFRIGERANT: CO2
- ✓ CASE TYPE: OPEN MULTIDECK
- ✓ LOAD: 13,125 BTUH
- ✓ TEMP: +20
- ✓ EEV: SER – A (39,480btu) 33% Loaded

MICRO THERMO – Case Control Tuning

TREND GRAPH

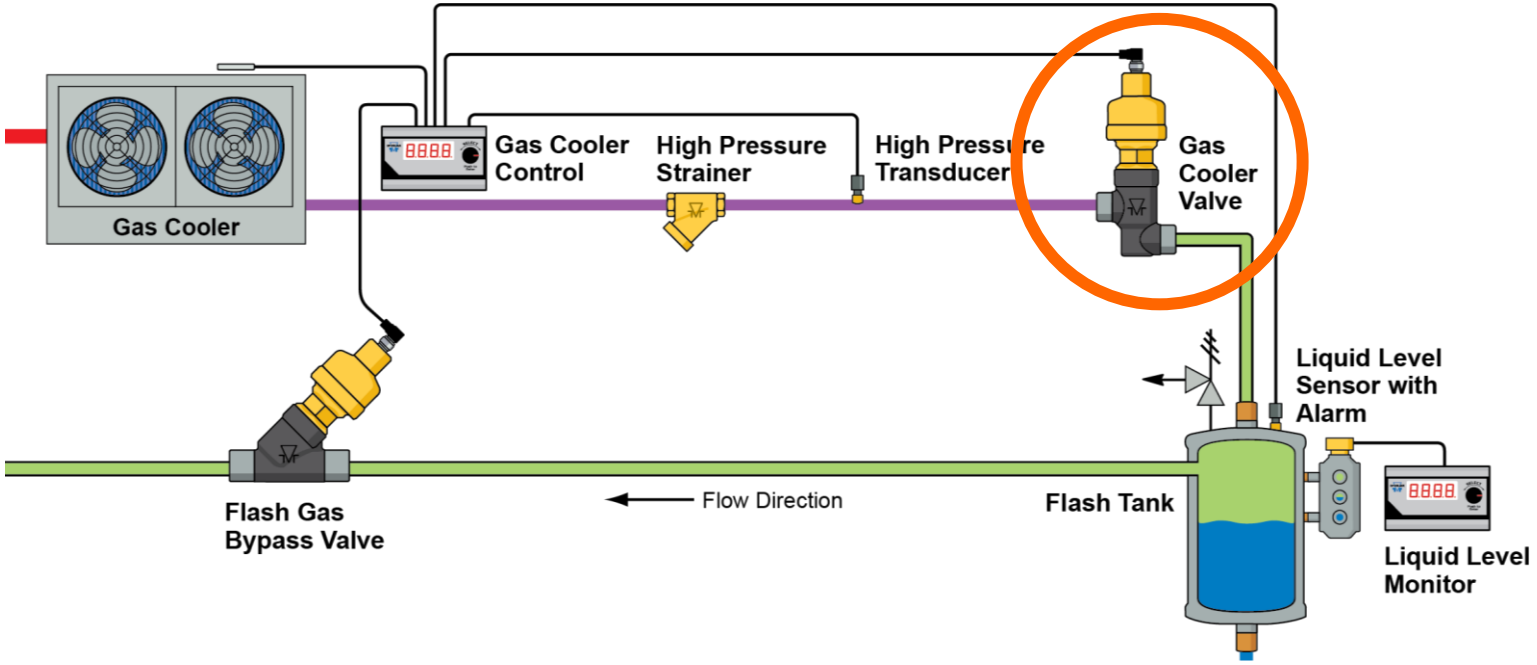


MICRO THERMO

Transcritical CO_2 Flow Controls

GAS COOLER VALVE

- Located on the high pressure side
- Regulates pressure in the condenser / gas cooler
- CO2 through the valve port drops in pressure
- Valve outlet typically is connected to a flash tank receiver at an intermediate pressure



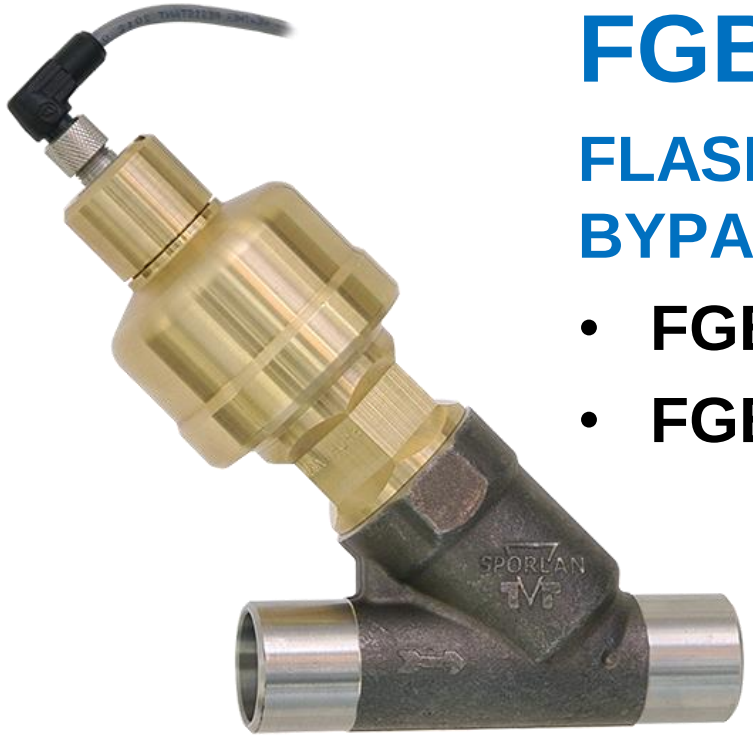
SPORLAN

Transcritical CO_2 Flow Controls

GC

GAS COOLER VALVE

- GC-10
- GC-20
- GC-30
- GC-40
- GC-50



FGB

FLASH GAS BYPASS VALVE

- FGB-60
- FGB-70

MICRO THERMO

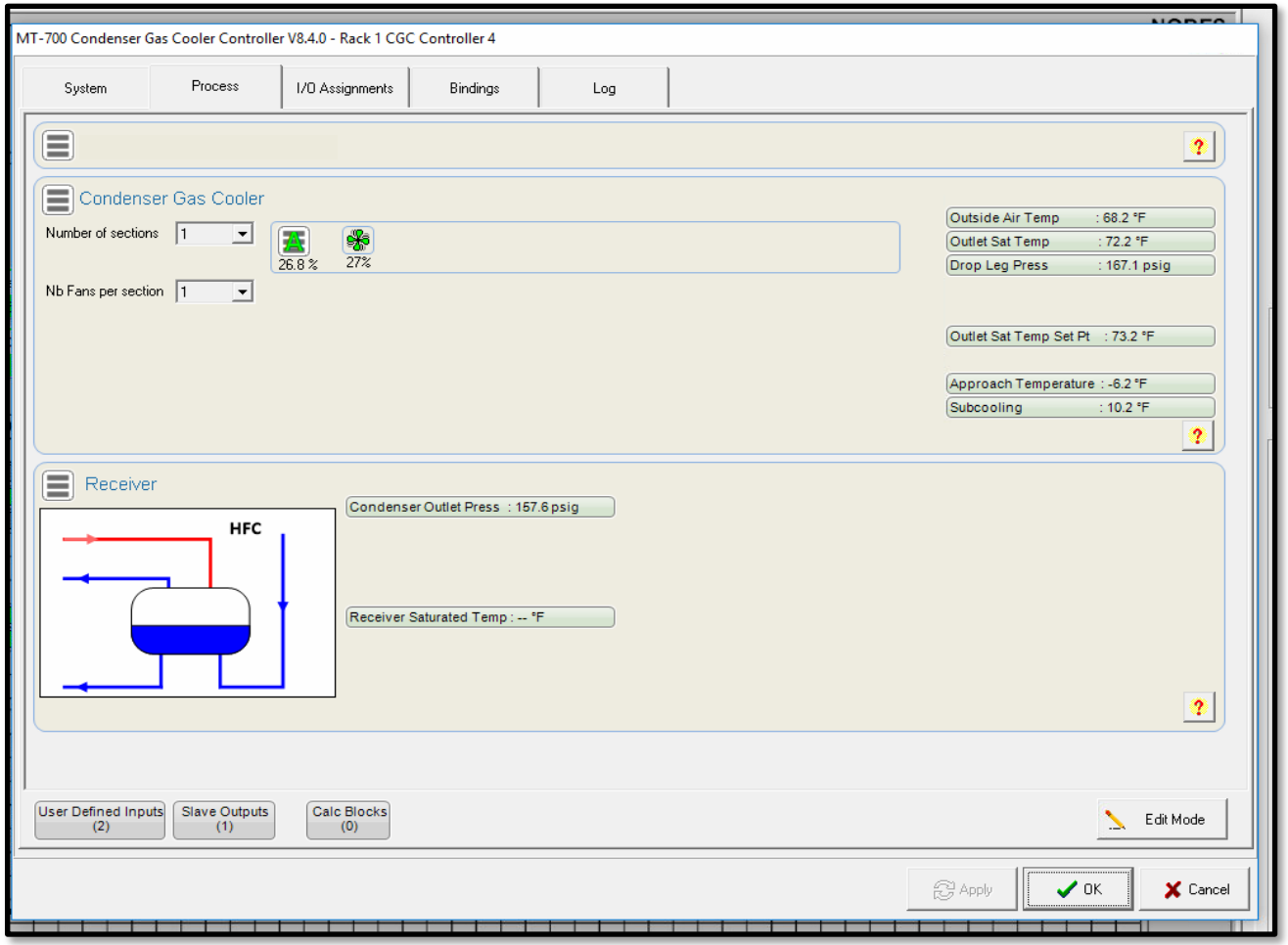
MT-700 2 Valve Controller

- Flash Gas Bypass Control
- GC and FGB control
- Main Defrost Valve Control
- Electronic Replacement of A8 and A9 Valves
- CDS Valve Control
- Heat Reclaim Control

MICRO THERMO

MT-700 Condenser / Gas Cooler Controller Train

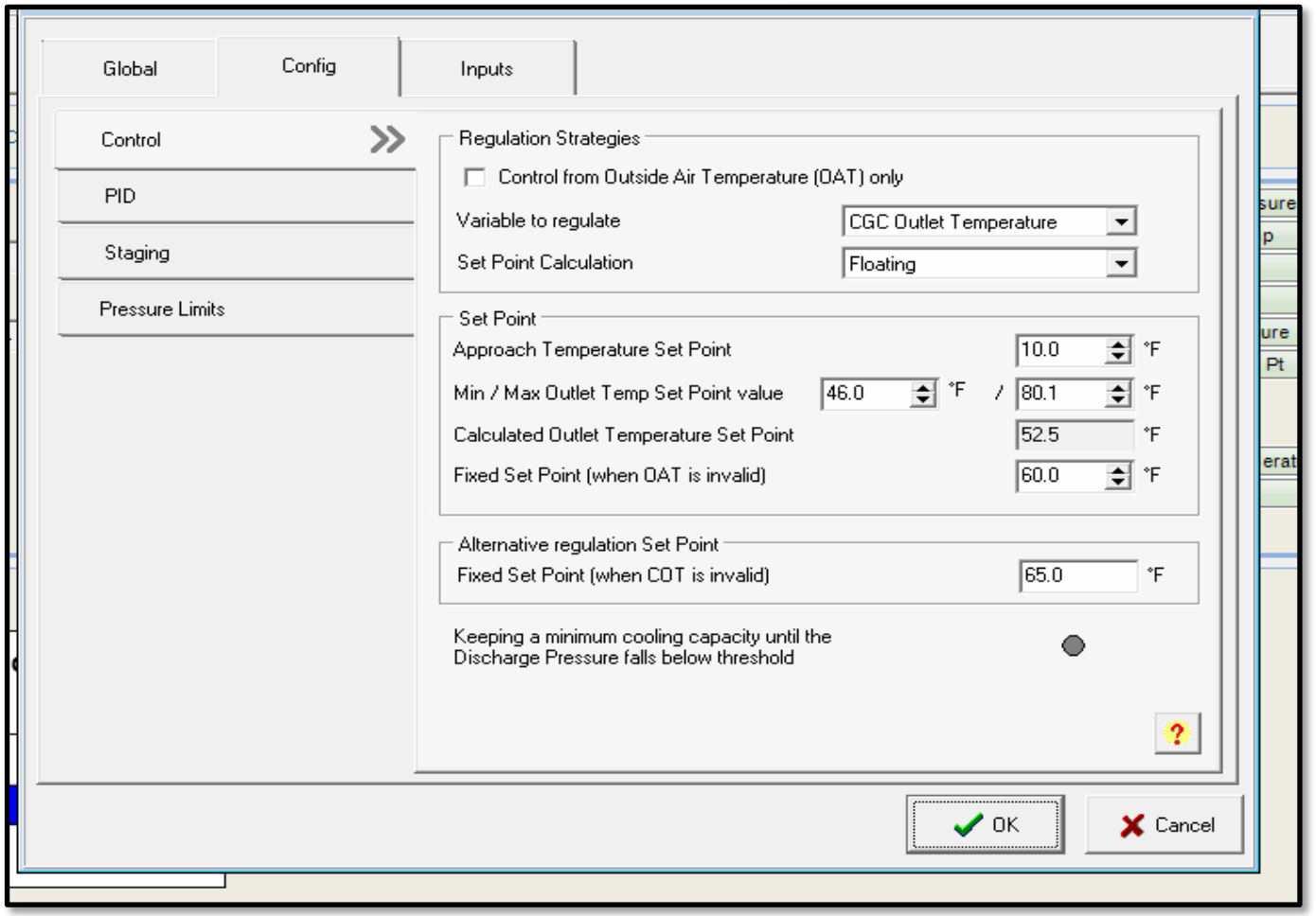
- **Up to 8 Sections / 16 Fans**
- **Split: Main Valve – Fan Power Output – Vent Valve Output**
- **Fan Control: OAT / COT / COP / DLP / DP**
  - Entering Air
  - Ambient RH
  - Water Relay (Adiabatic)
- **Receiver / Flash Tank**
  - FGB Valve Digital Output
  - Holdback / HPV
  - Pressure Regulation
  - Receiver Pressure / Receiver Empty
  - Liquid Level
- **Heat Reclaim – up to 8 HR subsystems**
- **Up to 8 HR subsystems**



MICRO THERMO

MT-700 Condenser / Gas Cooler Controller Train

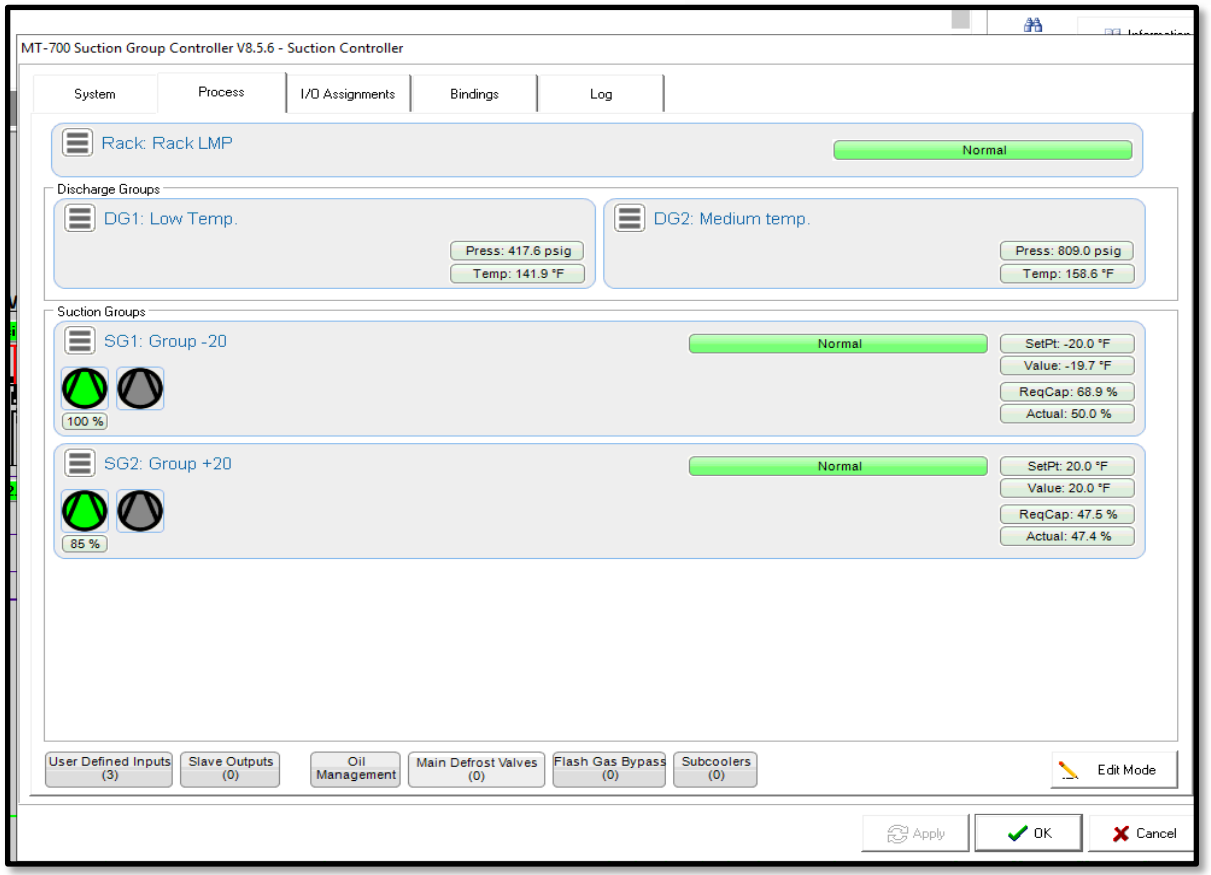
- **3 Plug-In Tabs**
  - Global
  - Configuration
  - Inputs
- **Control**
- **PID**
- **Staging**
- **Pressure Limits**



MICRO THERMO

MT-700 Suction Group Controller Train

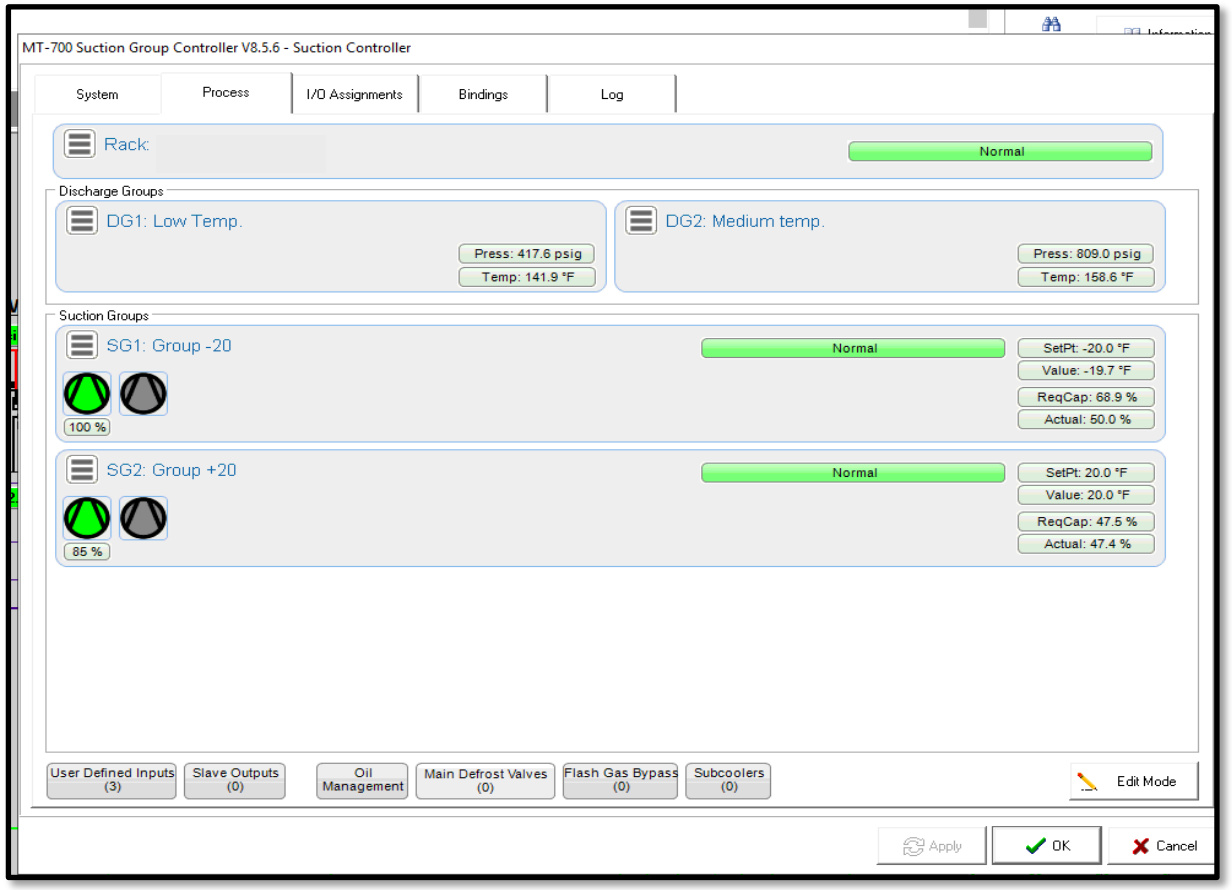
- **4 Suction Groups**
- **16 Compressors per Suction Group**
- **Compressor Digital Inputs**:
  - Safety Line Alarm
  - Low Oil Level
  - Proof of Running
  - Oil Injection
  - Digital
    - 1 Alarm
  - VFD
    - 1 Alarm
    - 1 out each: Bypass / Reset / Enable



MICRO THERMO

MT-700 Suction Group Controller Train

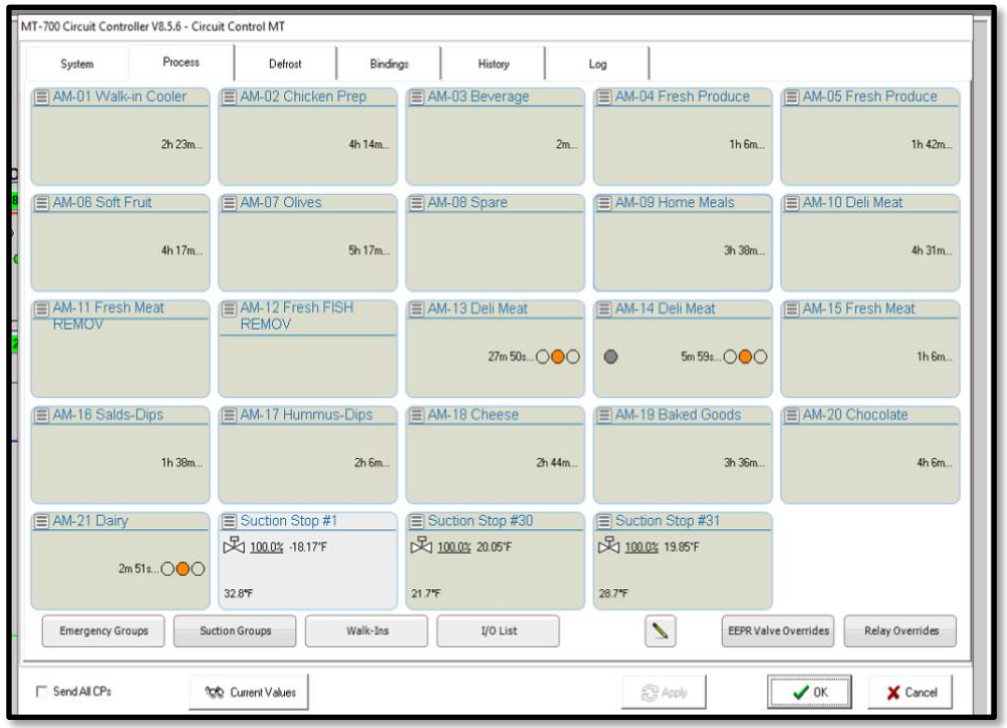
- **4 Discharge Groups**
- **Digital Inputs**:
  - 1 discharge pressure/group
  - 1 discharge temperature/group
  - 1 High Pressure switch/group
  - 1 High Pressure re-set/group
  - 2 Sub Cool
    - 2 DO with 3 stages
    - 1 sub-cool inlet temperature
    - 1 sub-cool outlet temperature
  - Main Defrost Valve
  - Oil Control



MICRO THERMO

MT-700 Circuit Controller Train

- Configurable I/O
- Regulate up to 24 Circuits
- Control up to 80 relays
- Support for TEV or Case Controllers
- Dual-Temp EEPRs
- Circuit pressure regulation based on local or remote pressure, or based on case temperatures
- Floating circuit pressure and suction pressure set points
- Alarming on circuit superheats



MICRO THERMO ALLIANCE

Graphical User Interface

Micro Thermo

Manages your entire chain, right from your desktop, laptop, tablet, or smartphone!

Leak Detection

Energy

Refrigeration

Lighting

Tº Monitoring

VFD

Generation

HVAC