COMPU-AIRE INC.
Specialized Environmental Air Conditioning Systems

SYSTEM 2500
PROGRAMMABLE CONTROLLER
-USER MANUAL-

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1.0 INTRODUCTION

The System 2500 is a programmable controller based on a double microprocessor, designed for precise "Smart" control of an air conditioning system. The System 2500 is made up of a microprocessor based MAIN BOARD equipped with a set of terminals used to interface the microcontroller board to the controlled devices such as compressors, fans, heaters, humidifiers, and valves. The program is retained in a flash based memory and configuration parameters are permanently stored (even in the case of a power failure) in a non-volatile memory.

The System 2500 also includes a microprocessor based TERMINAL unit complete with graphical touch screen display with built in navigation keypad and LED indicators allowing the users to easily set the controlled parameters for setpoints, dead bands, alarm thresholds, and carry out the main working operations (on/off, displaying controlled variables, printouts). The controller and graphical display terminal are powered by 24VAC power supply using low voltage control transformers from the unit. Connection between the terminal unit and main board is necessary only when programming the System 2500 basic parameters. The controller is linked to a graphic display terminal via standard three wire cable.

The System 2500 represents the evolution of the microcontroller towards the networking capabilities with integrated Ethernet interfaces. It offers a wide range of open stand protocols for local connectives. The new operating system is optimized to ensure optimal system resource usage and increase speed and reliability.

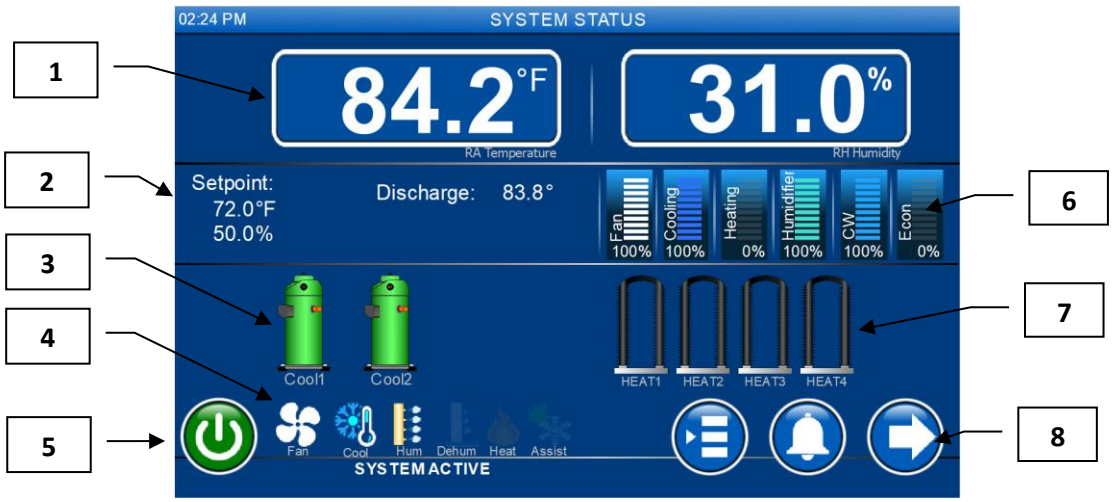
2.0 QUICK REFERENCE GUIDE

The controller is fully programmed and pre-configured per system configuration. Further modification may be required to better fit the application.

Figure 1 User Interface

1	Power/Link LED • Solid green: Normal operation • Flashing green: loss communication • OFF: No power
2	High contrast frame
3	Touch sensitive screen

Table 1 Touchscreen interface



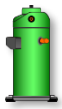
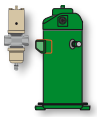
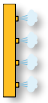
	Compressor stage • Active: Green • OFF: Black		Heating stage • Active: Red • OFF: Black
	Demand output		Pumpdown mode
	Evaporator fan		Humidifier mode
	Cooling mode		Dehumidification mode
	Heating mode		Econ/cooling assist mode

Table 2 Icon legends

1	Room temperature and relative humidity
2	Room return temperature and humidity setpoints
3	Cooling stages
4	Mode of operation
5	System ON/OFF control
6	System demands/outputs
7	Heating stages
8	Navigation system

	Main menu
	Alarm menu
	Next menu
	Previous menu

Table 3 Menu Options

3.0 SEQUENCE OF OPERATIONS

3.1 Standard Units in General

In general, the controller is operated as follows:

NOTE: The following are applicable while the controller is in active mode and only apply to DX and Chilled Water units.

- Fan starts up on demand for cooling, heating, humidifying or dehumidifying, or operates continuously.
- Sequences the compressors on in stages with adjustable delays to meet demand for specified temperature and humidity setpoints.
- Sequences the heaters on in stages with programmable delays to meet demand for heating or reheat during dehumidification mode.
- Activates the humidifier as needed to meet the humidity demand.
- Dehumidification is achieved by means of cooling to reduce the humidity level. During the dehumidification process, if the temperature falls below the room setpoint, heating is brought on to reheat the air and maintain room temperature.
- The controller monitors the complete system for any sensor, fan, compressor, heater, and/or humidifier failure. Upon critical failures, the complete system will shut down with alarm. For certain component failures, the applicable feature is disabled to ensure safe operation. For example, when compressor failure occurs, the failed compressor shall be locked out but the system shall provide cooling by other compressor if available. On a heater failure, the heaters are locked out. The system will not use that function until you manually reset on the display. The controller also keeps the history of last 100 alarms after you reset them.

3.2 How to Turn the Unit ON

- From the status screen, navigate to the On/Off menu and press enter. Use the Up/Down arrow buttons to toggle the On/Off operation.
- The System Status screen should indicate the current system operating mode.
- Default time delay for evaporator fan is 30 seconds to avoid short cycling.
- Unit will automatically control the necessary mode of operation to maintain room setpoints.

3.3 Lead/Lag Redundancy – pLAN Network

System 2500 series controllers can be set for n+1 redundancy setup. A maximum of 32 units can be linked together on the pLAN network. The pLAN networked systems are identified by IP addresses. Any system within the network can be configured as master unit. This alleviates the need to cumbersome wiring with the use of standard Ethernet cables. In case of master unit is out of service, any of the slave units can be set as a new master to reduce network downtime. No wiring changes are needed. Each controller is self-dependent with necessary sensors and it can be

used as a stand-alone unit. When used on the pLAN Network, each unit is not required to have to have the same software revision and date.

When the Master goes offline, all standby systems become active to standalone mode. This reduces the chance of the controlled space temperature and humidity trailing off setpoints. When an active unit with either Master or Slave goes into alarm, the next standby system or all standby systems should become active. Network alarm events are programmable via the technician menu. Communication between systems is maintained by a synchronized heartbeat.

Unit rotation can be set to achieve equal run time on. At the end of each cycle, the role of each unit switches to its counterpart, meaning the Master becomes the Slave and the Slave becomes the Master during the next cycle. During each cycle, the units operate according to the above lead/lag logic.

3.4 Air Cooled DX with Chilled Water Plus

Summary of Equipment

The primary system shall be Chilled Water Cooling. Direct Expansion Cooling shall be setup as a back up to the Chilled Water system. Both systems are designed to work independent of each other.

The Chilled Water System comes standard with a three (3) way water modulating valve, coil, and an optional “no water flow switch”. The DX system is equipped with a DX coil, compressor(s), and outdoor air cooled condenser. Optional heaters and humidifiers are also available if needed.

A unique feature of Air Cooled/Chilled Water Plus units is that the chilled water coil is located at the side of the direct expansion coil. The auxiliary chilled water coil is custom sized so that it provides identical cooling capacity obtained during the refrigeration cycle with the compressor operating.

Cooling-Chilled Water

Chilled Water cooling is the primary cooling system for C+ units. For optimum performance, the controller is programmed to call chilled water cooling for the first 300 seconds regardless of the chilled water temperature.

The C+ unit can switch over from one cooling mode to another based on sensing Chilled Water flow or Chilled Water temperature. The standard practice is to sense the Chilled Water flow for switching.

If “No Water flow” switch is selected, the unit senses the flow of chilled water by using a pressure differential switch and switches over to DX cooling based on loss of water flow. When no water flow switch is selected for switch over, the unit will only work on either DX or C.W. cooling mode.

If chilled water supply temperature is selected for switch over, than the unit shall continue with chilled water cooling if the chilled water supply temperature is below the required temperature setpoint and switch over to the DX cooling.

Cooling-Direct Expansion

Direct Expansion Cooling is designed to operate when the water flow switch senses that there is no water flow. A digital signal is sent to the system from the controller to modulate the three (3) way valve to cut water flow to the chilled water coil and the backup system direct expansion cooling should start. The controller signals the compressor to start cooling. The outdoor condenser gets energized as needed.

3.5 Air Side Economizer

Summary of Equipment

The Economizer Mixing Box is factory provided; however, it might be installed in the field by others.

Sequence of Operation

The evaporator fan and a set of dampers for the economizers are energized depending on heating or cooling demands. The controller commands the economizer box to bring either the minimum amount of outside air or only outside air based on outside air temperature and humidity. The controller determines whether the outdoor air temperature and humidity is suitable for "economizer-cooling". If the outdoor air is suitable, mechanical cooling shall be locked out by the outdoor enthalpy control. The set of economizer damper actuators shall be energized, operating the outdoor air and the return air dampers. The economizer damper actuators shall be regulated to maintain proper discharge air temperature. When outdoor air is not suitable for "economizer-cooling", the Economizer shall be locked out and the outdoor air damper shall maintain minimum position while the indoor fan is operating. Upon unit shutting down or power loss, the spring return motor actuator shall close the outdoor air damper. The economizer shall be automatically locked out during the heat mode (if applicable).

The Air Side Economizer box shall include: prewired modulating spring return damper actuators, economizer control logic with compressor assist option, minimum outside air damper position control, economizer control sensors including outdoor air temperature and humidity (enthalpy) sensor, supply air and/or mixed air sensors. The supply air temperature sensor is used to maintain the desire supply air temperature using DX and Economizer cooling together. The exhaust of room air during economizer cooling mode shall be done by others in the field.

3.6 Water Side Economizer Energy miser (EM) Unit Using 2-Way Valves

Summary of Equipment

Energy Miser units are provided with Dual Cooling options. DX cooling using Compressor based system and Economizer cooling using Water Side Economizer Coil.

The primary system shall be Direct Expansion Cooling. The free cooling Energy Miser coil is provided together with the DX cooling coil. If the Water temperature drops below the Energy Miser setpoint, the condenser water is diverted to the free cooling coil and DX cooling will be programmed to either turned off or made available to assist based on demand.

The Energy Miser System shall be provided with a Two (2) way water regulating valve for condenser coil, a Two (2) way modulating chilled water valve for energy miser coil, DX coil(s), compressor(s) and co-axial water condenser(s). The water valves on water cooled condensers and free cooling energy miser CW Valves will allow the water flow in either condenser coil or free cooling EM coil. The two way control valve shall control the amount of flow to auxiliary energy miser cooling coils to meet the demand when in EM cooling mode. The Two way water regulating valve will control the amount of water flow in condenser based on the refrigerant pressure in DX cooling mode. System shall be programmed to do either DX cooling or EM cooling based on entering water temperature.

Energy Miser systems are connected to Cooling Tower or Dry Fluid Coolers to obtain re-circulating water or water glycol solution. In addition, the system is equipped with steam generating humidifier, electric reheat and microprocessor based controller.

A unique feature of Energy Miser system is that the free cooling water coil is located just before the direct expansion coil and is properly sized to provide the same cooling capacity as the DX system at 45 deg. F. entering water temperature. The indoor unit will send a signal to enable and disable the outdoor auxiliary equipment. The outdoor equipment has its own control logic to provide water temperature suitable for either EM mode or DX cooling mode.

Cooling-Direct Expansion

Direct Expansion Cooling shall operate when the water temperature increases above the specified EM setpoint. A digital signal is sent to the system by microprocessor to signal the compressors and the two (2) way valves will regulate the water flow into the water cooled condensers based on the refrigerant pressure. Each compressor system shall have separate 2-Way water regulating valves. The Energy miser mode depends on the entering water temperature and it is adjustable.

Cooling-Energy Miser Mode

The unit can switch over from DX cooling mode to free cooling Energy Miser mode based on the Entering Water temperature.

Unit shall start in DX cooling mode. If the temperature of water supply drops below the setpoint for the Energy Miser mode, the unit will switch over to the Energy Miser free cooling mode. The outdoor fluid cooler shall be provided with Energy Miser control panel to maintain lower fluid temperature during Energy Miser mode.

In the free cooling Energy Miser mode, the compressors will remain shut off while the fans of the unit shall be on. Humidification and Dehumidification modes shall operate as needed.

3.7 Water Cooled Energy Miser

Summary of Equipment

Energy Miser units are provided with Dual Cooling options. DX cooling using Compressor based system and Economizer cooling using Water Side Economizer Coil.

The primary system shall be Direct Expansion Cooling. The free cooling Energy Miser coil is provided together with the DX cooling coil. If the water temperature drops below the Energy Miser setpoint, the condenser water is diverted to the free cooling coil and DX cooling will be programmed to either turned off or made available to assist based on demand.

The Energy Miser System shall come standard with a three (3) way water regulating valve for condenser coil, a three (3) way modulating chilled water valve for Energy Miser coil, DX coil(s), compressor(s) and co-axial water condenser(s). The water valves on water cooled condensers and free cooling Energy Miser CW Valves are three way mixing type designed to divert the flow in either condenser coil or free cooling EM coil. Three (3) way is used to maintain pressure drop, as constant GPM is required for free cooling systems. The (3) three way control valve shall control the amount of flow to auxiliary energy miser cooling coils and maintain constant temperature and relative humidity

Energy miser systems are connected to Cooling Tower or Dry Fluid Coolers to obtain re-circulating water or water glycol solution. In addition, the system is equipped with steam generating humidifier, electric reheat and microprocessor based controller.

A unique feature of Energy Miser system is that the free cooling water coil is located just before the direct expansion coil and is properly sized to provide the same cooling capacity as the DX system at 45°F entering water temperature.

Cooling-Direct Expansion

Direct Expansion Cooling shall operate when the water temperature increases above the specified setpoint. A digital signal is sent to the system by microprocessor to signal the three (3) way valve to divert the water flow from the free cooling coil to the water cooled condensers and the direct expansion cooling mode shall start. The microprocessor shall signal the compressor to start cooling and at the same time energize the water regulating valve to supply water flow to the co-axial condenser. The Energy Miser mode depends on the entering water temperature and it is adjustable.

Note: *Continuous water shall be flowing through the chilled water valve and will only supply water to coil when called upon.*

Cooling-Energy Miser Mode

The unit can switch over from DX cooling mode to free cooling Energy Miser mode based on the entering water temperature.

Unit shall start in DX cooling mode. If the temperature of water supply drops below the setpoint for the Energy miser mode, the unit will switch over to the Energy Miser free cooling mode. The controller will send signal to the auxiliary equipment to run Energy Miser mode for fluid temperature control. The outdoor fluid cooler shall be provided with Energy Miser control panel to maintain lower fluid temperature during Energy Miser mode.

In the free cooling Energy Miser mode, the compressors may shut off while the fans of the unit shall be on. Humidification and Dehumidification modes shall be operating as needed. The Compressors can be locked to remain off during Energy Miser mode if necessary.

3.8 Dry Fluid Cooler with Energy Miser

Summary of Equipment

DRY FLUID COOLER (DFC): The Dry Fluid Cooler Shall Consist of Casing, Coil, Direct-drive Propeller Fan(s) driven by individual Fan Motor(s), Fan Guard and Mounting Legs. All fan motors shall be factory wired to a common electrical control box. The Dry Fluid Cooler shall be arranged for Vertical Air Flow.

The Glycol Coil shall have aluminum fins bonded to copper tubes and shall have full collars that completely cover the copper tubes. The coil shall be pressure tested to 350 psig and shall be designed for counter flow for high heat transfer efficiency.

The Dry Fluid Cooler casing shall be made from a non-corrosive metal to minimize maintenance. Adjustable mounting legs and supports shall be furnished with the DFC. Vibration isolators of the rubber and shear or spring type are to be field provided by others.

The motors shall be permanently lubricated, sealed ball bearings, with inherent overload protection. Motors shall be mounted inside the Dry Fluid Cooler Casing for weather protection. The direct drive fan blades shall be aluminum, and shall be protected by a heavy gauge, steel wire, zinc plated, and epoxy coated fan guard. Full width baffles to prevent bypass air shall separate each fan section.

Dry Fluid Cooler (DFC) requires separate power supply and one set of dry contact from indoor unit to Enable/Disable.

DFC is equipped with its own control panel that includes power block, fan contactors, aqua stats, freeze stats, relays and single or dual pump package control as necessary.

Aqua stats are installed in the control panel and bulbs to be attached with leaving water header of the coil.

The fluid cooler shall be provided with ambient T-stats to control the water temperature during DX cooling mode. The DFC shall bypass the T-Stat control logic and run all fans continuously during Energy Miser mode.

Condenser cooling mode

If the water temperature is above 50Deg. F. (Default setting), the DFC will be in normal condenser cooling mode. Aqua stat # 1 will be open above 50 Deg. F. In normal cooling mode, the DFC will be enabled by either of the compressor from indoor unit.

The Freeze stat is installed in series of the enabling signal. If the freeze stat opens, the DFC unit will be fully disabled.

1. The first fan of DFC runs continuously as long as enabling signal is present.
2. The default setting for second fan to cycle OFF is 60 Deg. F and below with aqua stat #.
3. The default setting for third fan to cycle OFF is 70 Deg. F. and below with aqua stat #.
4. The default setting for forth fan to cycle OFF is 75 Deg. F. and below with aqua stat #.
5. All these default settings are field adjustable to fine tune the unit operation.

Energy Miser cooling mode

During winter months, when water temperature drops below 50Deg. F., the aqua stat #1 will close and DFC unit will switch over to free cooling energy miser mode. In Energy Miser mode, all other aqua stats (aqua stat 2, 3 and 4) will be bypassed and all fans will run continuously. The free cooling temperature setpoint on aqua stat #1 must synchronize with Energy Miser water temperature setpoint for indoor unit.

Pumps

Summary of Equipment

PUMP PACKAGE: The pump package shall include a close coupled, industrial duty pump with heavy-duty ball bearings motors, stainless steel shafts and bronze fitted construction. The pump package shall include pump starter, aqua-stats, and fan cycling contactor(s) to control the condenser glycol temperature. The control panel shall be factory provided for filed installation in a weatherproof box provided on the Dry Fluid Cooler. The pump shall be protected with a base and weather shield from the ambient conditions.

DUAL PUMP PACKAGE (Optional): The dual pump package shall include close-coupled, industrial duty pumps with heavy-duty ball bearings motors, stainless steel shafts and bronze fitted construction. The pump package shall include pump starters, aqua-stats, and fan cycling contactor(s) to control the condenser glycol temperature. The control panel shall be factory provided for filed installation in a weatherproof box provided on the Dry Fluid Cooler. The pumps

shall be protected with a base and complete vented weather enclosure from the ambient conditions. The optional Pressure Differential (No Water Flow) switch shall be provided for field installation.

GLYCOL PUMP: A matching centrifugal circulating pump is provided for field mounting and piping.

Pump Operation

When compressor is on, the pump and fluid cooler will be enabled. Note that this is in DX cooling. In free cooling, the logic is the same, as pumps are enabled with economizer cooling.

3.9 Special Pump and Dry Fluid Cooler control logic

Pump speed adjusted based on differential pressure across pumps as 2-way control valves modulate.

Dry cooler and Pump controller Sequence of operation

Free cooling mode

Either outdoor air temperature is monitored or a signal from each CRAC unit (free cooling and DX condenser) is sent to the pump controller to determine which function is provided.

Fan speed may be increased sufficiently to allow pump minimum operating speed to be maintained should zone loads decrease, thus decreasing flow below safe pump operation.

Outside air temperature reaches 48 deg. F.

Pump controls switch to free cooling mode – Fans run 100% until condenser outlet temperature reaches 38 deg. F., at which time fans speed will reduce to maintain 38 deg. F. or minimum pumps speed is reached, then fans will reduce speed to maintain minimum pump speed, which is accomplished by 2-way valves modulating open is response to increased condenser water supply temperature.

Controls shall monitor both fan KW and Pump KW energy consumption and determine best speed combination to maintain lowest condenser supply water temperature during free cooling mode.

DX Cooling mode

Outside air temperature 50 deg. F.

Pump control increases fan speed as condenser water temperature increases. Maintain 65F condenser outlet water by modulating fan speed. At 75 deg. F. exiting condenser water temperature fan speed is 100%.

Controls shall monitor both fan KW and Pump KW energy consumption and determine best speed combination to maintain lowest condenser supply water temperature during DX cooling mode.

3.10 Optional features

- Discharge air temperature sensor to prevent overheating or cooling of the air stream.
- Outside air temperature sensor for automatic temperature adjustment or economizer action.
- Free-cooling temperature sensor for water cooled systems.
- Hot gas bypass either by solenoid or by modulating electronic valve.
- Redundant system operation of two or more units with automatic crossover and compensation.
- Networking to a central command computer, or to an existing building automation system.

The System 2500 is truly one of the most powerful and flexible controllers available for HVAC units today.

4.0 CONFIGURATION

The display unit is pre-configured at the factory for the most common user requirements. Some settings can be changed to adapt to the user's specific needs.

4.1 Software version

Software version: During boot-up, the splash screen is shown briefly with a quick summary of the loaded operation system along with software, boot, and O/S version. The about screen can also be accessed via the menu. Version number is needed prior to contacting the factory for technical support.

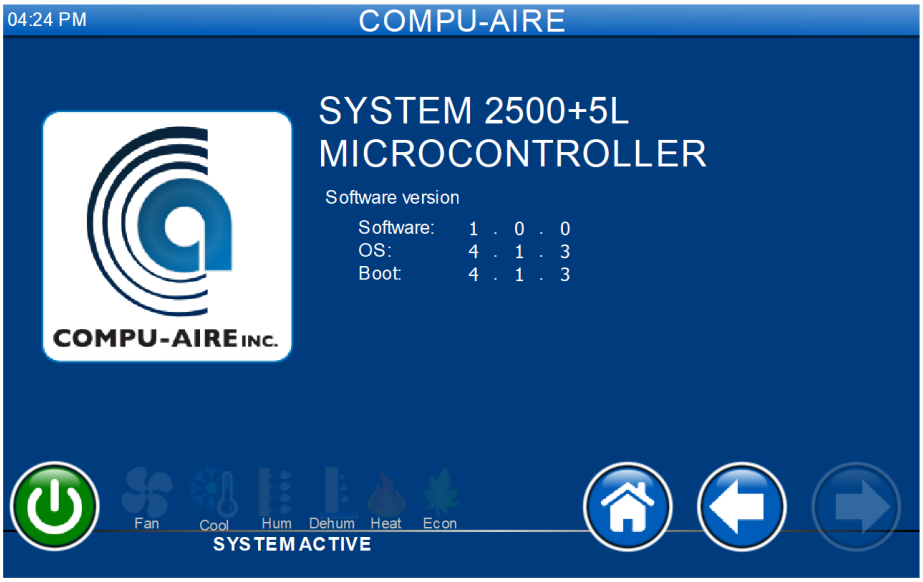


Figure 2 Software information

5.0 TECHNICAL SPECIFICATIONS

5.1 Controller and Display

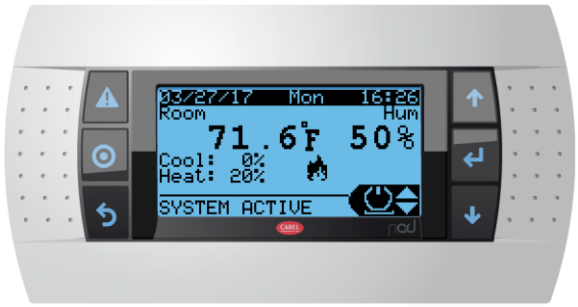


Figure 3 Optional External display

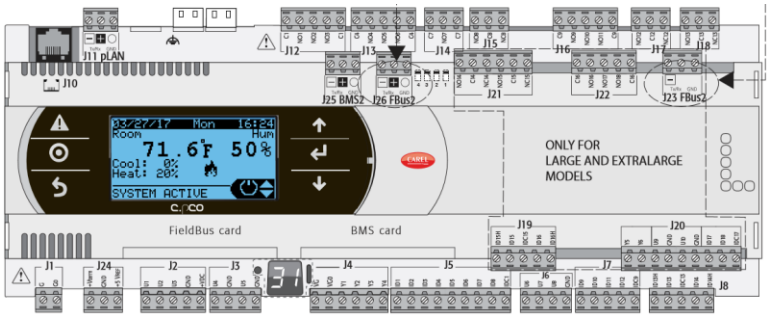


Figure 4 System 2500 controller

5.2 General Characteristics

System 2500 is a microprocessor-based electronic controller developed in compliance with the European RoHS standards. It provides a solution for many applications in the air-conditioning and refrigeration sectors ensuring absolute versatility, allowing specific products to be created to customer request. The controller runs the control program, and is fitted with the set of terminals required for connection to the devices (compressors, fans, etc.). The program and the parameters are saved to FLASH-MEMORY and E2prom for safe keeping even in the event of a power failure (without requiring a backup battery). The controller also allows connection to the pLAN (Private Local Area Network) and can be connected to other System 2500 controllers. All the controllers in the pLAN can exchange information (variables, digital or analogue, depending on the application software used) at high transmission speed. Up to 32 units can be connected via RJ45 interface.

The connection to the supervisor serial line, via the Modbus™, BACnet, or Lontalk protocols are also supported via RS485 standard or over TCP/IP connection.

System 2500 is also equipped with USB peripheral that allowed easy firmware/software upgrade via a standard thumb drive. Each controller supports both LCD and touch screen interface.

5.3 Mechanical Characteristics

SMALL 13 DIN modules 110 x 227.5 x 60mm

Plastic container	
Assembly	Fitted on DIN rail as per DIN 43880 and IEC EN 50022
Material	techno-polymer
Flame redundancy	V0 (UL94) and 960°C (IEC 695)
Ball pressure test	125°C
Resistance to creeping current	≥250 V
Color	Grey RAL7035

5.4 Electrical Characteristics

Power Supply	24VAC 50/60Hz P=40 VA
Terminal Block	Plug-in male/female connectors, max voltage 250 Vac; cable cross-section: min. 0.5 mm2 - max 2.5 mm2
Clock	Built in with battery backup

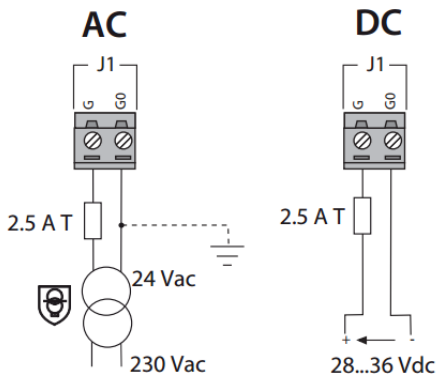


Figure 5 power connection

5.5 Digital Inputs

The controller features digital inputs for connecting safety devices, alarms, device status indicators and remote switches. Digital inputs are not optically isolated and have voltage free connects.

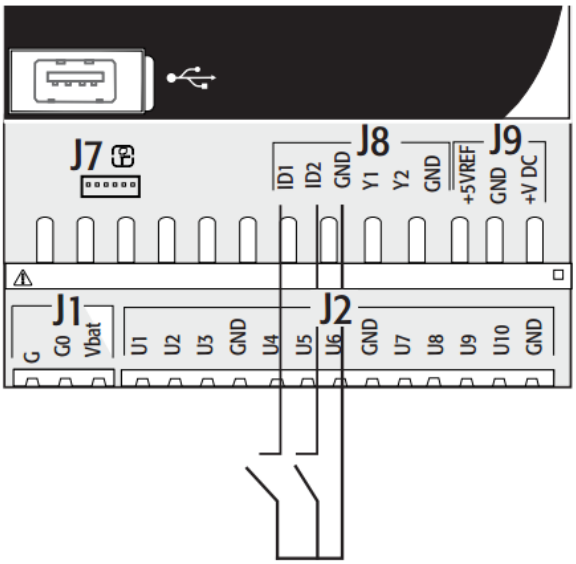


Figure 6 Digital inputs

Note: *Separate the probe and digital input signal cables from the cables carrying the inductive loads and the power cables, to avoid possible Electromagnetic disturbance.*

5.6 Universal inputs

Universal inputs/outputs are distinguished by the letter U. They can be configured from the application for many different uses such as NTC, 4-20mA, voltage inputs, dry contact, or PWM. The maximum number of analog inputs that can be connected to the universal inputs/outputs depends on the type used.

Maximum number of inputs connectable to universal inputs/outputs

	Type of signal	c.pCO									
		mini - c.pCOe		Small		Medium/ Built-in driver/ Extralarge		Large			
Analogue inputs	- NTC/PTC/ PT500/PT1000 probes	10		5		8		10			
	- PT100 probes	max 5		2		3 (2 on U1...U5, 1 on U6...U8)		4 (2 on U1...U5, 1 on U6...U8, 1 on U9... U10)			
	- 0 to 1 Vdc/0 to 10 Vdc signals from probes powered by the controller	0		max tot 5	5	max tot 8	6	max tot 10	max 6		
	- 0 to 1 Vdc/0 to 10 Vdc signals powered externally	10			5		8		10		
	- 0 to 20 mA /4 to 20 mA inputs from probes powered by the controller	max tot 4	2	max tot 4	4	max tot 7	6: (max 4 on U1... U5, 3 on U6...U8)	max tot 9	6: (max 4 on U1... U5, 3 on U6...U8, 2 on U9...U10)		
	- 0 to 20 mA / 4 to 20 mA inputs from probes powered externally		4		4		7: (max 4 on U1... U5, 3 on U6...U8)		9: (max 4 on U1... U5, 3 on U6...U8, 2 on U9...U10)		
	- 0 to 5 V signals from ratiometric probes powered by the controller	max 2		max 5		max 6		max 6			

WARNING: The 21VDC available at the +Vdc terminal (J2) can be used to power any active probes, the maximum current is 150 mA, thermally protected against short-circuits. To supply the ratiometric 0 to 5V probes, use the +5VREF (max: 60 mA) present at terminal J24.

5.7 Analog Outputs

The controller features 0-10Vdc and PWM analog outputs without optical isolation, powered directly by the controller.

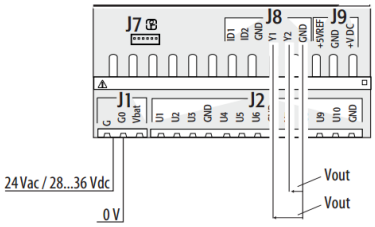


Figure 7 Analog outputs

5.8 Digital Outputs

The controller features digital outputs with electromechanical replays. For ease of installation, the common terminals of some of the relays have been grouped together. Some relays feature changeover contacts.

5.9 Cable Length

Cable Type	Power Supply Distance	Power Supply
Telephone	50m	150mA from controller
AWG24 shielded cable	200m	150mA from controller
AWG20/22 shielded cable	500m	Separate power via TCONN6J000

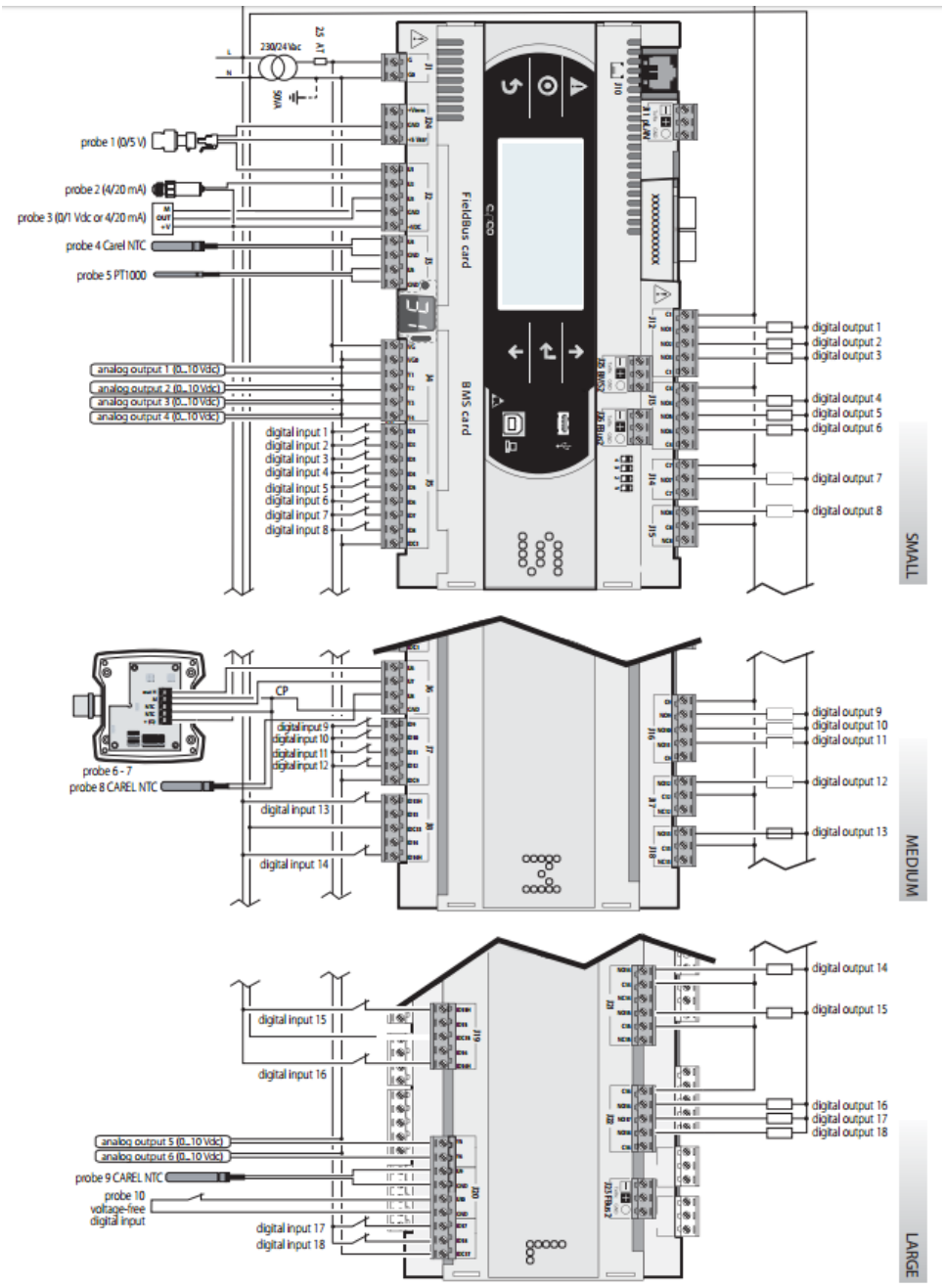
The maximum cable length between the two controllers using AWG20/22 shielded cable is 500 meters.

Note:

- A maximum of one terminal (pCOT, pCOI, pGD0, pGD1) can be connected, or two terminals but without using use the backlighting on display. One version of the controller features optically-isolated connection to the pLAN network.
- The graphic terminal and aria terminal should be always powered with a separate power supply.
- The 21VDC present at +Vterm (J24) can be used to power an external terminal with a maximum input of 2 W. Only one terminal can be connected (for example PLD terminal or ARIA terminal) in addition to the one connected to terminal J10.

5.10 Standard Input / Outputs

The following table defines standard I/O ports for the System 2500 controller. Refer to the electrical wiring diagram for actual wiring.



5.11 Optional Features

Option	Function
	RS-485 CARD Protocol: MODBUS
	PCO-WEB CARD Protocol: BACnet, SNMP,HTTP,FTP,TCP/IP
	PCO-NET Protocol: BACnet MS/TP
	LONCARD Protocol: LONWORKS
	pGD Touch 4.3” graphical touch screen user interface
	Remote LCD interface

5.12 Functional characteristics

Multiple controllers may be used to combine cooling units into a pLAN network that operates as a single entity, enhancing the already-high performance and efficiency of units.

System 2500 controllers are available as factory-installed assembly. Remote console box with graphic touch sensitive display wall-mount version is also available for remote operation and monitoring of cooling units.

Supported Protocol: pLAN protocol, “Point-Point” protocol with up to 32 nodes
Backlighting Level: Two levels of brightness, “high” and “normal”

5.13 Building Management System

BMS Protocol: LONWorks
BACnet over TCP/IP
BACnet over MS/TP
Modbus over RS-485
Web based interface
SNMP

6.0 Navigation Menu

The controller's menu is organized under different categories. Each category may require a different accessing password if setup from the factory setting. At any given time, pressing the -> key will take the screen back to the previous menu.

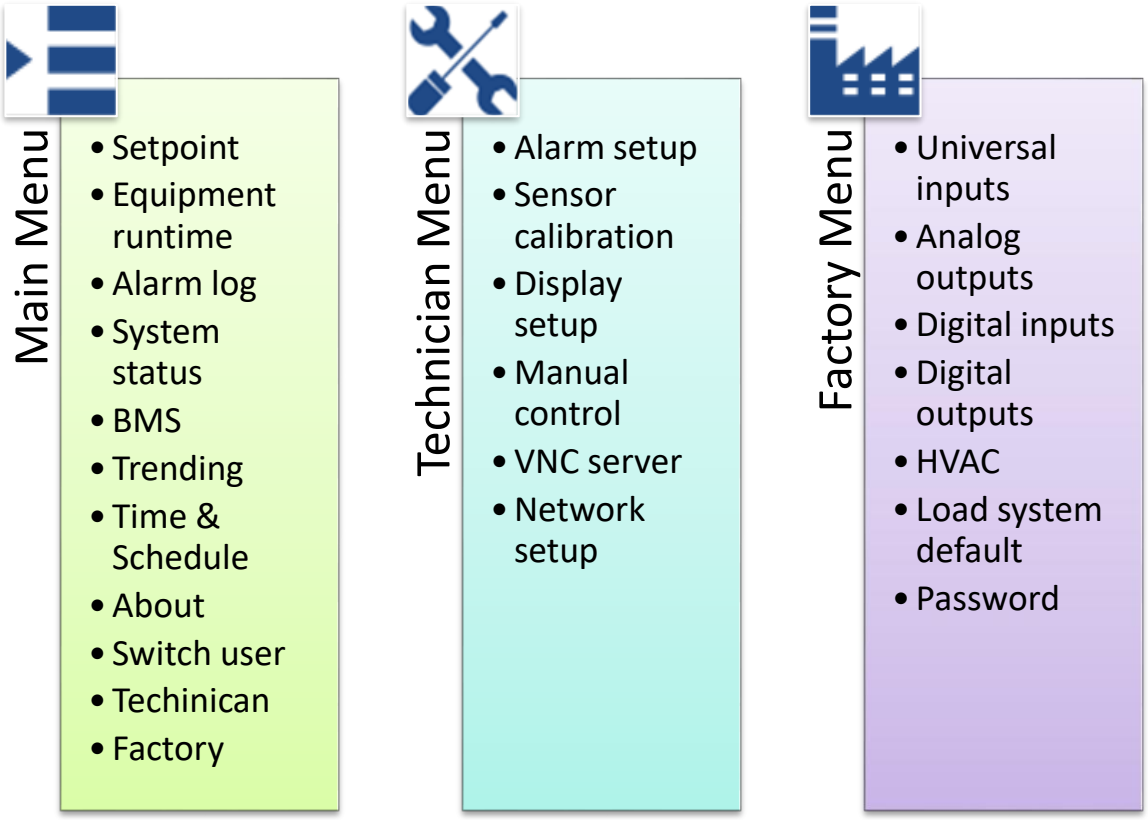
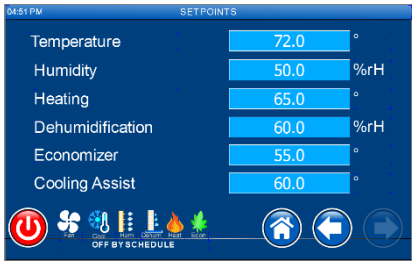


Figure 8. Menu tree

- **Setpoint**
  - Temperature (Cooling/Heating)
  - Humidity (If applicable)
  - Discharge (If applicable)
  - Dehumidification (If applicable)
  - Economizer (If applicable)
  - Cooling Assist (If applicable)



- **Equipment Runtime**

  Each individual run hour can be reset via the reset button. Pressing the reset button will reset counter to zero. The following operating counters are accessible.
  - Evaporator fan
  - Compressors
  - Chilled water valve
  - Humidifier
  - Filter
  - Electric reheat

- **Alarm log**

  Active alarm: View current active alarms.

  Alarm history: View previous stored alarms.

  Reset alarms: Reset all active alarms. Note alarm history is stored in flash and cannot be cleared.

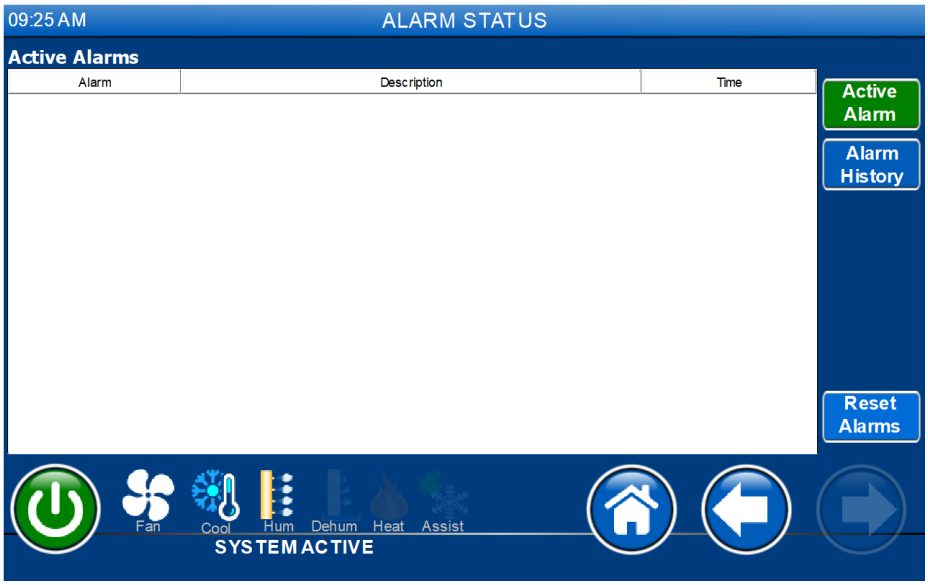


Figure 9. Alarm Status

- **System status**

  All the I/O are shown and grouped in three categories. Output is shown in term of percentage. Actual control functions are set as direct acting or reverse acting.

  - Universal inputs show all the analog sensors
  - Analog outputs shows the current output value in 0-100%.

    0% = 0Vdc

    100% = 10Vdc
  - Optional sensors show derived reading from connected sensors. The following calculated values are available.
    - Return/Outside air dew point
    - Return/Outside air enthalpy
    - 24 hours temperature min/max

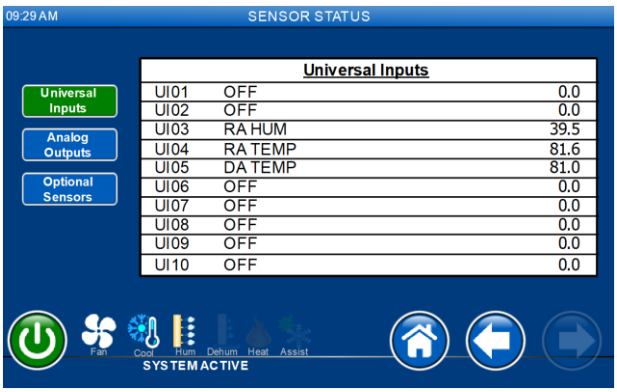


Figure 10. Universal inputs

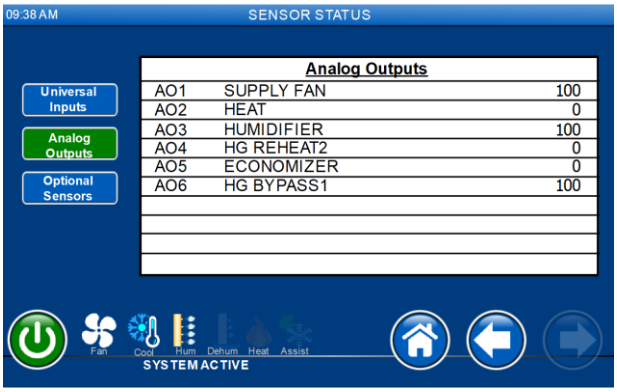


Figure 11. Universal outputs

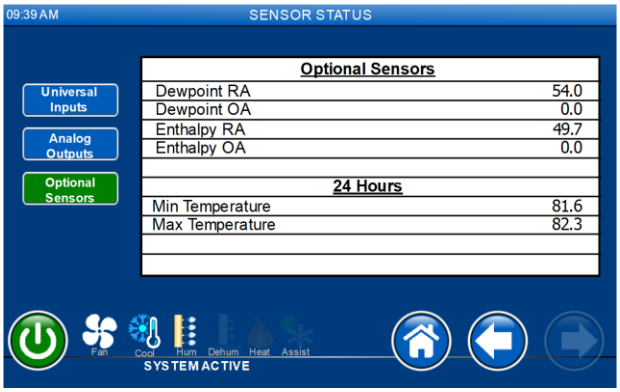


Figure 12. Optional sensors

- **Building Management System (BMS)**
  The following protocols are supported by System 2500 via RS-485 (BMS2) and TCP/IP (Ethernet). *Changes to protocol and baud rate requires system power cycle. Supporting protocol includes BACnet TCP/IP, BACnet MS/TP, Modbus, and LonTalk.*

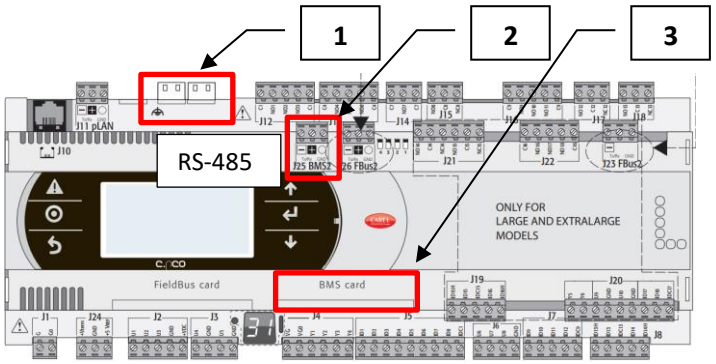


Figure 13. Communication ports

- RJ45 port: two equivalent 10/100Mbps Ethernet ports (100-base tx standard). Supports BACnet IP and pLAN network
- RS-485 slave port: Supports Modbus and BACnet MS/TP
- BMS card: Optional add on network cards

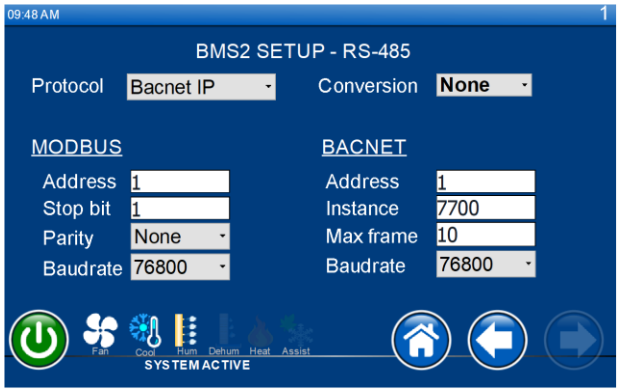


Figure 14. BMS2 (RS-485) setup

- **Trending**

  Each trending point is recorded and plotted for every 3 seconds. The following sensors are supported.

  - Room temperature
  - Room humidity
  - Discharge temperature
  - Water in temperature

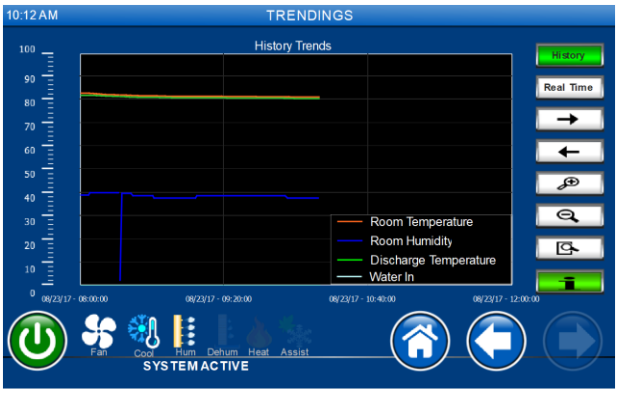
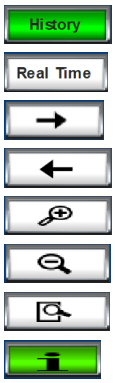


Figure 15. Trending plot



Trending history

Start a real time trending

Right scroll

Left scroll

Zoom in

Zoom out

Zoom full scale

Legend on/off

- **Schedules - Time & Date**

  How to update time/date:

  - Tab on the desired field in the combo box
  - Use up/down arrow keys to update the values

  How to edit schedule: (*Note: Schedule name is fixed and not editable)*

  - Tape on the desired schedule
  - Tab on Enable check box to enable schedule

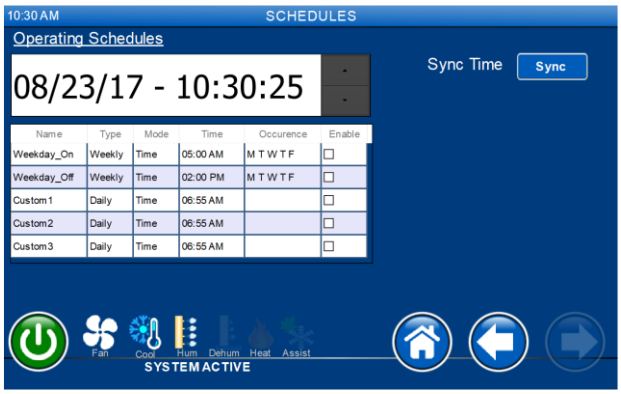


Figure 16. Schedule

- Alarm setup
  Alarms are triggered if the conditions dropped or exceeded setpoint. Default settings are shown as follows:

Alarm	Low	High	Delay (second)	
Temperature	65	85	30	
Humidity	25	65	30	
Discharge temp	35	150	30	
Compressor	35	355	60	(Unit in PSI)
Fire stat temp		125	30	
Fan feedback	30			
Condensate overflow	Alarm			
Condensate pump	Shutdown			

- Sensor calibration
  Default offset for all the analog inputs are zero. To perform a calibration, enter the +/- values in the offset field. New changes take immediate effect. The value column shall show the immediate changes.

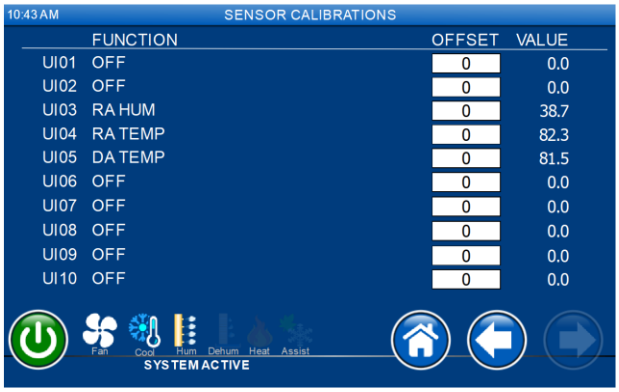


Figure 17. Sensor calibration

- Display Setup

  The following settings are accessible via the touch screen interface. Default settings are shown below:

Backlight timeout	900s	
Brightness	255	
Alarm buzzer	OFF	(Only available on 13” screen)
Display-Control Sync	1	

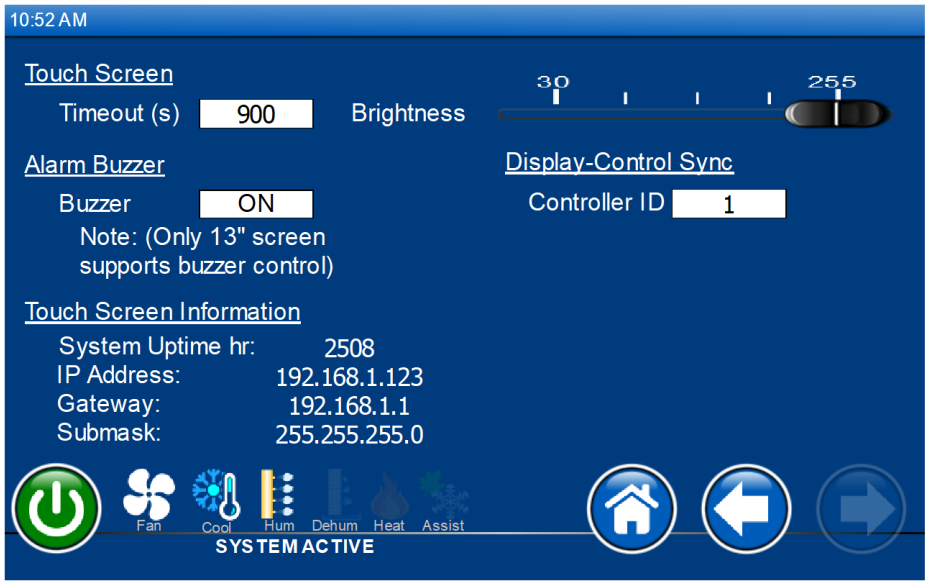


Figure 18. Display setup

- Manual Controls

  Analog and digital outputs can be overridden at any given time. Each outputs can be as follows (changes are reflected under value column):

Outputs	Channel	Option
Analog outputs:	AO[1:6]	Auto, ON, OFF
Digital outputs:	DO[1:18]	Auto, ON, OFF

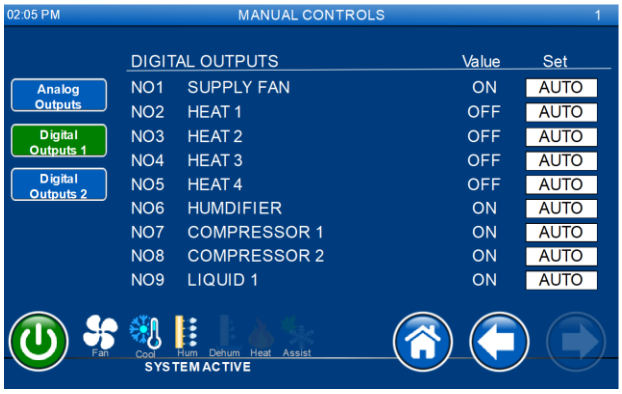


Figure 19. Manual controls

- Network

  The controller supports unit to unit communications via a Private Local Network also known as P-LAN. This communications supports up 32 units. P-LAN supports the following functions after the initial hardware and software setup.

  Lead/Lag function allows more than one units to be set as active and standby. Active units are functional and operate within its setpoints. Standby units are remained in waiting mode and ready to rotate based upon alarm events or a rotation timers.
  Alarm Switchover: Each unit can be individual configured to switch over to the standby units based on a user selectable alarm options.

  Network Assist functions allow both active and standby units to work in a teamwork mode. In case of a cooling, heating, humidifying, or dehumidification is needed, standby units can become active to assist bring the room down to its setpoints. Once the room setpoints are met, the standby units return to their offline stage.

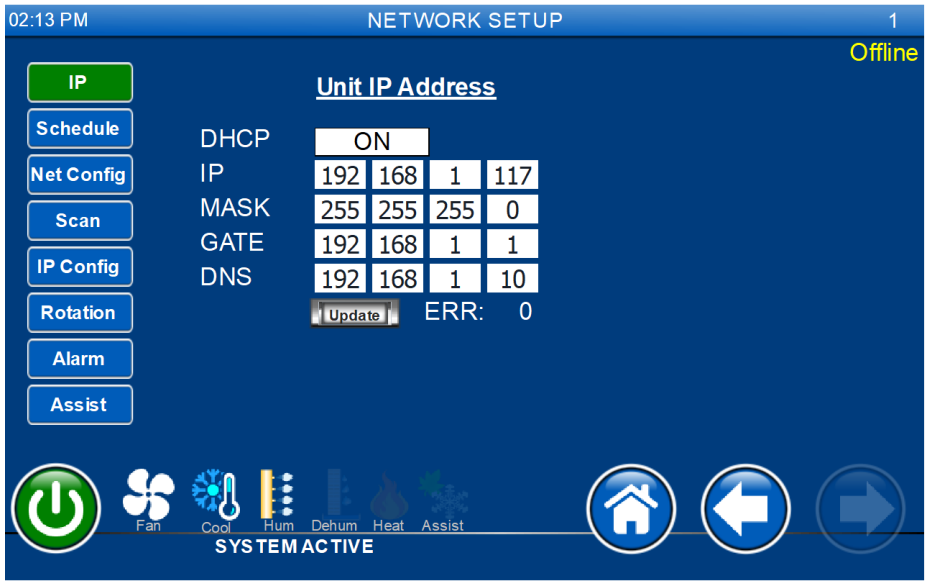


Figure 20. Network p-LAN menu

IP Address

Each controller in the network must be assigned a unique IP address. If DHCP option is set to OFF, a static IP address must be entered. Consult with IT department for an assigned address. This address is also used for BACnet BMS communication option.

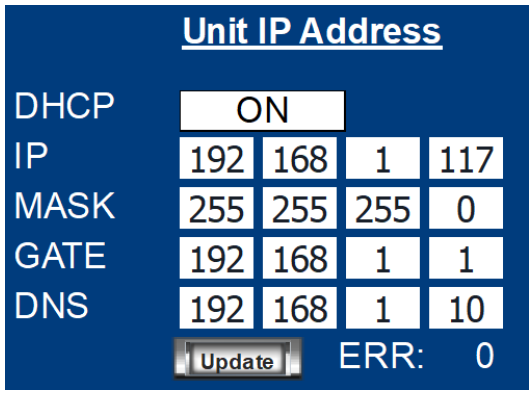


Figure 21. IP address

Schedule

Network rotation supports the following mode. Note that master unit is keeping track of all of the functions.

Mode	Description
OFF	No rotation allowed
Day of week	Rotation is based on selected day of the week such as every Monday
Date of month	Rotation is based on selected day of the month such as every 1st of every month
Num. of hours	Rotation is based on number of active hours

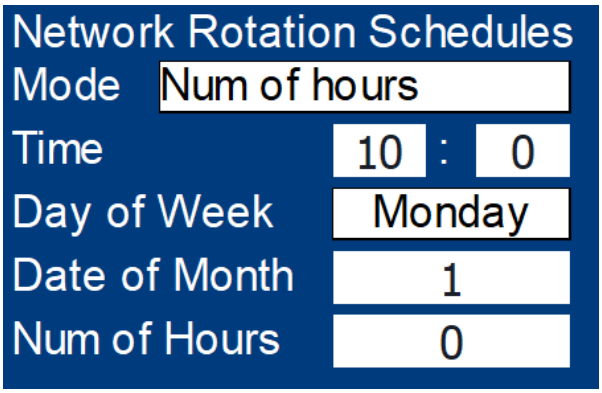


Figure 22. Rotation schedules

Net Configuration

By default, all System 2500 units are configured as standalone unit. To setup a network, a master and a minimum of one slave unit are required. The following modes are supported:

Mode	OFF, Slave, Master
Master poll	slave(s) heartbeat polling time
Slave poll	master heartbeat polling time
Network sensors	Sensor used for all networked units. **Internal:** Each unit shall use its own sensors **Master:** Each unit shall use master sensors **Average:** Sensors from all networked units are used as averaging

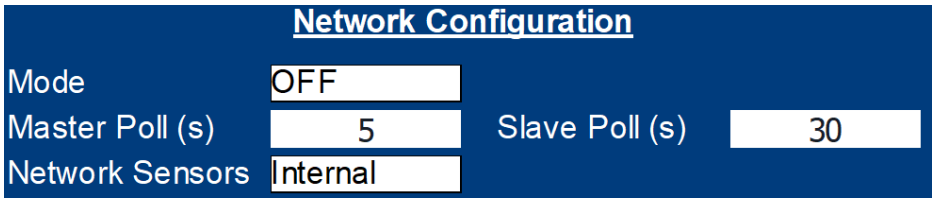


Figure 23. Network configuration

Scan

Use network scan function to discover all connected systems through their IP addresses. All system must be connected to the same network. If a scan is successful, all of the IP addresses get indexed and their current online/offline status are also reflected in the network mapping.

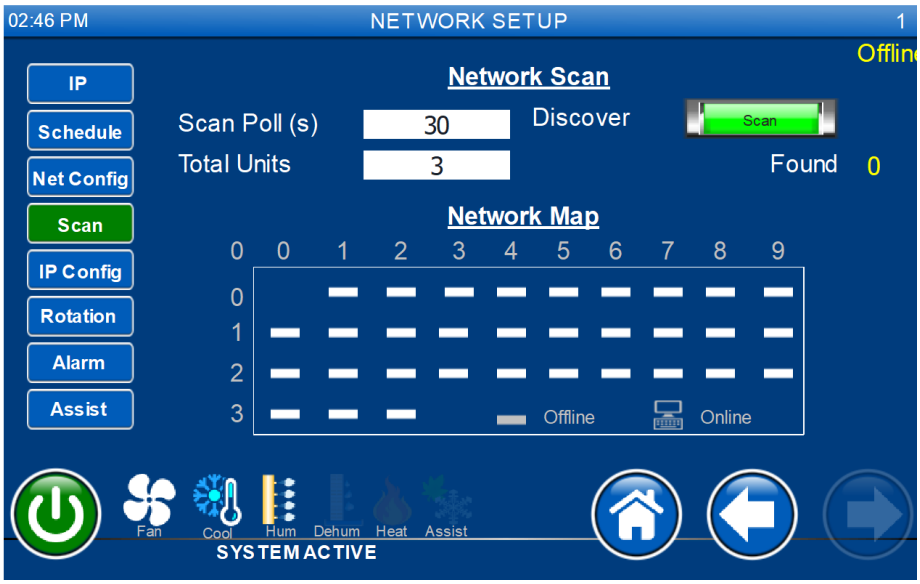


Figure 24. Network scan

Note: Total units value must reflect all the configured system.

IP Configuration

Master unit is assigned a base IP address. All the slave units are assigned in the mapping table as shown in the Figure below:

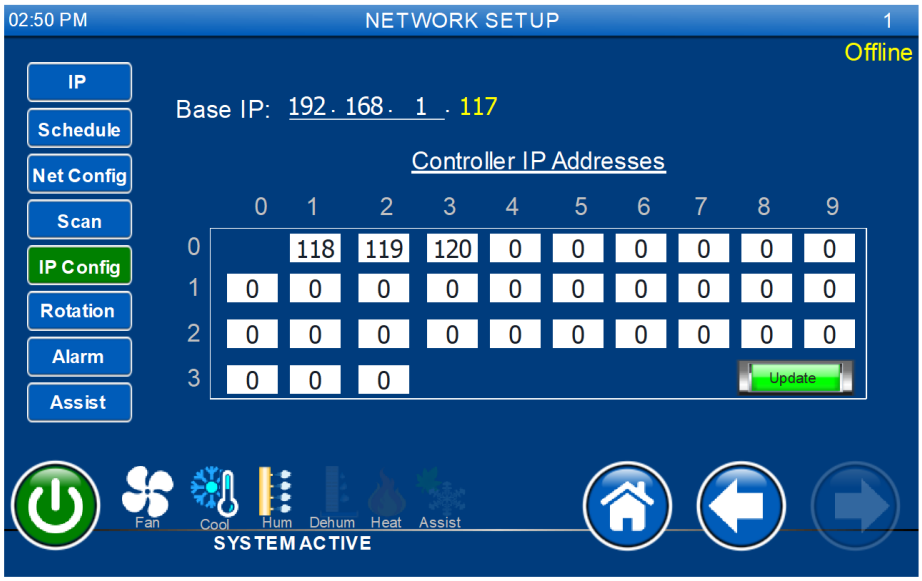


Figure 25. IP Configuration

The Figure above shows the following settings are configured.

Master IP	192.168.1.117
Slave1 IP	192.168.1.118
Slave2 IP	192.168.1.120

Rotation

Network rotation map is configured by setting units as **Active** or **Standby** Force rotation is also achievable through this menu.

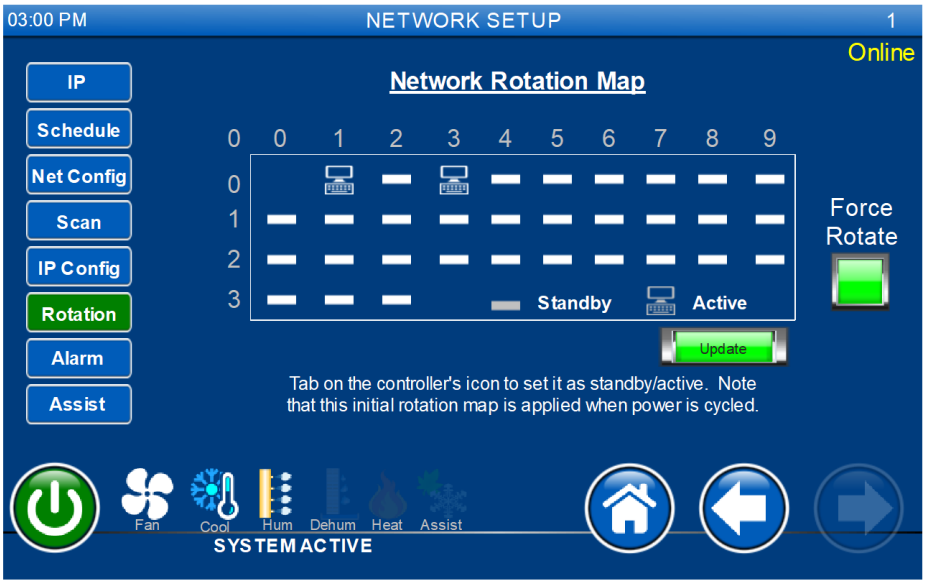


Figure 26. Network rotation map

The above image shows system 1 and system 3 are active. System 2 is set as standby.

Alarm

The following alarm options are support in P-LAN network. Once the alarm from each unit is active, the configured function shall take place.

Function	Description	Option
Temp hi/lo	hi/lo temperature alarm	ON/OFF
Hum hi/lo	hi/lo humidity alarm	ON/OFF
Compressor	hi/lo pressure alarms for all circuits	ON/OFF
Condensate	Condensate leak detector	ON/OFF
Smoke	Smoke alarm	ON/OFF
Pump	Condensate pump alarm	ON/OFF
Sensors	Sensor failed alarm	ON/OFF
Heater OL	Heater overload alarm	ON/OFF
Filter	Dirty alarm	ON/OFF
Keyboard Off	External keyboard (optional)	ON/OFF
Alarm	Alarm function	No action, next standby, all standby

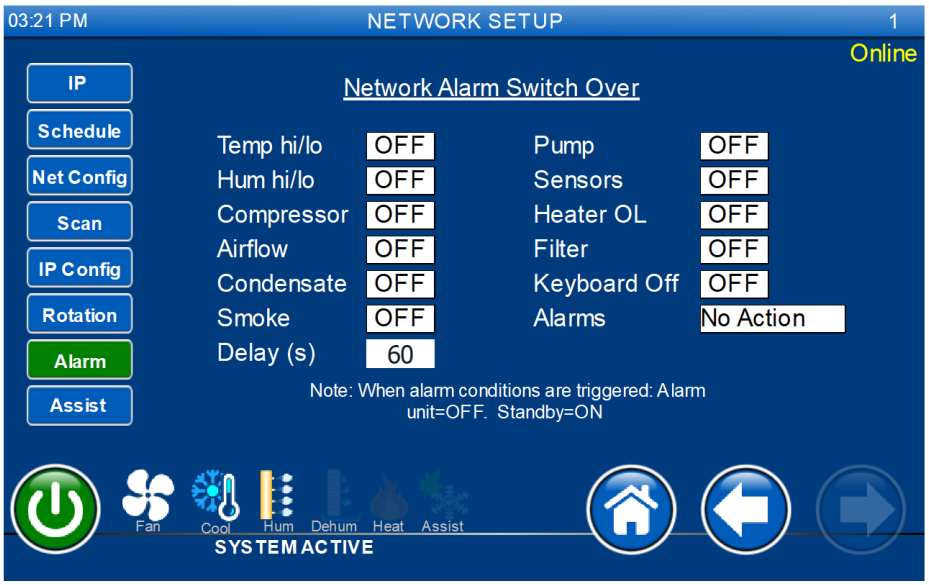


Figure 27. Network setup

Assist

The following network assist functions are supports. Once delay timeout, all standby units shall come online and perform assist function. Once setpoints are satisfied, previous standby systems shall go back in standby mode.

- Cooling
- Heating
- Humidity
- Dehumidification

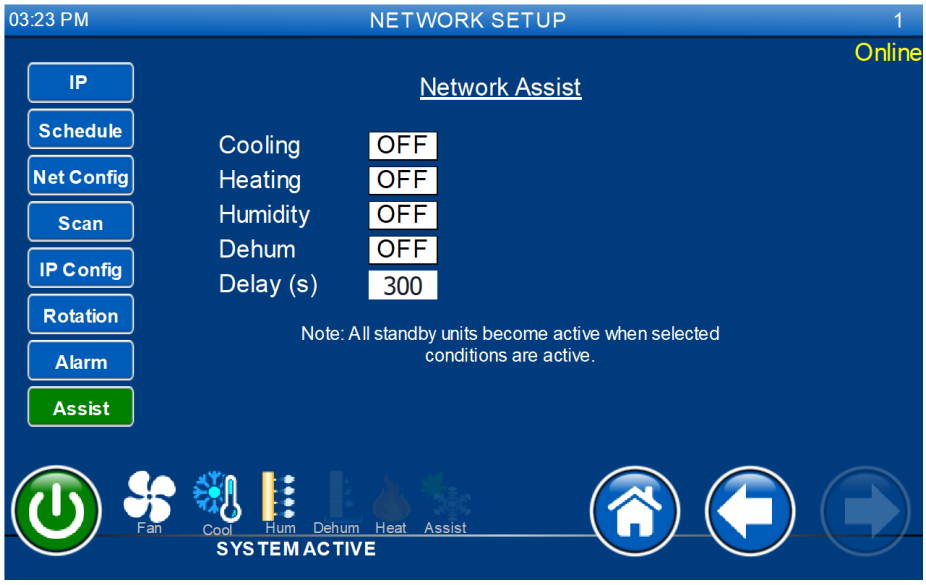


Figure 28. Network Assist

7.0 Factory Setup

Factory setup is reserved for qualified or factory tech. Changes to factory settings are not recommended without consulting with factory representative. Factory menu divided into sub categories including **Universal Inputs, Analog Outputs, Digital Inputs, Digital Outputs, HVAC, Load System Default, and Password**.

7.1 Universal Inputs

Each UI supports the following functions. For a typical setup, min and max values shall be left at default of 0 and 100 respectively.

UI[1:10]	Description
• OFF	No function
• RA temp	Return air temperature
• RA hum	Return air humidity
• MA temp	Mixed air temperature
• MA hum	Mixed air humidity
• OA temp	Outside air temperature
• OA temp	Outside air humidity
• DA temp	Discharge air temperature (after reheat if any)
• LPT1 PSI	Low pressure transducer for circuit 1 in PSI
• HPT1 PSI	High pressure transducer for circuit 1 in PSI
• LPT2 PSI	Low pressure transducer for circuit 2 in PSI
• HPT2 PSI	High pressure transducer for circuit 2 in PSI
• EFan FB[1:4]	Evaporator EC fan feedback voltages. Scale: 2-10Vdc.
• Water IN	Water in temperature
• Water out	Water out temperature
• Air DP	Air pressure differential transducer
• AVG temp[1:5]	Averaging temperature sensors
• Cond. Temp1	Condenser temperature 1 used in heatpump
• Cond. Temp2	Condenser temperature 2 used in heatpump
• User[1:3]	User sensor1, sensor2, and sensor3 inputs

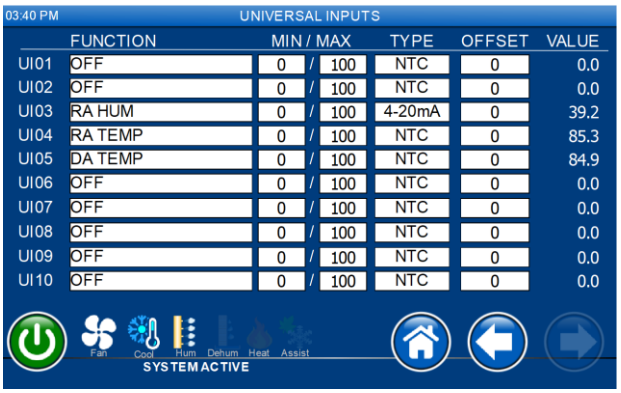


Figure 29. Factory setting analog inputs

7.2 Analog Output

All analog outputs support output voltage from 0-10Vdc. Min/Max function only takes effect when unit is active. All output shall become 0Vdc once system off has taken place.

Support function

- OFF No function
- Cool Cooling output
- Heat Heating output
- Humidifier Humidifier output
- Supply fan Supply fan output
- HG bypass Hotgas bypass
- Economizer Air or chilled water econ
- Condenser fan Condenser fan output. Requires HP transducer
- HG Reheat Hotgas reheat used in dehumidification
- Chilled water Chilled water output
- VFD comp Digital compressor output

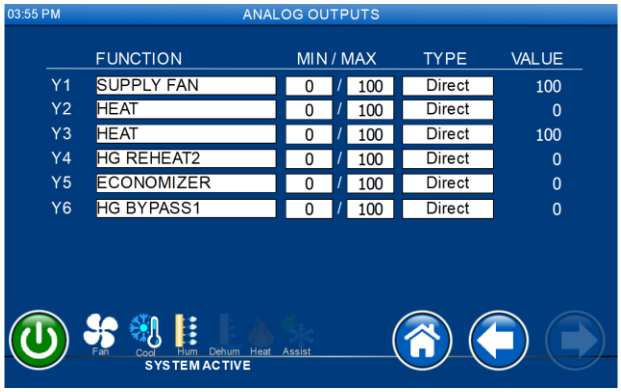


Figure 30. Factory Analog Outputs

7.3 Digital Inputs

The following input functions are supported:

- OFF No function
- Air flow No air flow switch
- Smoke al Smoke alarm
- Heater OL Heater overload
- Condensate WOF Condensate water
- Water Flow Water flow switch
- C1/2 low pressure
- C1/2 high pressure
- Pump al Pump failed alarm
- Remote On/OFF
- Fan overload
- Humidifier alarm
- Damper proof switch
- Compressor overload
- User1,2, 3

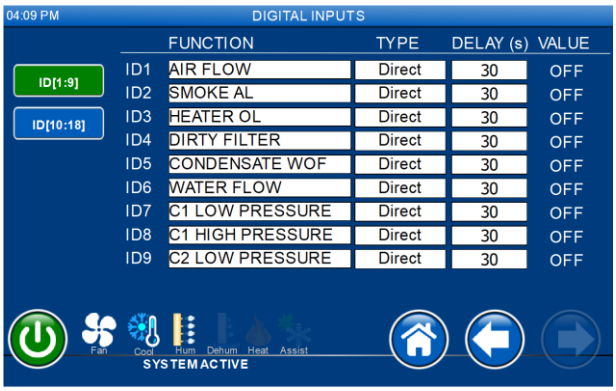


Figure 31. Digital Inputs

7.4 Digital Outputs

The following output functions are supported. Note that duplicated channels settings are allowed but not recommended unless instructed by the factory representatives.

Supported output functions:

- OFF
- Supply fan
- Heat 1, Heat 2, Heat 3, Heat 4, Heat 5
- Compressor 1
- Compressor 2
- Liquid 1
- Liquid 2
- Unloader 1
- Unloader 2
- Hot gas Bypass 1
- Hot gas Bypass 2
- Drain
- Selectable alarm
- Global alarm
- Humidifier
- Fan low speed
- Dehumidification

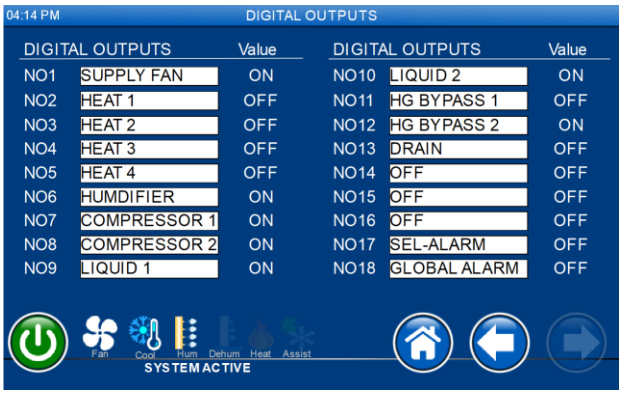


Figure 32. Digital Outputs

7.5 HVAC

HVAC provides options to fine tune controlled PID loop for: Evap fan, DX, Heat, Humidity, Dehumidification, Chilled water, Economizer, Assist, Hot gas bypass, and condenser outputs. Default values are shown below:

Control By	Input sensor
Type	Control type for PID, P
Dband	Deadband
Delay	Delay time in second before the output takes place
Bump	Output bump control
Set	Current setpoint
Kp	K proportional gain
Ti	Interval time
Td	Derivative time
Cycle	Cycle time in second

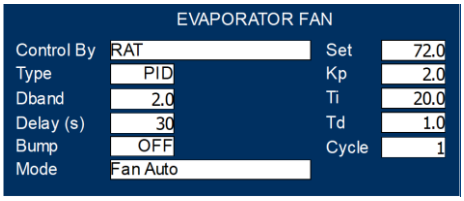


Figure 33. Evap PID tuning

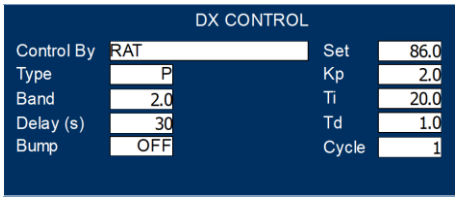


Figure 34. DX compressor PID tuning

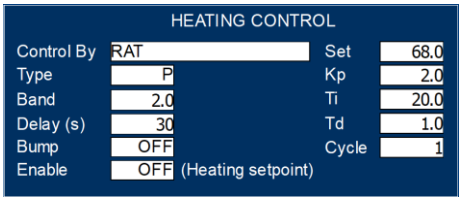


Figure 35. Heat PID tuning

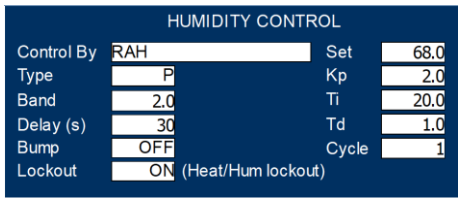


Figure 36. Humidity PID tuning

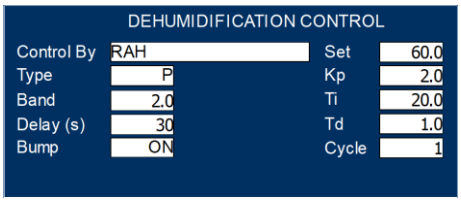


Figure 37. Dehumidification PID tuning

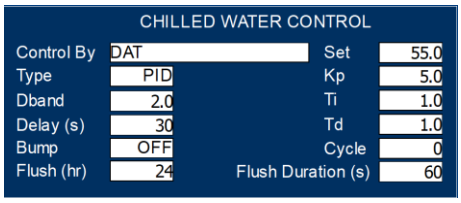


Figure 38. Chilled water PID tuning

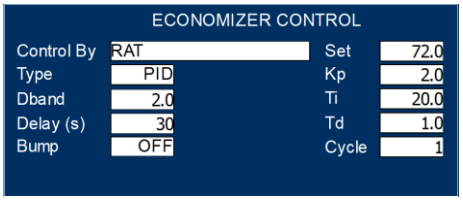


Figure 39. Economizer PID tuning

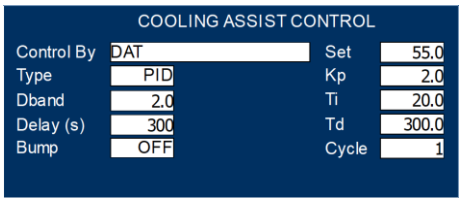


Figure 40. Assist PID tuning

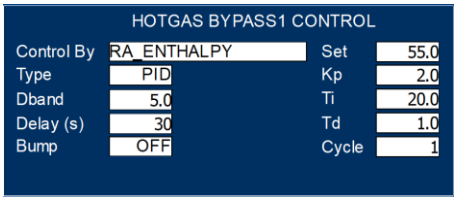


Figure 41. Hotgas bypass PID tuning

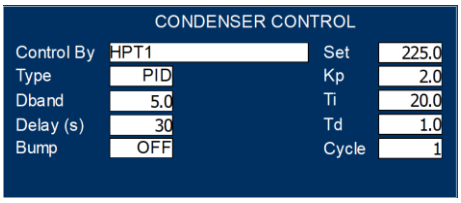


Figure 42. Condenser fan PID tuning

7.6 Loading System Default

Loading system default returns system predetermined stage. Do not load default without consulting the factory as it wipes out all previous settings.

7.7 Password

Only an admin can change user password. By default, technician password is not configured. Level 1 password allow changes of setpoint. Level 2 password grants access to technician menu. Level 3 password grants access to factory menu.

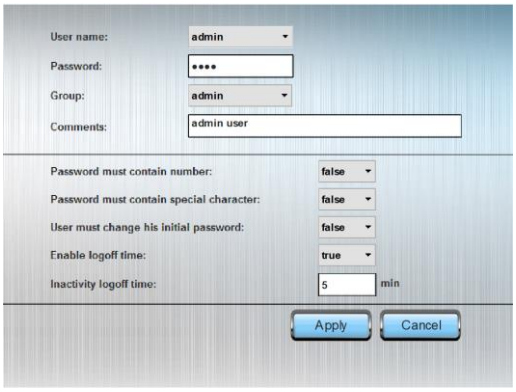


Figure 43. Password management

Note: *Viewing settings require a password*
***Level 1 Password** = 1* ***Level 2 Password** = 2* ***Factory Setting** = 1798*

7.8 Clock Setup

The controller features an internal clock. Current time and date are backed up by an internal Lithium-Ion battery. Consult the factory for battery replacement. To change the clock, press: Menu->Time & Schedule. Tap on the selective field and enter new value. Press the "Sync" button to synchronize new settings.

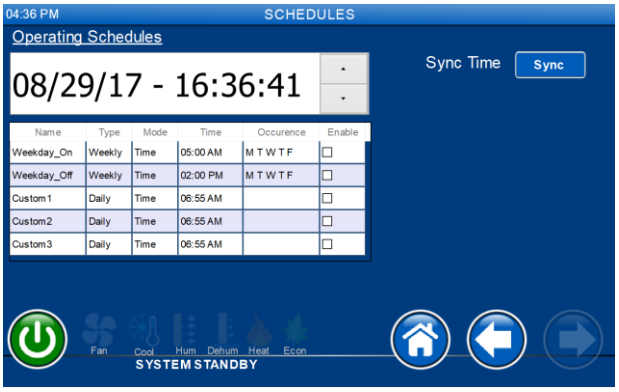


Figure 44 Date and time

7.8.1 Night Setback

The controller supports 7 days unoccupied and occupied modes. Separate temperature and humidity setpoints are available and take priority when the night setback mode is active.

To active the Night Setback, change its setting to “YES” and follow the on screen directions. Use the arrow keys to navigate through the different screens to program each individual day.

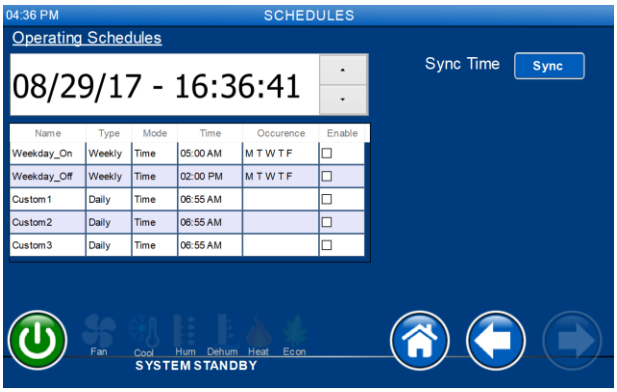


Figure 45. Night setback

NIGHT SETBACK IS ONLY AVAILABLE ON THE TOUCH SCREEN USER INTERFACE.

8.0 BUILDING MANAGEMENT SYSTEM (BMS)

In addition to the built in BMS ports, The System 2500 is capable of communicating with external remote **B**uilding **M**anagement **S**ystem (BMS) through the add on BMS Card interface. Supporting protocol is enabled by a plug-in communication card.

Figure 46 - Building management system

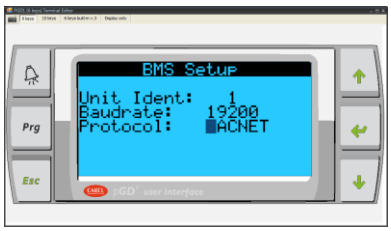


Figure 47 - Communication protocol

Protocol	Description	Default Baud Rate
Modbus	Serial communication through RS-485	19,200
LONWorks	LONTalk communication	4,800
BACnet MS/TP	BACnet over MS/TP	4,800
BACnet TCP/IP	BACnet over TCP/IP, SMNP, HTML, FTP	19,200

The controller also features an alternative method of networking multiple cooling units in a built in standalone pLAN network through terminal **J11**. Baud Rate setting under BMS menu is only applied for Modbus protocol. Other protocol required separate software interface. Consult factory for more information.

Default Setting:
Unit Identification: 1 Baud Rate: 19200 Protocol: Modbus

8.1 Modbus

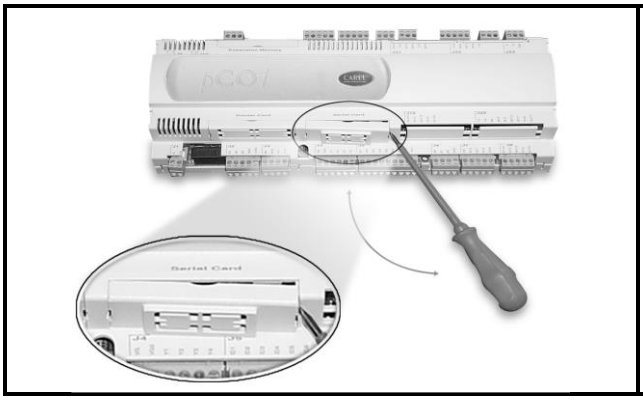
The controller supports an optional RS-485 card, which allows you to interface directly to a supervisory network RS-485. The max baud rate available is 19200 baud (it can be set by software).

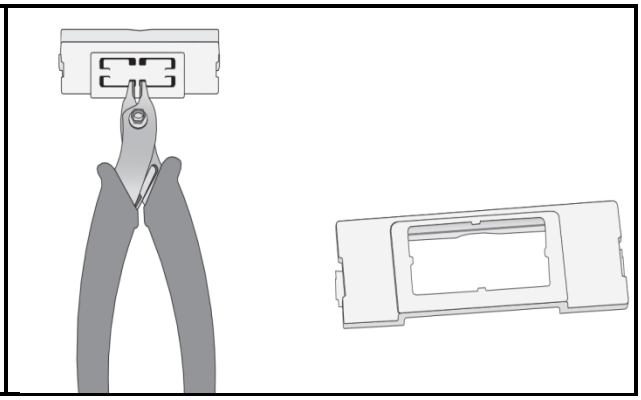
8.1.1 Mounting

To install the card in the unit follow these instructions:

1. Remove the "serial card" placement cover with a screwdriver.
2. Remove the pre-punctured plastic piece corresponding to the card being installed.
3. Insert the optional card into the corresponding connector; confirm the card is firmly placed on both plastic supports on the controller case.
4. Close the cover using the screwdriver making sure the outside card terminal fits within the punched hole made on the cover.

The connection with the RS485 network is carried out by means of the plug-in terminal connector on the card Pin-wiring of the connector is stamped on the card. If the card is placed in the last position of the supervision serial line, pins 2 and 3, you must connect a 120 Ω - 1/4 W end line resistors.





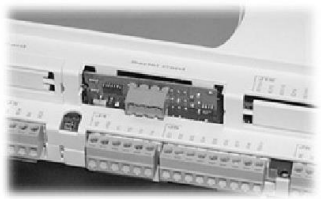
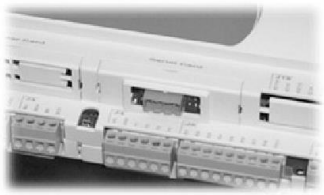


Fig. 3



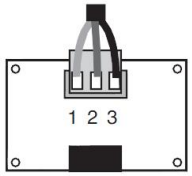


Fig. 5

pin	significato *meaning*
1	GND
2	RX+/TX+
3	RX-/TX-

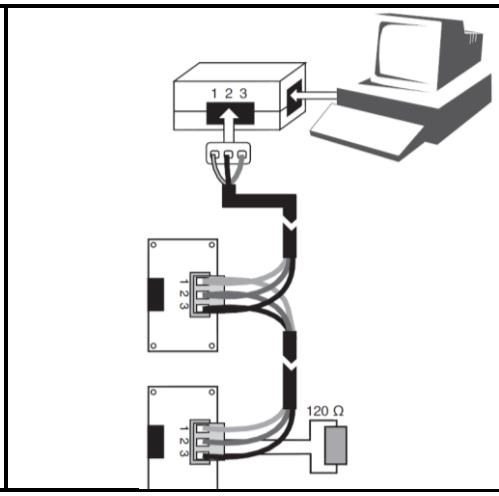


Table 4 - Modbus card installation

Warning

When handling the card, please follow the advice below. Electrical damage may occur to the electronic components as a result of electrostatic discharges from the operator. Suitable precautions must be taken when handling these components.

- Before using any electronic component or card, ground yourself (not touching the card does not prevent a spike, as static electricity can produce a 10000V spike discharge which can form an arc of about 1cm).
- All components must be kept inside their original package as long as possible. If necessary, take the board from its package and place it into an antistatic package without touching the back of the board with your hands.
- Absolutely avoid non-antistatic plastic bags, polystyrene or sponge.
- Do not pass the card directly to other operators (to prevent from electrostatic induction and discharges).

8.2 LONWORKS

The serial interface boards for LonWorks® networks are optional accessories for the controller which allows the controllers to be connected directly to a LonWorks® network.
The use of these boards requires knowledge of and experience with the LonWorks® network installation and maintenance tools.

8.2.1 General characteristics

Note: *The LONTalk card is preprogrammed at the factory. Commissioning the device is required to have proper readings when probing.*

The program installed on the board may correspond to a standard LonMark® profile. The board is programmed by the manufacturer when LonMark® profiles are used or in the field for custom profiles.

8.2.2 Physical channels

Depending on the model, the interface boards communicate via two physical channels, TP/FT-10 and TP-RS485-39, as described in the LonWorks® literature. The LONTalk card uses an Echelon® FTT-10 transceiver, approved for use on the TP/FT-10 channel. This channel has the following main characteristics:

- Allows the connection of a maximum of 64 nodes for each network segment.
- The nodes can be connected without any restrictions in the topology: that is, star, ring, on one bus only, or with any combination of these.
- Communication speed: 78,125 kbps.
- Maximum distance (Belden 85102 cable): 500m for connections between the nodes with free topology; 2700m for bus connections with double line terminator.

8.2.3 Physical Circuit Board Layout

1. Connector to the Controller
2. Terminal block for LonWorks® network (GND, A, B)
3. Service pin
4. Green service LED
5. Red fault LED

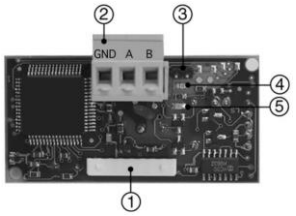


Figure 48 - LONTalk Card

Note: *The ground wire (GND) is not requires in some application.*

8.2.4 LED Color Description

The green service LED:

- Signals the status of the node, as per the LonWorks® protocol
- Hardware fault: always ON or always OFF
- Node configured (normal operation): ½ second ON, then always OFF
- Node NOT configured: flashing at ½ Hz
- Node without software application: 1 second ON, 2 seconds OFF, then always OFF
- Node in continuous reset: flashing
- Remains on during the activation of the service pin
- Remains on for one second when receiving a wink command via the network

The red fault LED:

- Signals problems in the connection between the board and the controller.

WARNING: If the red LED comes on make sure the instructions described under Installation have been carefully followed. THE COMMUNICATION BAUD RATE ON THE CONTROLLER HAS BEEN SET TO 4800 BAUD.

8.2.5 Installation

WARNING: Please use extreme cautions when handling the board. Electrical damage may occur to the electronic components as a result of electrostatic discharges from the operator. Suitable precautions must be taken when handling these components, specifically:

- Before handling any electronic component or board, touch an earthed object (simply not touching the component is not enough to prevent a spike, as static electricity can produce a 10000V discharge, which can form an arc of about 1cm).
- All materials must be kept inside their original package as long as possible. If necessary, take the controller from its package and place it into antistatic packaging, without touching the back of the board.
- Absolutely avoid non-antistatic plastic bags, polystyrene or sponges.
- Do not pass the electronic components or boards directly to other operators (to prevent electrostatic induction and discharges).

8.2.6 Connection to the Controller

With reference to **Figures 25-28** below, insert the board in the controller as follows:

1. Disconnect the power supply to the controller and use a screwdriver, remove the serial card cover.
2. Remove the pre-cut plastic part from the cover to make a rectangular window cutout.
3. Insert the optional board in the corresponding plug-in connector, initially holding it diagonally and then making sure it is properly inserted and pushed up against the two plastic supports on the case of the controller.
4. Close the cover and aligning the connector on the serial board with the hole made in the cover.
5. Reconnect the power supply to the controller. If the controller supervisor serial communication has been set to use the Carel protocol at 4800 baud, the red LED on the board will come on for a few seconds and then will go off immediately, indicating normal operation.

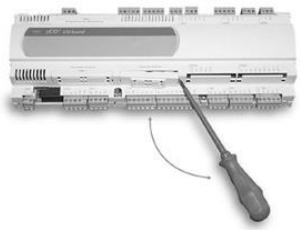


Figure 49 - Remove plastic cover

Figure 50- Cut out window

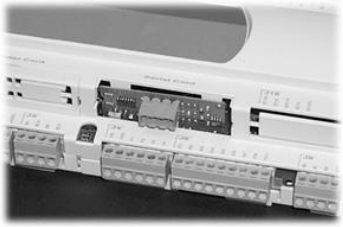


Figure 51 - Installing plugin card

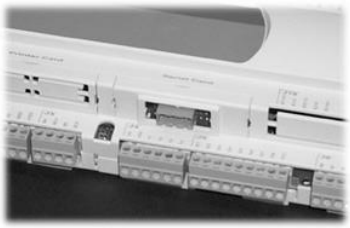


Figure 52 - Replacing windows cover

8.2.7 Connection to the LonWorks® network

The physical connection to the LonWorks® network is performed using the connector with removable terminals fitted on the board, according to the Echelon® instructions and specifications. For further information on installation, maintenance, the cross-section and type of cable, refer to the LonWorks® literature.

8.2.8 Service pin

To activate the service pin, simply momentarily short-circuit the two pins on the board (see Figure 24) with the tip of a screwdriver or a similar tool. The service pin must only be activated

during the installation of the node. When the pin is activated, the node sends a broadcast message over the LonWorks® network, containing the information required for identification.

8.2.9 WINK event

A generic supervisor can send the WINK command to a specific node on the LonWorks® network. This generates an event that the application on the specific node can respond to with any action decided by the programmer. In this specific case, the service LED on the interface comes on for one second, thus making it possible to check the correct operation of the connection between the interface and LonWorks® network.

8.3 BACNET OVER TCP/IP For BMS Card Add ON

8.3.1 Installation

The board is installed in the controller, when off, as follows

1. Remove the “Serial Card” cover from the controller using a screwdriver.
2. Insert the board in the corresponding plug-in connector, making sure it is fully inserted and in contact with the two supports located on the case of the controller. This operation may be difficult due to the limited space, consequently, it is recommended to insert the board at an angle and then turn it until aligning the connectors.
3. Close the cover again, using the cover supplied with the board, lining up the connector on the serial board with the opening in the cover.
4. (OPTIONAL) Stick one or both labels supplied outside and/or inside the electrical panel near the controller, so that the MAC ADDRESS can be read without needing to open the electrical panel for the connection to the Ethernet network, use an S/FTP cable, category 5e or higher.

8.3.2 Functions

The pCOWeb board is used to connect the controller to an Ethernet network and consequently perform the following functions.

- Access the information on the controller (network variables and parameters) using an Internet browser, such as Internet Explorer™ installed on a PC and connected to the pCOWeb via TCP/IP (see Web server)
- Connection to a supervisory network that uses one of the following standard protocols
  - SNMP v1 & v2c
  - BACnet Ethernet ISO8802-2/8802-3
  - BACnet/IP

8.3.3 Default parameters

In order to access the configuration (see the Configuration section), the pCOWeb can be started using the “factory bootswitch parameters”:

- **IP address= 172.16.0.1 Net mask= 255.255.0.0;**
- **“root” user password: froot**
- **“httpadmin” user password: fhttpadmin**
- **“guest” user password: fguest**

To start the pCOWeb with default parameters, proceed as follows:

When the pCOWeb is off:

- Switch on the controller with the pCOWeb already inserted and hold the button for at least 20 seconds, until the status LED starts flashing SLOWLY 3 times, red-dark;
- Release the button while the LED is flashing, after having flashed 3 times, the LED turns green, then, to confirm the recognition of the button, the LED will flash QUICKLY 3 times, red-dark.
- To complete the pCOWeb boot phase, wait approximately 50 seconds until the status LED flashes regularly. From this moment on, the pCOWeb can be accessed via the network.

When the pCOWeb is already on:

- Restart the pCOWeb software (see "Restarting the software")
- After restarting, proceed as above for when the pCOWeb is off.

Note: *In "factory bootswitch parameters" mode, the pCOWeb does not save the parameters recalled, but simply uses them, and therefore, when next restarted without pressing the button, it will use the parameters set by the user (if just acquired, with DHCP)*

8.3.4 Restarting the software

To restart the software when the board is in stable operation (that is, with the status LED flashing regularly), press and hold the button for between 5 and 10 seconds; after around 10 s from releasing the button, the status LED will stop flashing, and after a further 15 seconds the software on the board will restart.

8.3.5 Configuration

Note: *For the correct operation of the pCOWeb, a number of basic parameters need to be set, such as the IP address and Netmask; each device connected to an Ethernet network, to communicate with a host, must have a unique IP address.*

PCOWeb is supplied with the DHCP function already active. Therefore, in a network served by a DHCP server, pCOWeb will automatically acquire the necessary parameters without requiring configuration. In the case of a network without DHCP, the parameters need to be configured manually (see the "Accessing the user configuration..." section).

Accessing the user configuration (via Ethernet network and configuration web pages)

Automatic network configuration (DHCP): ask the network administrator for the address that has automatically been assigned to the pCOWeb already connected; the administrator will need to know the MAC ADDRESS of the pCOWeb.

Network without DHCP: when first using the board, it is recommended to connect pCOWeb directly to a computer using a crossed Ethernet cable; then start the board with the "factory bootswitch" parameters (see "Pushbutton").
To allow the PC to access the pCOWeb:

- The PC used for the configuration must be in the same sub-network as the pCOWeb; set the network parameters on the PC as follows:
    - IP address= if DHCP: ask the network administrator; with "factory bootswitch parameters": 172.16.xxx.xxx (with xxx.xxx as desired, as long as different from the 0.1 already used by pCOWeb);
    - Netmask= 255.255.0.0.
- The browser on the PC must have the option corresponding to the use of a proxy server disabled. If the network settings on the PC and the browser are correct, typing the IP address of the pCOWeb in the address bar will access the default home page of the pCOWeb. Then enter the area reserved for the administrator, using the special link (Go to Administrator Area) and the following pre-set account:
    - username= admin
    - password= fadmin

The basic parameters for communication and access are located in the "Configuration" area. Choose "Network": the primary IP address of the board and three aliases can be set.

To configure the DHCP function type "DHCP" in the place of the IP address. If the network does not use DHCP, ask the network administrator for a valid IP address and Netmask for the local network that the controller will be connected to.

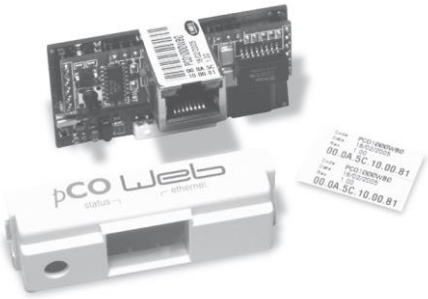


Figure 53 - PCOWeb

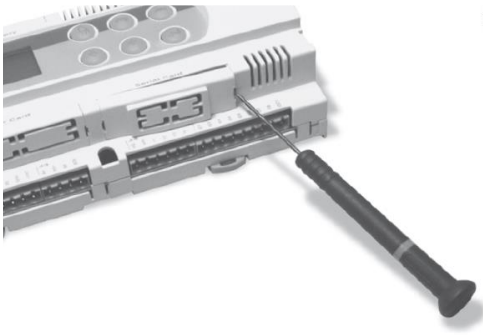


Figure 54 - Window cover

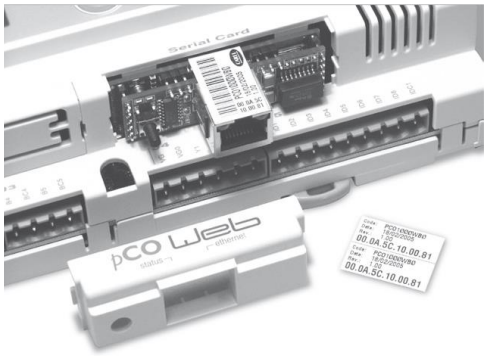


Figure 55 - Installing PCOWeb

Figure 56 - Installing plastic cover

Note: *The parameters recalled with the "Pushbutton" cannot be modified and must not be confused with the values that are modifiable by the user. For a complete description of all the parameters that can be set, consult the factory for user manual.*

8.3.6 Web server

The web server included in the pCOWeb is "thttpd", compliant with the HTTP 1.1 specifications, and is used to display HTML pages directly on the Internet browser. A client application can thus control and monitor the controller that the pCOWeb board is installed on from a remote location.

The HTML pages can be easily created and downloaded to the pCOWeb by the end user with any FTP client. Common programs can be used to create the custom HTML pages (e.g. Macromedia® Dreamweaver™ or Microsoft® FrontPage™) and download them to the pCOWeb via FTP client such as SmartFTP™ (www.smartftp.com).

8.3.7 Accessing the operating system by authentication

The system can be accessed via a telnet terminal or via FTP. Authentication with user name and password is required for each access. The following users are registered.

User Name	Description	Default Password	Allowed
root	administrator of the operating system	froot	no limitation

httpadmin	web administrator	Fhttpadmin	R/W access to the http directory; read-only to the other directories.
guest	guest	fguest	

Table 5 - PCOWeb passwords

The password can be modified by accessing the administrator page. The password recalled with the "Pushbutton" function will not be modified and must not be confused with the passwords that are modifiable by the user. This page can also be used to set the access restrictions for each of the various directories in the http tree. Consequently, connecting via FTP and logging in as the web administrator, as follows will access the pCOWeb user file system

- username= httpadmin;
- password= fhttpadmin (note "f" as in "factory" as the first letter).

The customized pages should be saved in the following directory: /usr/local/root/flash/http.

Note: *The pages downloaded to the pCOWeb must have the correct properties and be able to be displayed with a browser; setting these attributes correctly via FTP is quite difficult, and consequently the "auto-set attributes" function is available in the administrator pages. To activate this function, simply click the "Adjust HTML pages attributes" link; it is recommended to do this whenever modifying one or more HTML pages.*

8.3.8 CGI script

CGI scripts can be written in bash language or compiled languages. These must have the .cgi extension and must reside in the http/usr-cgi directory. As for the HTML pages, these files must also have the properties correctly set and enabled. IMPORTANT: It is recommended to click on the "Adjust HTML pages attributes" link whenever modifying one or more .cgi scripts.

8.3.9 SNMP

PCOWeb is able to communicate using the SNMP protocol (v1 & v2c). It therefore acts as a gateway between the CAREL proprietary protocol and SNMP. The information available via SNMP relates to all the data sent to the supervisors by the application loaded on the controller.

PCOWeb manages some standard traps and allows a trap to be defined for each digital variable on the controller. The parameters relating to the management of the SNMP protocol can be set using the administrator configuration pages.

8.3.10 BACNET

PCOWeb is able to communicate using the BACnet protocol over Ethernet:

- ISO8802-2 over 8802-3;
- BACnet/IP.

It acts as a gateway between the controller proprietary protocol and BACnet. The information transferred involves all the data sent to the supervisor by the application loaded on the controller.
The parameters relating to the management of the BACnet protocol are set using the administrator configuration pages.

8.3.11 WARNINGS

Precautions when handling the board!

The electrical damage that occurs to electronic components is almost always due to electrostatic discharges caused by the operator. Consequently, suitable precautions must be taken when handling these components, in particular:

- Before handling any electronic component or board, touch an earthed object (avoiding contact with a component is not sufficient, as a 10,000 V discharge, a voltage that can easily be reached by static electricity, creates an arc of around 1 cm);
- The materials must remain as long as possible inside their original packages. If necessary, remove the board from the packing and then place the product in antistatic packaging without touching the sides of the board containing the electronic components;
- Always avoid using plastic, polystyrene or non-antistatic materials;
- Always avoid passing the board between operators (to avoid the phenomena of electrostatic induction and consequent discharges).

8.4 BANET over MS/TP For BMS Card add on

Optional add on board is available for BACnet over Master/Slave application.

8.4.1 Installation

1. Disconnect the power supply from the controller and remove the “Serial Card” cover.
2. Insert PCOnet card in the plug-in connector, making sure that it is fully inserted and in contact with the two supports on the controller. As there is little space available, this operation may be complex: as a result, insert the PCOnet card at an angle then tilt it back until the connectors’ line up.
3. Insert the required jumpers (see below for the meanings of these).
4. Fit the cover supplied with the PCOnet.

Note: *If the device used to read the data from the 485 network is grounded and the RS232-RS485 converter or the RS485 serial port on the device have functional insulation of less than 2kV, connector G0 on the controller must be grounded. The board cannot be installed in direct contact with the metal panel on the electrical panel.*

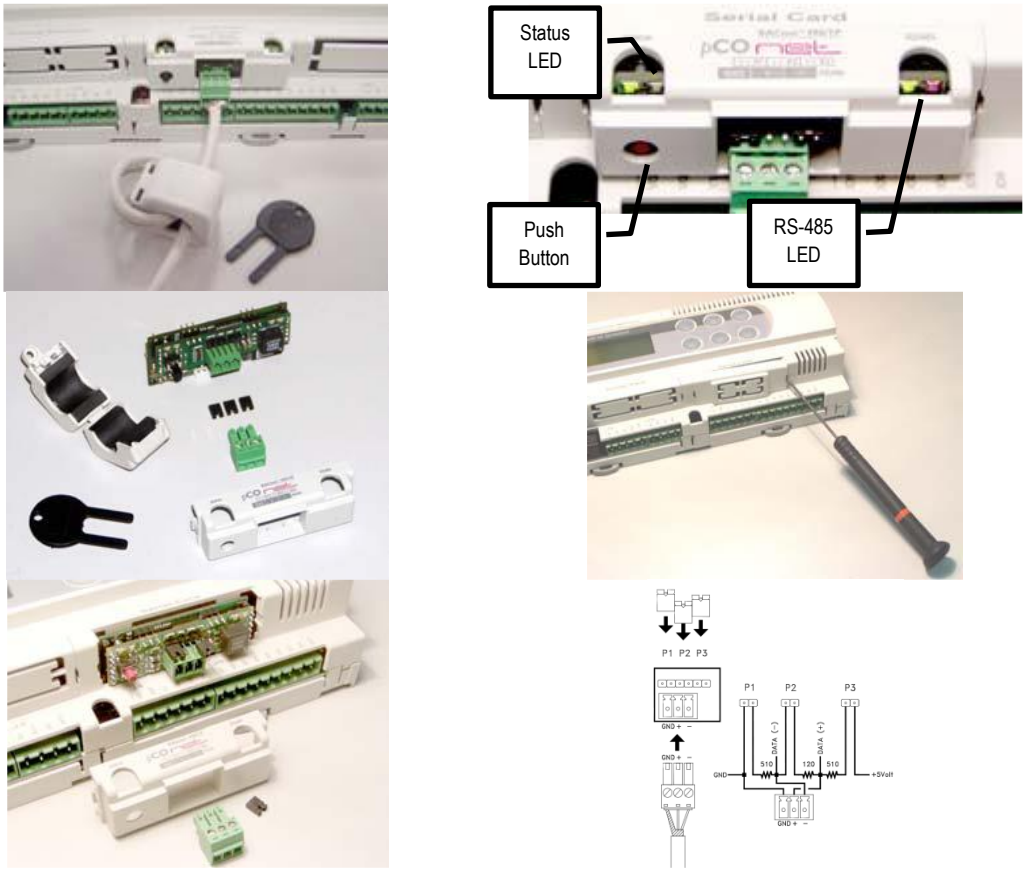


Table 6- Installation guide

8.4.2 Meaning of the jumpers

Jumpers P1, P2 and P3 are located inside the front opening of the cover. See table 7 for installation guide.

- Jumper P1 adds a 510 ohm polarization resistance between the negative data line (-) and GND
- Jumper P2 adds a 120 ohm terminal resistance between the two data lines (+) and (-);
- Jumper P3 adds a 510 ohm polarization resistance between the positive data line (+) and the +5 VDC internal voltage.

Insert all three jumpers on the unit at the start of network and the unit at the end of the network. Do not insert the jumpers on the intermediate units. For compliance of the product with the European EMC standards, add the ferrite supplied to the network cable, as illustrated in Table 7.

8.4.3 Operation

The Status LED (left) indicates the status of communication with the controller and the status of the PCOnet.

Starting sequence: on power-up, or after restarting PCOnet, the Status LED switches in the following sequence:

- OFF for 2 seconds;
- 2 seconds after restarting: quick flash red-green-red-green
- 5 seconds after restarting: green on steady
- Approximately 50 seconds after restarting: flashing (color: see below - Status of communication with the controller) PCOnet-pCO* communication starts.

Status of communication with the controller: Once the starting sequence has been completed, the Status LED flashes to indicate the quality of communication with the controller:

- Quick green-OFF-green if communication with the controller is OK (pCO* ON-LINE);
- Slow red-OFF-red if communication has not been established with the pCO* (controller OFF-LINE)
- Green-red-green if PCOnet detects errors or a temporary lack of response from the controller.

The RS485 LED (right) indicates the status of communication with the BACnet MS/TP network (RS485). The LED shows the following information:

Starting sequence: on power-up or after rebooting PCOnet, the RS485 LED switches in the following sequence:

- Off for approximately 50 seconds;
- Approximately 50 seconds after restarting PCOnet: slow green–red–green–red: at the end, BACnet will be active.

Status of communication with the BACnet MS/TP network: once the starting sequence has been completed, the RS485 LED flashes to indicate the quality of communication with the BACnet MS/TP network:

- Green with occasional red flashes if communication is OK (BACnet MS/TP meaning: green ON = PCOnet keeps the Token (control of the MS/TP network); green OFF = PCOnet DOES NOT keep the Token; red on = Poll-For-Master, search for a Master to pass the Token to)
- Green and red ON together (BACnet MS/TP meaning: continuous Poll-For-Master): communication not established (connection problems, or no network device found); this may depend on electrical connection difficulties or communication settings that are not compatible with the other network devices connected. See the section on configuration.

The Pushbutton Function

- restart PCOnet
- recall the factory configuration

Restarting PCOnet

With the board on and in stable operation (Status LED flashing continuously), hold the button for more than 5 seconds and no more than 10 seconds. Approximately 10 seconds after releasing the button, the Status LED will stop flashing, and 15 seconds later PCOnet will be restarted: Status LED quickly flashing red-green-red-green.

8.4.4 Recalling the factory configuration ("factory bootswitch" mode)

With the following procedure, PCOnet uses the default parameters instead of the ones specified by the user. See the table of parameters and factory values in the section on Configuration. In "factory bootswitch" mode, PCOnet does not save the recalled values, and consequently when next restarted without pressing the button, PCOnet will again load the user settings. When purchasing PCOnet, the user parameters are set to the factory configuration values.

With PCOnet OFF:

- Switch PCOnet on (i.e. switch on the pCO* controller with the PCOnet board inserted) by pressing and holding the button for at least 20 seconds: the Status LED will flash SLOWLY 3 times, red-off
- Release the button while the LED is flashing: after 3 red flashes, the LED comes on green; the LED then confirms recognition of the button by flashing QUICKLY 3 times red-off, and then comes on green again

Complete start-up of the PCOnet will take another 40 seconds, then the RS485 LED starts flashing; only from this moment on can PCOnet be accessed via a remote connection.
With PCOnet already ON:

- Restart PCOnet (see above: Restarting PCOnet)
- After the restart procedure, follow the steps described above for PCOnet OFF

8.4.5 Configuration

Configuring the PCOnet parameters for correct communication over an MS/TP network:

- Connect PCOnet via RS485 to a computer: during configuration, the CAREL product code CVSTDUMOR0 for USB ports can be used.
- Converters should not be used in the installation due to the large volume of data transmitted across a complex BACnet™ network.
- Install the CAREL "BACset" configuration tool, available free-of-charge at ksa.carel.com.

Note: *If the values of the PCOnet parameters are not suitable, communication with BACnet may not be possible. To connect to PCOnet, restart PCOnet using "factory bootswitch" mode (see the section on Operation - Pushbutton).*

8.4.6 BACNET Parameter Description

Device Instance

This is a number that uniquely identifies a device inside the BACnet® network (the BACnet® network can also include non-MS/TP BACnet® devices). If two units have the same Device Instance, identification errors will be generated.

Station Address

This is a number that differentiates the units in the BACnet® MS/TP network. If two units have the same Station Address, identification errors will be generated. To speed up the data exchange between the Master units, the Station Address of the Master units should start from 0 and continue without skipping any numbers.

Max Info Frames

This establishes the maximum number of information packages exchanged, above which the Master unit will give up control (Token) of the network to another Master unit. It thus indirectly establishes a sort of priority between the Master units in the network: high numbers guarantee the Master a higher data exchange volume.

MaxMaster

To speed up data exchange between the Master units, Max Master should be set to the Station Address of the Master with the highest Station Address. In fact, each Master, after having used the network, passes over control to the next Master. The Max Master parameter specifies to PCOnet the address of the network Master with the highest Station Address: using this parameter, PCOnet will know that there is no other Master with a higher Station Address than Max Master; PCOnet will then give control of the network to the next Master, however not beyond Max Master; if no next Master is found, the cycle will begin again, with control being given to the Master with the lowest Station Address.

Baud Rate

Data transfer speed. The Baud Rate must be the same for all the devices connected. Otherwise the exchange of data will generate communication errors. For extended networks, low baud rates should be specified, as these guarantee less communication errors. If Baud Rate=76800, make sure the device supports this communication speed. This baud rate is not supported by the RS232 serial port on a normal PC.

Parameter	Min	Max	Factory
Device Instance	0	4194303	**77000**
Station Address	0	127	**0**
Max Master	0	127	**127**
Max Info Frames	0	255	**20**
Baud Rate	9600, 19200, 38400,76800		

Table 7 - BACnet MS/TP parameters

9.0 TROUBLESHOOTING GUIDE

SYMTOM	POSSIBLE CAUSE	REMEDY
Black screen	Loss of power	Check 24Vac at controller and display
No link	Wrong unit ID	Check Unit ID. See "**pLAN setup"** for instruction.
	Incorrect wires	Check wiring on J11 from the controller to the display.
	Loss of communication link between controller & display	Make sure the controller and display get proper 24Vac voltage.
	Cable length	Check to make sure cables meets specification and not exceeding 200 meters for 24AWG.
Buzzer ON	Alarm events	Press the Alarm button to view the alarm. Press up/down arrow key to view next alarm.
	Alarm reset	Press the alarm button following by pressing the down arrow key until "Reset" shows on the screen. Tap the Reset button on the screen to clear the alarm.
Screen nonresponsive	Missed calibration	See "Screen Calibration" for detail on recalibration.
Modbus not communicating	Cabling	Check to make sure cable is comply with standard and not exceeding **1000 meters**.
	Speed	Make sure computer and controller are set to the same speed. Default speed on the controller is **19.2k.**
	Add-on card not installed properly	Verify that the card is installed properly. Check the matting connectors with a flash light. Check for status light.
LONTalk not responding	Cabling	Verify the physical wires between the controller and the BMS system. A parallel cable should be in used.
	Not commission	Decommission and commission the card. Use a **Wink** command to check response.

	Wrong speed configured	Verify that the speed is set to 4800 from the controller under **"Supervisor Setup".** Check for LED status error code.
	BMS not accessible	Verify that the card is setup properly
PCOWeb fails communication	Wrong cable	A crossed over cable is required for direct connection from PC to controller
	Add-on card not installed properly	Check for proper matting connectors between the controller and the add-on card
	Incorrect IP	Check DHCP server for correct IP. Boot up in factory setting for default IP: 172.16.0.1 to assign static IP. See PCOWeb setup for detail
Wrong Temperature or Humidity reading or sensor fail	Wrong jumper setting	Pop open the sensor module and verify that the setting on the temp/hum sensor board is set to 0-1V
	Power supply	Check for proper 24VDC coming on +G and GND at the sensor board
	Water damage	Check for water condensation on the probe. Dry it out for any moisture. Relocate the sensors if necessary.
	Wrong offset / Calibration	Check for sensor offset and recalibrate against a reference point if necessary.
Alarm not reset	Alarm source not rectified	Check for the cause of the alarm. The alarm cannot be cleared if the cause of the alarm still persists.
Stuck in Manual Mode	Force components ON	Set all components under "Manual Ctrl" screen to Auto mode
Compressor not ON	Incorrect setpoint	Check system setpoint for cooling temperature. Compressor only runs when temperature drops below room setpoint.
Reheat Lockout	Over amp protection	System incorporate a reheat lockout if cooling and humidifier are ON

High Temperature	Temperature rises above max setpoint	Room is too hot. Check sensor and reset alarm after fixing the problem.
Low Temperature	Temperature drops below min setpoint	Room is too cold. Check sensor and reset alarm after fixing the problem.
High Humidity	Humidity rises above max setpoint	Too much moisture in the air. Check and reset the alarm after fixing the problem.
Low Humidity	Humidity drops below min setpoint	Room is too dry. Check and reset the alarm after rectify the problem.
No Air Flow	Static pressure drop	Check motor, duct work, and filter. Reset the alarm after rectifying the problem.
	Sensitive switch	Check and recalibrate the switch if necessary. Consult the electrical wiring for more detail.
Dirty Filter	Clogged filter	Check and replace filter if necessary
	Sensitive switch	Check the dirty air filter switch and recalibrate the sensitivity level if necessary. Consult the electrical wiring for more detail.
High Pressure	Refrigerant pressure rises above limit	Check the high head pressure and reset the alarm after a manual reset on the pressure switch.
Low Pressure	Refrigerant pressure drops below limit	Check for low pressure switch. Change low pressure bypass time out and reset the alarm after rectifying the problem.
Compressors short cycling	Compress ON/OFF too frequent	Check discharge and return air temperature. Adjust compressor Max ON if needed.
Heater Overheat	Heater overload	Check if heater is overloading. Check and reset alarm after rectifying the problem
	Incorrect trigger level	Verify setting under “Technician->DI Setup->Heater Overheat” Alarm IF=Closed

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