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Controller Operation Manual

A+V Adiabatic Cooler

ENG00020912 Rev 0



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1. INTRODUCTION

1.1. Controller overview

- 1.1.1. The Colmac Coil Fluid Cooler/Air-Cooled Condenser controller can be used to specify operation for the EC fans and adiabatic water supply valve when included with the unit.
- 1.1.2. The specific unit documentation should be referenced when changing setpoints or other control parameters.
- 1.1.3. A variety of control options are available for specifying whether the unit should operate, whether and when the EC fans should operate, and whether and when the adiabatic water supply should open.
 - A manual mode is available for all controller functionality, enabling the user to test operation and verify functionality directly. This mode can be used to directly specify EC fan speed or to enable fans and let the controller specify speed, as well as to directly open or close the adiabatic water supply valve.
 - A “Run” signal can be provided by the BMS using Modbus RS486 or Ethernet IP, by a user-provided contact, by a set schedule, or by a manual selection at the controller. See unit wiring diagram and documentation for connections and requirements for these options.
 - A “Dry Out” mode is available that can be scheduled during which the fans will operate and the adiabatic water supply will be disabled. This mode can be used to improve longevity of the adiabatic pads which should be fully dried out at least once per 24 hours.
- 1.1.4. The controller additionally features two special modes with setpoints designed to minimize either water or fan power usage.
 - **Water Saving Mode** will cause the unit to run using the adiabatic supply water less frequently. This mode will only activate adiabatic pre-cooling when the ambient temperature is over the set minimum adiabatic operating temperature and the fans are operating at or above high operating speed (typically 80-90% of max speed). In this mode, the adiabatic water supply will only be used when desired operating fluid conditions cannot be met using fans alone, resulting in overall higher fan power usage but lower water consumption in most conditions.
 - **Energy Saving Mode** will cause the unit to prioritize adiabatic water supply in order to reduce fan power consumption. This will activate adiabatic pre-cooling whenever the ambient temperature is over the minimum adiabatic operating setpoint and the fans are operating at or above a low operating speed (typically 30-40%). In this mode the adiabatic water supply will be used even when the unit meets the desired operating fluid conditions without it, resulting in overall lower fan power usage but higher water consumption in most conditions.

1.2. Functionality Enabling Hierarchy

- 1.2.1. The Colmac Adiabatic Controller is set up to allow several unique sources to call for fan operation and adiabatic water supply. In order to manage this, the controller has been programmed to allow the user to enable or disable functionality at different levels depending on the desired controller state and effect.
- 1.2.2. The first level is the main controller ON/OFF functionality. This is accessed through the HOME PAGE screen, in the ON/OFF menu. If this is set to “OFF”, the fans and adiabatic supply valve will not operate regardless of call to from the BMS, Controller,

or other source. If this is set to “ON”, controller functionality is enabled depending on individual enable/disable settings for each feature.

1.2.3. The second level is the run permission. This is a signal from the BMS, controller schedule, digital input pin, or keyboard (set by user at the interface) that tells the unit to begin operation. The unit will operate according to the setpoints and control parameters or BMS signal when it receives run permission. This is accessed through the HOME PAGE screen, in the ON/OFF menu. Note that if more than one run permission mode is enabled, all enabled modes must signal ON or the unit will not operate.

1.2.4. The lowest level is individual manual operation. In the menus for EC fan configuration or adiabatic configuration, there are options to manual enable the fans or adiabatic supply valve. If the first two tiers of this hierarchy are satisfied such that the unit is set to ON and the controller has a run permission signal, then the manual controls can be used to directly operate the fans or valve.

1.3. Keys/Buttons

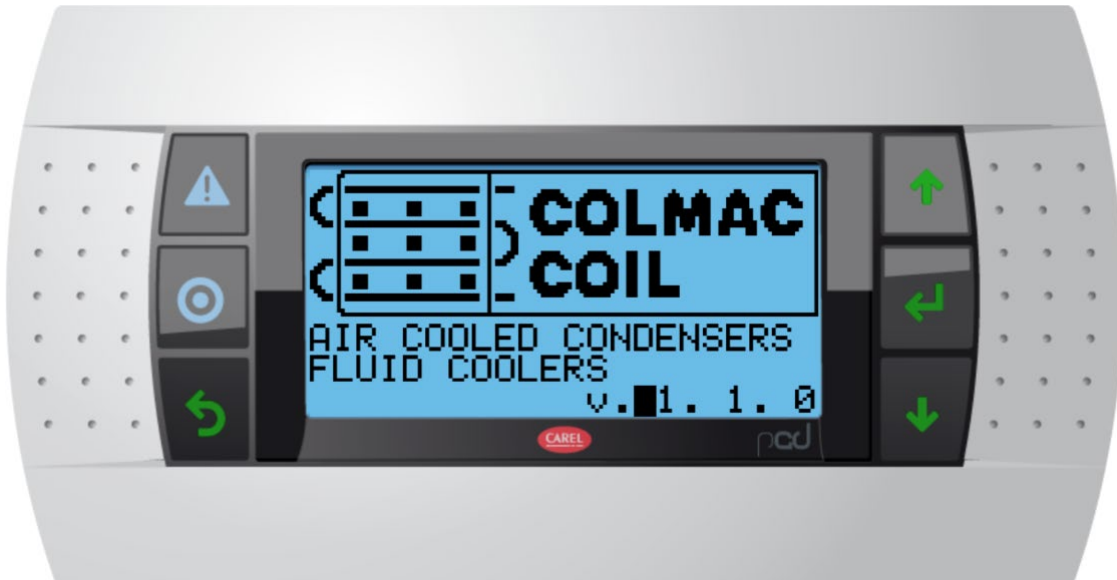
1.3.1. The controller features 6 buttons for navigating through the interface.



- **ALARM** – brings up the active alarm if there is an active alarm, otherwise displays alarm history. Alarm icon will glow red when there is an active alarm.
- **PRG** – Pressing the button will take you to the main menu. A yellow glow indicates that the user is in “programming mode”, which corresponds with navigation through the main menu.
- **ESCAPE** – Pressing this button will return to the previous screen.
- **UP/DOWN** – Navigate between screens in multi-screen menus. Adjust values when an item is selected for editing.
- **ENTER** – Scroll between selectable items on menus with adjustable values.

2. CONTROLLER STARTUP

2.1. When first starting up, a splash screen with the Colmac Coil logo and software version will be displayed. After a few seconds, the HOME PAGE screen will appear.



2.2. HOME PAGE



2.2.1. The HOME PAGE screen can be used as a quick menu to navigate between the different controller functions. It also shows the unit status, indicating whether it is enabled/on or disabled/off by one of the control or manual options.

2.2.2. The MAIN MENU screen can be accessed at any time by pressing the PRG key (left-center of the key pad, appears as a "bulls-eye" icon).

2.2.3. Unit Status: indicates whether the unit is currently ON or OFF, and what control method is specifying the condition.

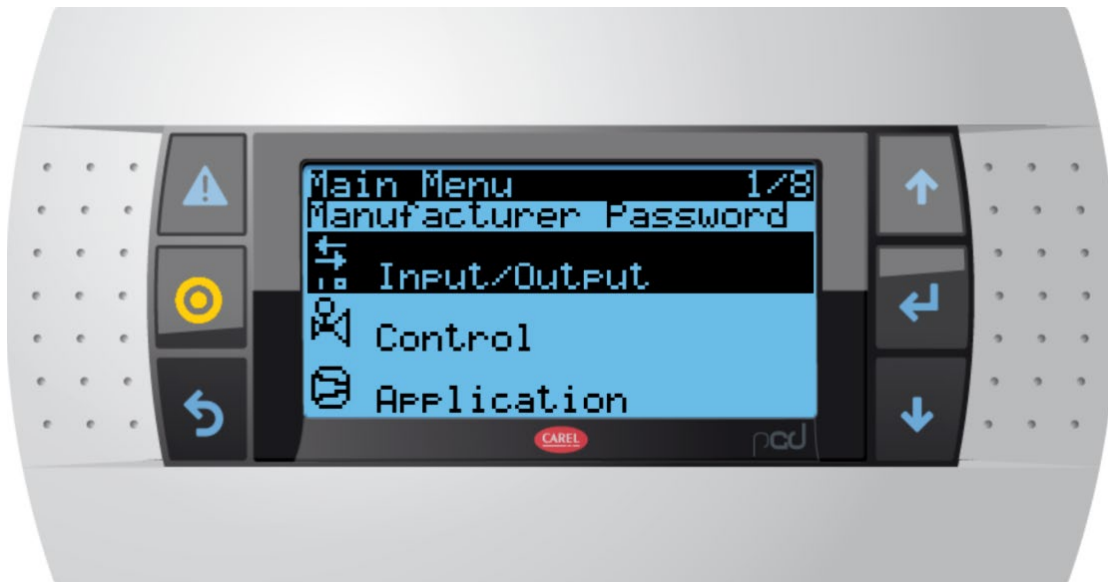
2.2.4. Use the UP and DOWN arrows to select the function, which will be displayed at the lower right. Use the ENTER key to enter the specified menu. The options here are:

- ON/OFF (indicated by a power symbol)
- Manual mode (“Man”)
- System setpoints (“Set”)
- Information (“i”)

3. MAIN MENU

3.1. The MAIN MENU screens can be used to access all of the controller's information, setpoints, and other operations. It can be accessed at any time using the PRG key (left-center of the key pad, appears as a "bulls-eye" icon). Pressing the PRG key again while in the MAIN MENU screens will return to the HOME PAGE screen.

3.2. MAIN MENU



3.2.1. Use the arrow UP/DOWN keys to select an item and the ENTER key to go to the menu for the selected item. Continue to scroll up or down through the menu with the arrow keys to access additional MAIN MENU items.

3.2.2. The MAIN MENU provides access to the following screens. See each screen's descriptive section in this manual for details on usage.

- INPUT/OUTPUT – Navigates to the I/O screen.
- CONTROL – This function is not enabled in this version of the controller software.
- APPLICATION – This function is not enabled in this version of the controller software.
- DEVICES – This function is not enabled in this version of the controller software.
- UNIT CONFIG – This function is not enabled in this version of the controller software.
- ALARM LOGS – Navigates to the alarm logs screen.
- SETTINGS – Navigates to the settings screen.
- LOGOUT – Navigates to the logout screen.

4. ON/OFF Mode

4.1. UNIT MASTER ENABLE



- 4.1.1. This is the main control to enable/disable unit functionality. It is accessible from the HOME PAGE screen by selecting the “power” icon in the lower right and pressing the ENTER key. Once the unit is set to ON in this menu, it requires a run signal from one of the ON/OFF methods described below. Run signal methods are listed in order of descending priority for the controller.
- 4.1.2. **Note that this feature acts as a master permission for the unit and must be set to “ON” for any of the unit’s control or operation to function.**
- 4.1.3. **The unit additionally needs permission from one of the below ON/OFF methods in order to operate. If more than one mode is enabled, all enabled modes must signal ON for the unit to operate.**

4.2. BMS ON/OFF



4.2.1. This enables the plant's main control system to provide a run signal using Modbus RS485 or Ethernet IP. The Unit Status indicator shows whether the master control is enabled and whether the unit is receiving a run signal from the BMS control.

- Both Modbus and Ethernet connection methods use standard Modbus protocol for communication.
- See Index 1 for communication details.

4.3. SCHEDULE ON/OFF



4.3.1. This enables the user to set a daily run schedule for the unit. The Unit Status indicator shows whether the master control is enabled and whether the unit is currently scheduled to be on.

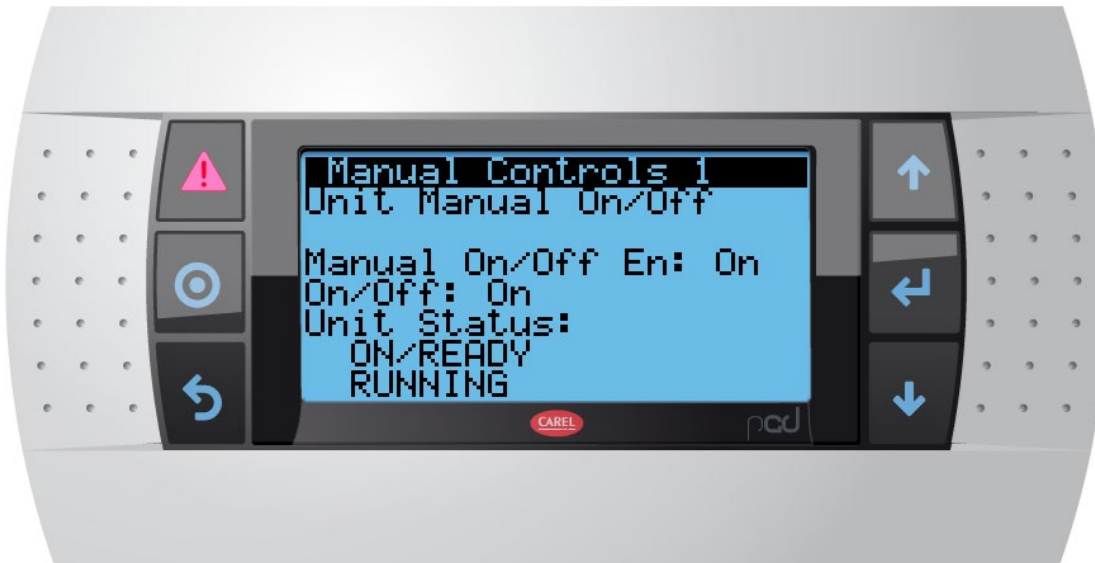
4.4. DIGITAL IN ON/OFF



4.4.1. Enabling this functionality will allow use of a permissive contact to enable the unit to run. See unit wiring diagram for details.

4.4.2. The Unit Status indicator displays whether the unit is enabled by the master control, and whether the digital input is receiving a run signal.

4.5. MANUAL ON/OFF



4.5.1. This functionality allows the user to directly turn the unit's operation on or off from the controller.

5. MANUAL MODE

5.1. The Manual Controls menu allow the user to directly specify fan speed and adiabatic water supply valve position from the controller. Note that the unit must be “ON” by one of the above control signals in order for the fans or adiabatic valve to operate.

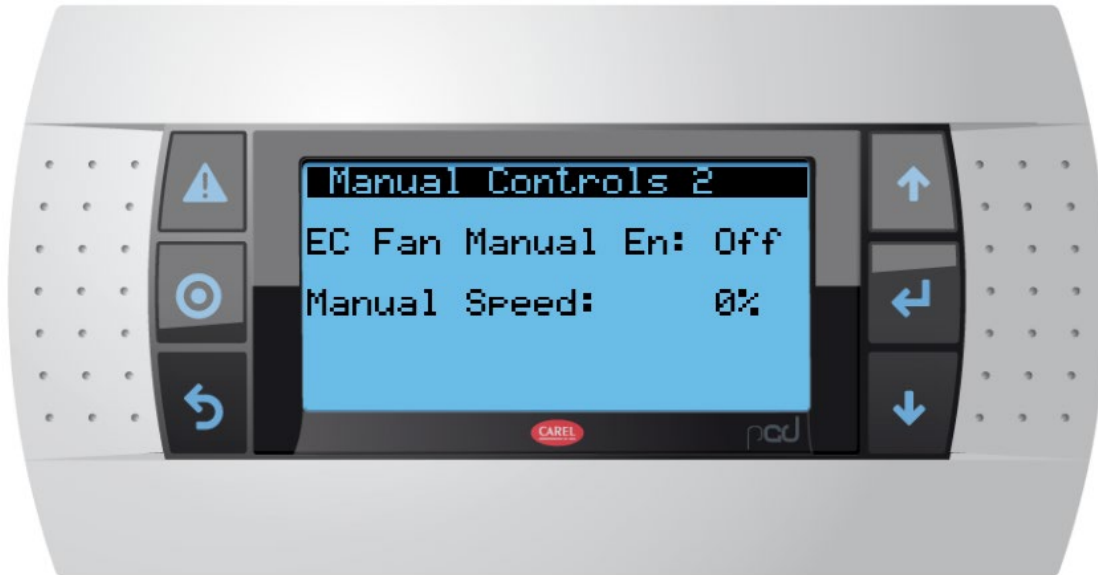
5.2. Manual Controls 1



5.2.1. This screen shows three status indicators

- Manual On/Off En: This enables the manual control from this screen.
- On/Off: Turn the unit on or off if enabled above. Note that this functions the same as the Manual Mode ON/OFF and the unit must not be set to OFF by any other run permission mode in order to operate.
- Unit Status: Displays unit on/off status.

5.3. Manual Controls 2



5.3.1. This screen allows the user to manually turn the EC fans on or off and to set their speed directly. Note that for control signals below 10% the fans may not be able to overcome static friction to start.

5.4. Manual Controls 3



5.4.1. This screen allows the user to manually enable or disable the adiabatic water supply valve, and to directly open or close it.

6. SYSTEM SETPOINTS

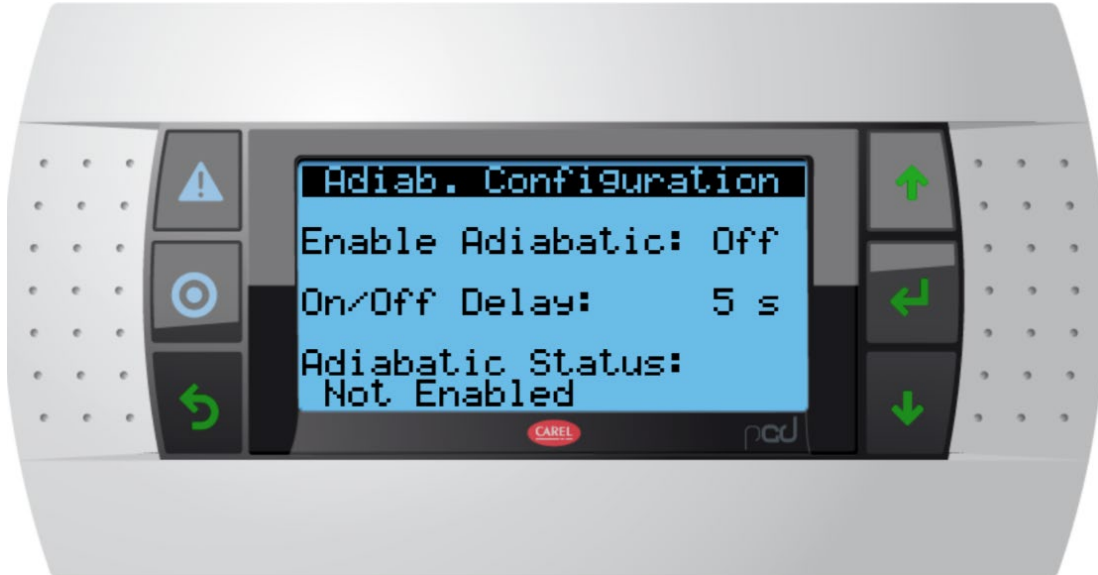
6.1. The control setpoints menus can be accessed from the HOME PAGE screen by selecting the “Set” option with the arrow keys and then pressing the ENTER key.

6.2. UNIT CONFIGURATION



6.2.1. Unit Configuration allows the user to specify whether the unit should operate as a Fluid Cooler or as an Air-Cooled Condenser (ACC). In Fluid Cooler mode, the controller will operate based on the working fluid temperature in relation to the setpoint and PID settings. In ACC mode, the controller will operate based on the working fluid pressure.

6.3. ADIABATIC CONFIGURATION



6.3.1. This screen allows the user to specify whether the adiabatic water supply will be enabled if the controller and settings call for it. It also allows the user to specify a delay of up to 300s before the adiabatic water supply valve begins to open after the controller calls for water.

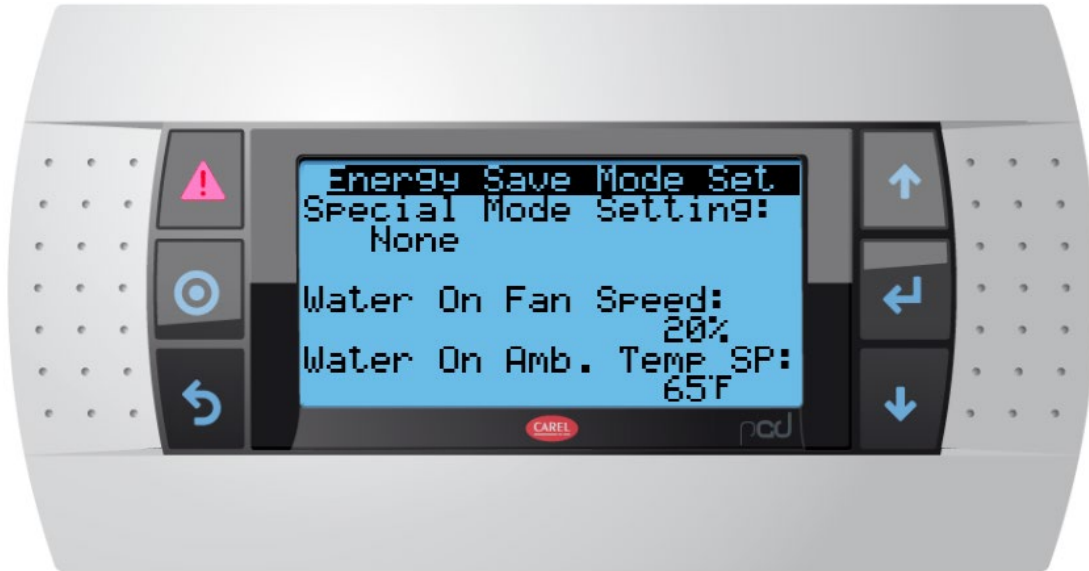
6.4. EC FAN CONFIG



6.4.1. This screen allows the user to enable or disable the EC fan operation as well as to specify the various parameters for the fans' operation.

- Auto Control En: specify On/Off to enable the controller to modulate fans as needed.
- Min Fan Speed: minimum run signal to the fans. A minimum value of 10% is recommended to ensure the fans overcome static friction on startup.
- Max Fan Speed: maximum run signal to the fans. A signal of 100% corresponds to the maximum fan speed programmed at the factory. See unit documentation for details on maximum fan speed.
- BMS Control En: Enables a 0-10V control signal for fans directly from the BMS. See unit documentation and wiring diagram for details on using this option.
- Man Control En: Enables the user to manually control the fans directly from this screen. Note that this functions the same as the Manual Mode ON/OFF and the unit must not be set to OFF by any other run permission mode in order to operate.
- Man Speed: Specify the fan operation directly when the above option is "On".
- On/Off Delay: Allows the user to specify a delay of up to 300s before the fans turn on when the controller calls for fan operation.

6.5. ENERGY SAVE MODE SET



6.5.1. This screen enables setting for one of the special modes, “Energy Save” or “Water Save”. The minimum fan speed and ambient temperature required for adiabatic water usage can also be set here.

6.6. DRYCOOLER PID CONFIG



6.6.1. This screen allows adjustment of the parameters for the PID used when in Dry Cooler mode. Use the ENTER key to cycle between options and the UP/DOWN arrows to adjust.

- Fluid Temp: Current measured working fluid temperature.
- Temp Setpoint: Target working fluid temperature for PID control.
- Deadband: Range around setpoint before control will operate to return to setpoint.
- Kp: Proportional PID constant
- Ti: Integral PID constant
- Td: Derivative PID constant
- PID Out: Current signal out of PID controller to fans.

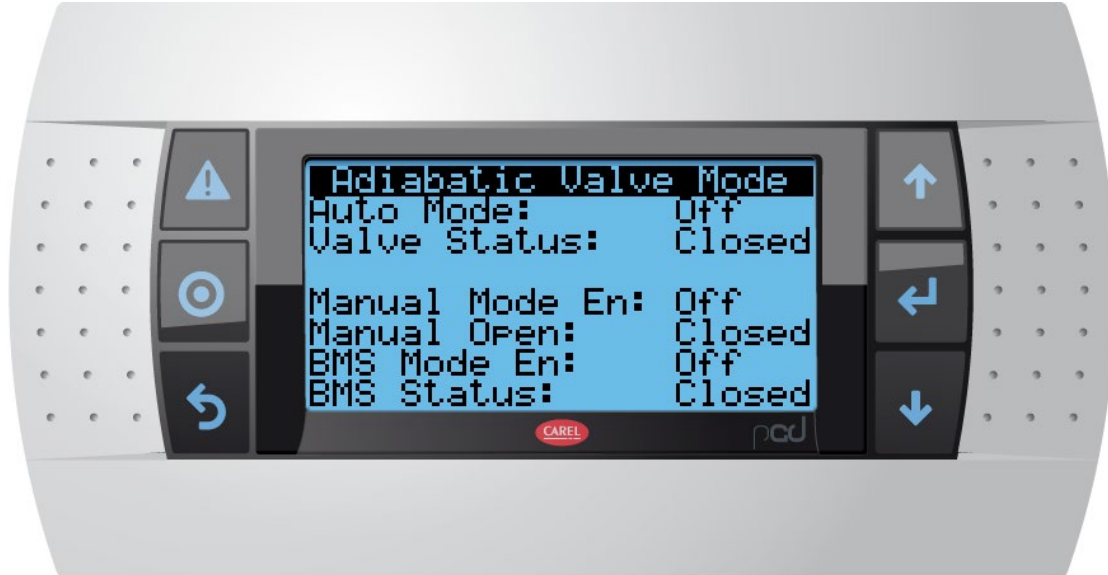
6.7. ACC PID CONFIG



6.7.1. This screen allows adjustment of the parameters for the PID used when in ACC mode. Use the ENTER key to cycle between options and the UP/DOWN arrows to adjust values.

- Fluid Press: Current measured working fluid pressure.
- Press. SetPt: Target working fluid pressure for PID control.
- Deadband: Range around setpoint before control will operate to return to setpoint.
- Kp: Proportional PID constant
- Ti: Integral PID constant
- Td: Derivative PID constant
- PID Out: Current signal out of PID controller to fans.

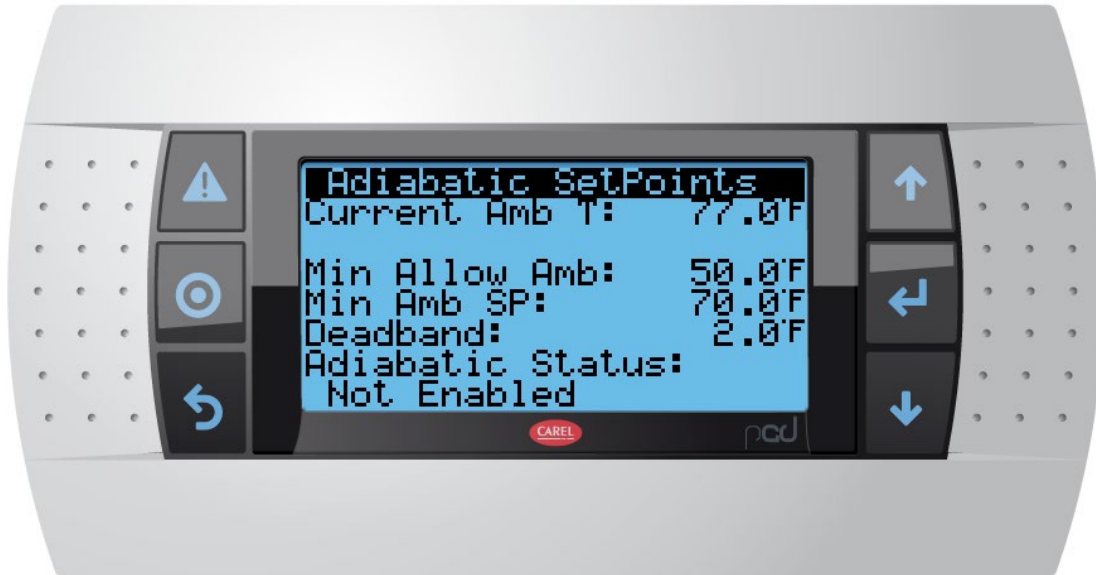
6.8. ADIABATIC VALVE MODE



6.8.1. This screen displays status and options for the adiabatic water supply valve. Use the ENTER key to cycle between options and the UP/DOWN arrows to adjust values.

- Auto Mode: Indicates whether the valve is set to operate automatically based on the unit configuration options. This must be set to ON for the adiabatic water supply to operate when the controller calls for it.
- Valve Status: Indicates whether the valve is currently open or closed.
- Manual Mode En: Enable or disable manual valve operation from this screen.
- Manual Open: Set the valve open or closed if the above option is enabled.
- BMS Mode En: Indicates whether the valve is operating on a BMS signal. This must be set to ON for the adiabatic water supply valve to operate when the BMS calls for it. See unit wiring diagram for details.
- BMS Status: Indicates whether the BMS signal is calling for the valve to be open or closed.

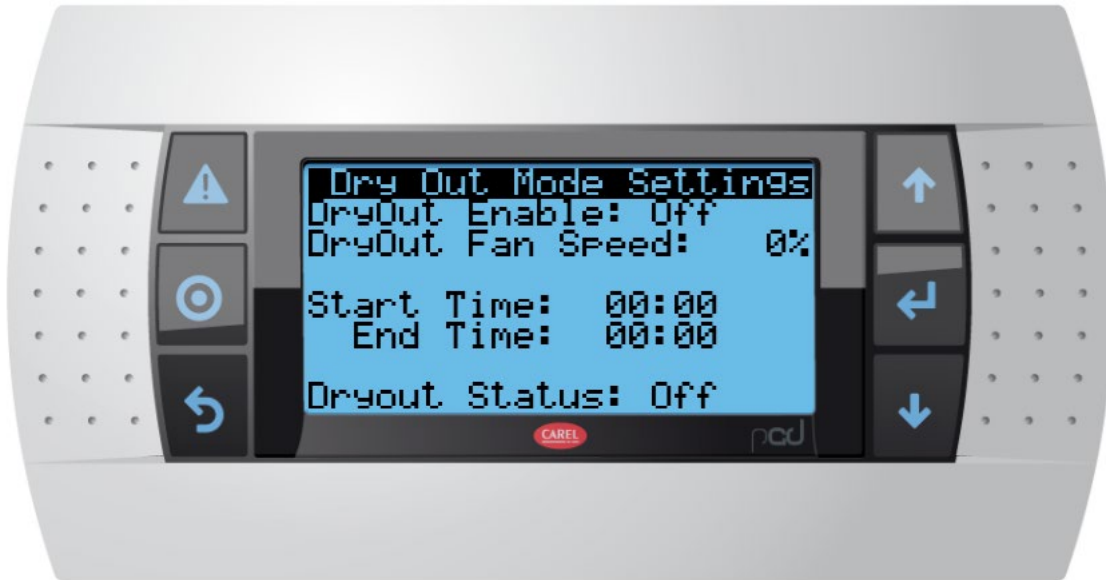
6.9. ADIABATIC SETPOINTS



6.9.1. This screen allows the setpoints for adiabatic water flow to be adjusted.

- Current Amb T: displays current measured ambient temperature.
- Min Allow Amb: Minimum allowed ambient temperature for adiabatic water operation. The valve will not operate below this temperature even in manual mode.
- Min Amb SP: Minimum ambient temperature for adiabatic water in auto/BMS operation.
- Deadband: Temperature change from minimum ambient setpoint below which adiabatic supply valve will turn back off.
- Adiabatic Status: Indicates whether the adiabatic operation is enabled.

6.10. DRY OUT MODE SETTINGS



6.10.1. This screen displays settings for the Dry Out mode. During Dry Out mode, the fans will operate at the specified speed and adiabatic water supply will be disabled.

- DryOut Enable: Enable or disable Dry Out mode.
- DryOut Fan Speed: Set the fan speed during Dry Out mode.
- Start Time: Scheduled start of Dry Out mode.
- End Time: Scheduled end of Dry Out mode.
- Dryout Status: Indicates whether Dry Out mode is currently running.

7. INFORMATION

7.1. The Info screen provides information about the controller software version.

7.2. INFO



7.2.1. This screen displays the current version of the software running on the controller.

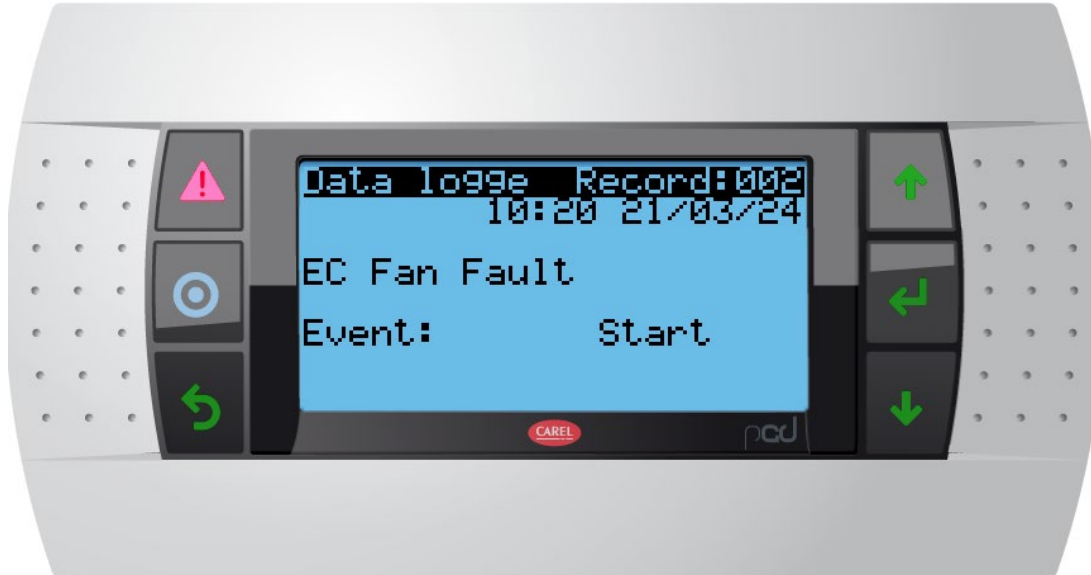
8. ALARMS

8.1. ACTIVE ALARMS



8.1.1. When an alarm is active, the Alarm key will glow red. Pressing the key will open the alarm screen to show the currently active alarm.

8.2. LOGGED ALARMS



8.2.1. Pressing the alarm key when an alarm is not active will open the alarm log. Using the UP and DOWN keys will navigate between logged alarms.

- Event: This indicates whether the log is for the START of the alarm or the STOP. The time of the log corresponds to the start or stop time of the alarm. Each alarm will log separate event for when the alarm started and when it stopped.

8.3. ALL ALARMS

8.3.1. Al_retain – error in the number of retain memory writings. This indicates a controller hardware or software error in which the controller is overwriting a memory variable more frequently than expected. Contact Colmac Coil for assistance.

8.3.2. Al_Err_retain_write – error in retain memory writings. This indicates a controller hardware or software error in which the controller is unable to overwrite a memory variable when needed. Contact Colmac Coil for assistance.

8.3.3. AL_EC_Fault – one or more EC fans has sent a fault signal to the controller. Check EC fans and wiring for errors.

8.3.4. AL_Min_Temp_Limit – ambient temperature at or below minimum temperature setting.

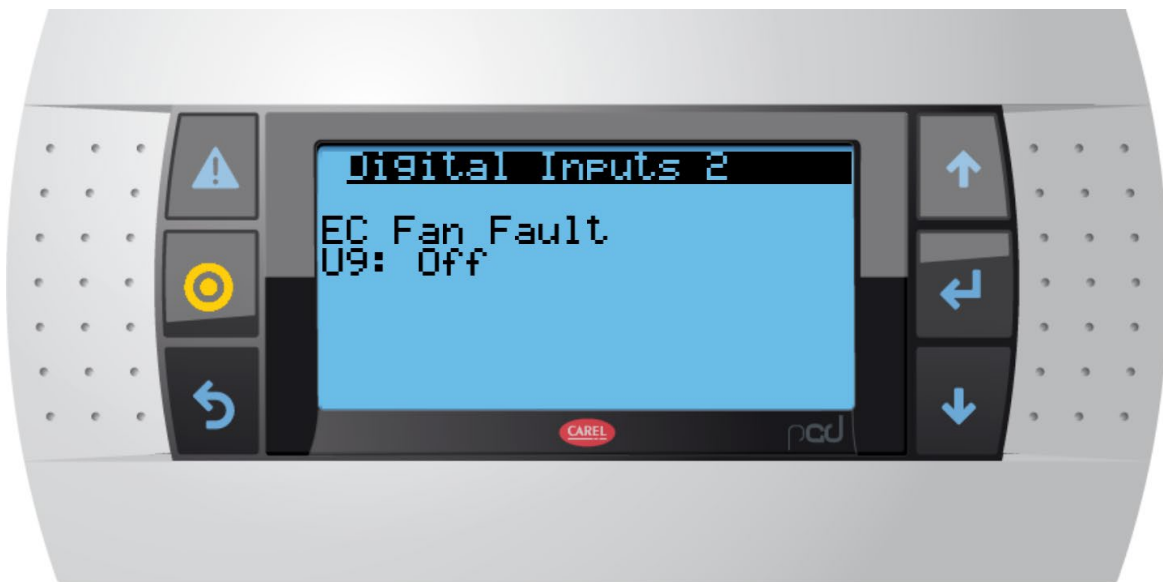
9. Input/Output

9.1. DIGITAL INPUTS 1



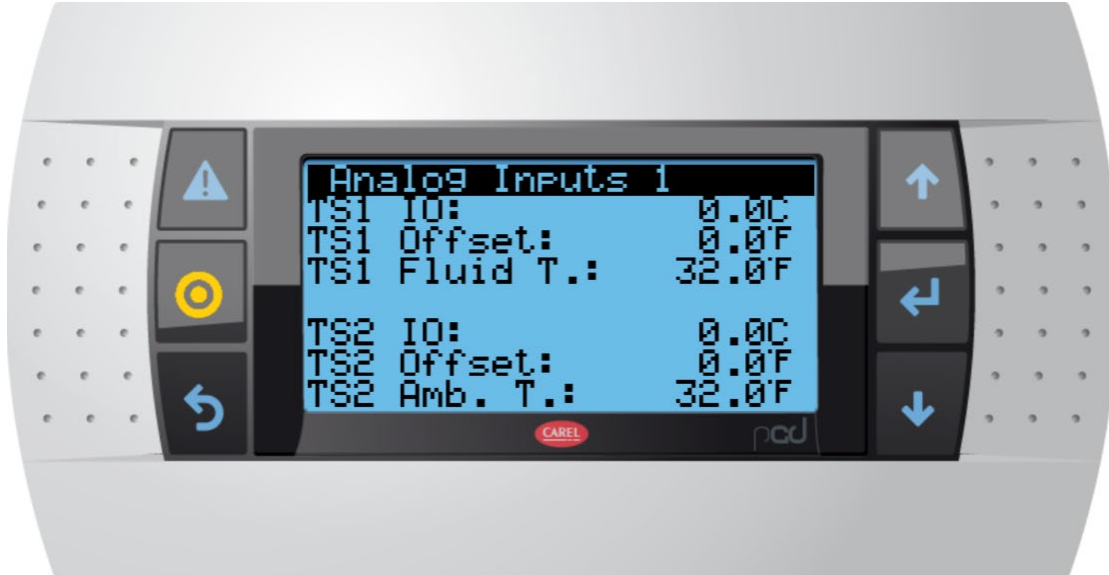
9.1.1. This screen shows the status of the input pin tied to the DIGITAL IN operating mode.

9.2. DIGITAL INPUTS 2



9.2.1. This screen shows the status of the input pin tied to the EC fan fault signal.

9.3. ANALOG INPUTS 1



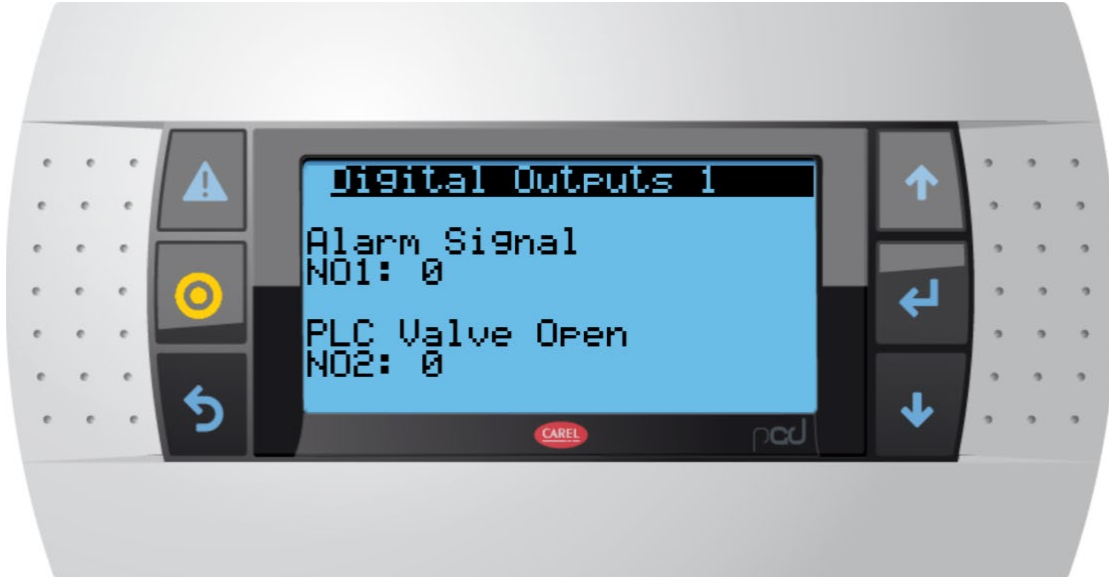
9.3.1. This screen shows the status of working fluid (TS1) and ambient (TS2) temperature sensors. The “Offset” value can be adjusted to provide a measurement offset if the sensor reading is incorrect when testing and calibrating.

9.4. ANALOG INPUTS 2



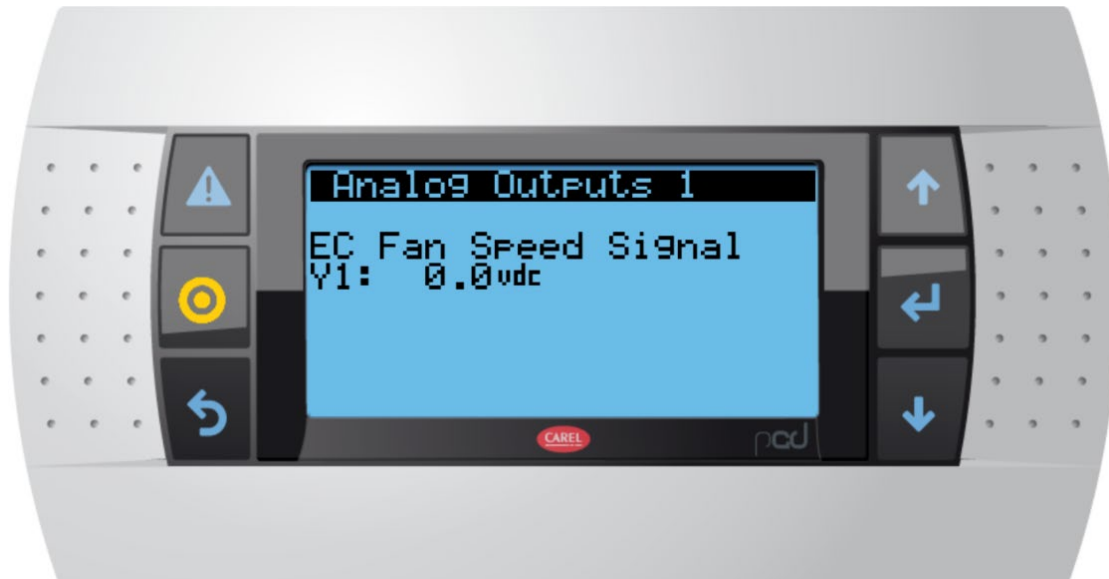
9.4.1. This screen shows the status of the working fluid pressure sensor. The “Offset” value can be adjusted to provide a measurement offset if the sensor reading is incorrect when testing and calibrating.

9.5. DIGITAL OUTPUTS 1



9.5.1. The Alarm Signal output is wired to a contact relay that the user can tie to the control system to receive notification when the controller signals an alarm. See unit wiring diagram for details.

9.6. ANALOG OUTPUTS 1



9.6.1. This screen shows the current status of the 0-10 VDC signal output to the EC fans.

10. SETTINGS

10.1. SETTINGS MENU



10.1.1. Use the arrow UP/DOWN keys to select an item and the ENTER key to go to the menu for the selected item. Continue to scroll up or down through the menu with the arrow keys to access additional SETTINGS items.

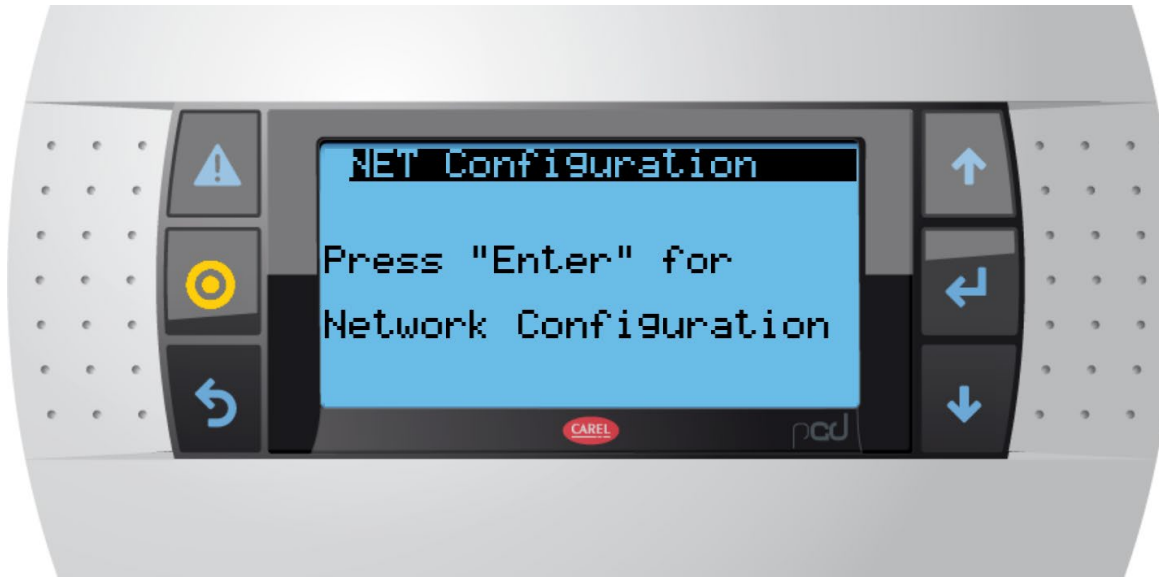
- DATE/TIME – Allows adjustment of the date and time and time zone.
- UOM – This function is not enabled in this version of the controller software.
- LANGUAGE – This function is not enabled in this version of the controller software.
- NETWORK – Navigates to the Network setup screens.
- PWD CHANGE – Enables the user to change the password.
- INITIALIZATION – Navigates to INITIALIZATION screens.

10.2. SETTINGS – NETWORK, BMS



10.2.1. This screen can be used to specify the details for the Modbus connection to the BMS.

10.3. SETTINGS – NETWORK, NET CONFIGURATION



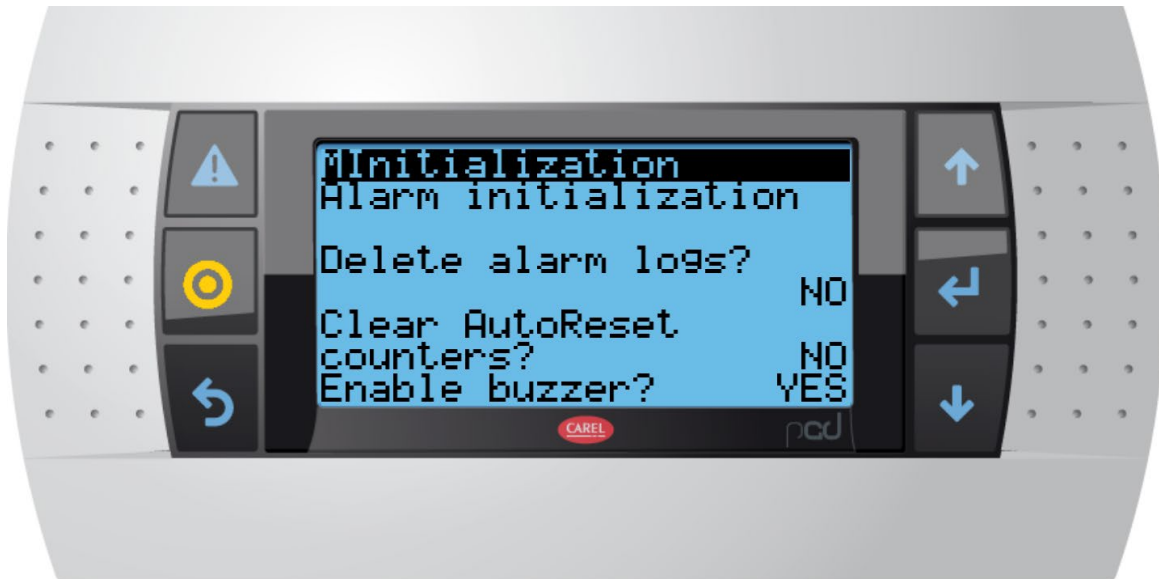
10.3.1. This screen provides access to the network settings for connecting the controller to a network via IP/ETHERNET.

10.4. SETTINGS – NETWORK, PGDX IP



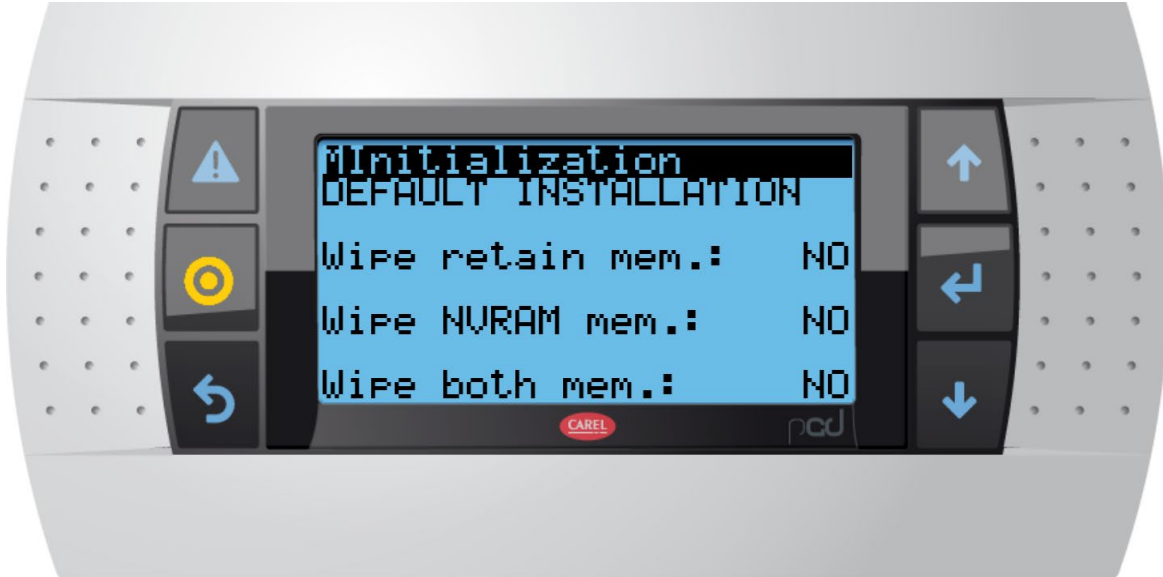
10.4.1. This screen allows the user to set the IP address on the local network for a connected Carel pGDx interface. This functionality is not used in this version of the controller software.

10.5. SETTINGS – INITIALIZATION 1



10.5.1. This screen enables the alarm log to be cleared and the controller's buzzer to be enabled or disabled.

10.6. SETTINGS – INITIALIZATION 2

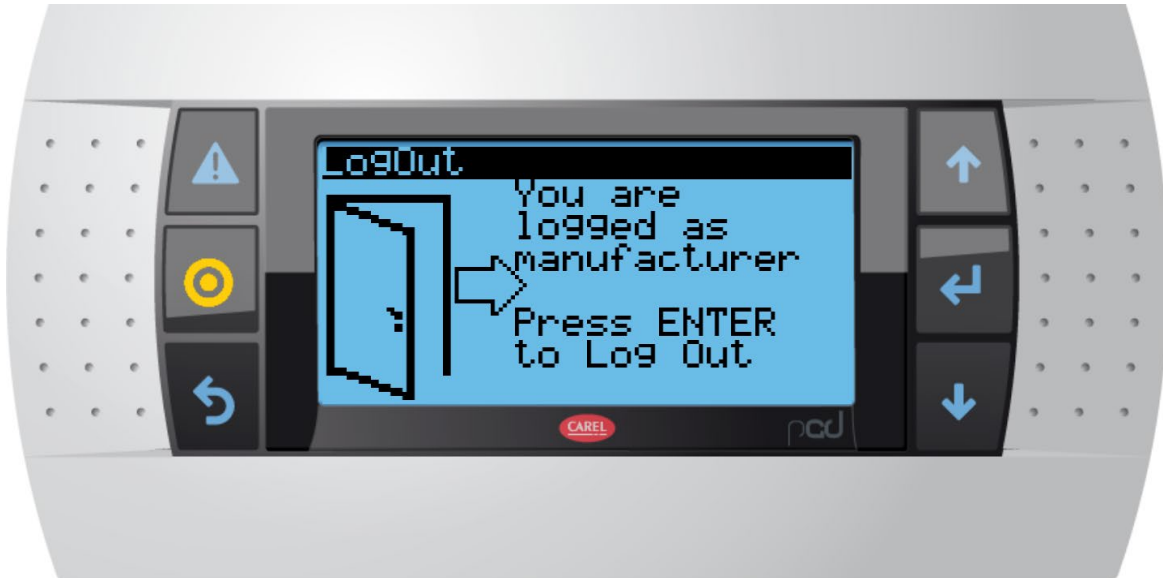


10.6.1. This screen enables the user to wipe some or all of the controller's memory.

- Wipe retain mem: will reset all stored variables, setpoints, and configurations.
- Wipe NVRAM mem: will reset the controller to factory **default (WARNING: THIS WILL ERASE THE COLMAC-PROVIDED PROGRAM AND RESET THE CONTROLLER TO BASE CAREL FUNCTIONALITY)**.
- Wipe both mem: will do both of the above.

11. LOGIN/LOGOUT

11.1. LOGOUT



- 11.1.1. By default, the controller for Colmac units is set to enable access to all menus without additional login. This screen can be used in combination with the reset password function (available through the SETTINGS menu) to restrict access to some parts of the controller by unauthorized users.
- 11.1.2. Logging out will restrict access to anything under the MAIN MENU. A logged-out user will still have access to HOME PAGE navigation screens and can still change system setpoints and other values accessed through that screen.

11.2. LOGIN



11.2.1. The default password is "9999".

12. INDEX 1: CONTROLLER MODBUS CONNECTION DETAILS

Variable Name	Variable Description	Types	Index	Size	DataType	Direction	Default Value
AADB _SP _UI	Ambient Air Temperature Dead Band	HoldingRegister	0	2	Real	ReadWrite	2 .0
AAValveOpen	Valve Open/Close operational variable tied to IO	DiscreteInput	0	1	Bool	Read	
ADAmbAirTempSP _UI	Adiabatic Ambient Air Temperature Setpoint, SP2	HoldingRegister	2	2	Real	ReadWrite	70 .0
Adiabatic _RunFans	Trigger to run fans due to adiabatic control loop demand	DiscreteInput	1	1	Bool	Read	
AL _EC _Fault .Active	One or more EC fans has a fault - Alarm status	Coil	0	1	Bool	ReadWrite	
AL _Min _Temp _Limit .Active	Ambient temperature at or below minimum temperature setting . - Alarm status	Coil	1	1	Bool	ReadWrite	A
AlarmLogReset	Reset the alarm log	Coil	2	1	Bool	ReadWrite	
AlarmMng .AlrmRes	Alarm all reset	Coil	3	1	Bool	ReadWrite	
AlarmMng .AlrmResByBms	Alarm reset by BMS	Coil	4	1	Bool	ReadWrite	
AlarmMng .UnitAlrm	Unit alarm (triggered one or more alarms are active)	Coil	5	1	Bool	ReadWrite	
AnalogVDC _Perc .Dryout _FanSpeed _UI	User Input set fan speed during dryout mode (%)	HoldingRegister	4	2	Real	ReadWrite	
AnalogVDC _Perc .EC _10Vout _UI	Current fan speed output (%)	InputRegister	0	2	Real	Read	

Variable Name	Variable Description	Types	Index	Size	Data Type	Direction	Default Value
AnalogVDC_Perc .EnergySaveFan _SP_UI	Fan speed setpoint for energy save mode (%)	HoldingRegister	6	2	Real	ReadWrite	20 .0
AnalogVDC_Perc .Manual_FanSpeed _UI	Manually set fan speed for manual fan operation (%)	HoldingRegister	8	2	Real	ReadWrite	0 .0
AnalogVDC_Perc .MaxFanSpeed_SP _UI	Maximum fan speed setting (%)	HoldingRegister	10	2	Real	ReadWrite	100 .0
AnalogVDC_Perc .MinFanSpeed_SP _UI	Minimum fan speed setting (%)	HoldingRegister	12	2	Real	ReadWrite	10 .0
AnalogVDC_Perc .WaterSaveMode _SP_UI	Setpoint for turning adiabatic water on when water save mode is active	HoldingRegister	14	2	Real	ReadWrite	50 .0
BMSin_ValveOpen	Operates adiabatic valve manually via BMS trigger	Coil	6	1	Bool	ReadWrite	
BMSin_ValveOpen _En	Enable for BMS adiabatic valve control	Coil	7	1	Bool	ReadWrite	
CallForCooling	Internal call for cooling variable	DiscreteInput	2	1	Bool	Read	
EC_10Vout_IO	EC fan commanded speed (0-10VDC) tied to IO hardware	InputRegister	2	2	Real	Read	
EC_FaultIn_IO	Hardware variable for EC fan fault status	DiscreteInput	3	1	Bool	Read	
ECFanMng .BMS _FanSpeed	0-10V signal from BMS for fan speed	HoldingRegister	16	2	Real	ReadWrite	0 .0
ECFanMng .En _BMS_RunFans	Enable BMS fan speed control	Coil	8	1	Bool	ReadWrite	

Variable Name	Variable Description	Types	Index	Size	Data Type	Direction	Default Value
ECFanMng .FanOnOffDelay_UI	Fan on/off delay to avoid short cycling	HoldingRegister	20	1	Int	ReadWrite	
En_AdiabaticControl_UI	Enable adiabatic water control functionality	Coil	9	1	Bool	ReadWrite	
En_ECfanAutoMode_UI	Enable Auto mode for EC fan control	Coil	10	1	Bool	ReadWrite	
En_Manual_RunFans	Enable manual fan control	Coil	11	1	Bool	ReadWrite	
EnergySaveMode_SP_UI	Air temp for fans to turn on in energy save mode	HoldingRegister	21	2	Real	ReadWrite	65 .0
GeneralMng .Address_BMS2	Address of BMS	HoldingRegister	23	1	UInt	ReadWrite	1
GeneralMng .Baudrate	Baud rate (up to 375000)	HoldingRegister	24	2	UDInt	ReadWrite	19200
GeneralMng .BITS	Data bits (7, 8)	HoldingRegister	26	1	USInt	ReadWrite	8
GeneralMng .CurrVer .X	Current version of the application according to standard - X version of the application	HoldingRegister	27	1	UInt	ReadWrite	1
GeneralMng .CurrVer .Y	Current version of the application according to standard - Y version of the application	HoldingRegister	28	1	UInt	ReadWrite	0
GeneralMng .CurrVer .Z	Current version of the application according to standard - Z version of the application	HoldingRegister	29	1	UInt	ReadWrite	0
GeneralMng .Day	Actual day	HoldingRegister	30	1	UInt	ReadWrite	

Variable Name	Variable Description	Types	Index	Size	Data Type	Direction	Default Value
GeneralMng .DayOfWeek	Day of week	HoldingRegister	31	1	UInt	ReadWrite	
GeneralMng .DST	Show if you are in Daylight Saving Time or not (works with En_DaylightSavingTime = TRUE)	Coil	12	1	Bool	ReadWrite	
GeneralMng .Hour	Actual hour	HoldingRegister	32	1	UInt	ReadWrite	
GeneralMng .Minute	Actual minute	HoldingRegister	33	1	UInt	ReadWrite	
GeneralMng .Month	Actual month	HoldingRegister	34	1	UInt	ReadWrite	
GeneralMng .PARITY	Parity (0=no, 1=odd, 2=even)	HoldingRegister	35	1	USInt	ReadWrite	0
GeneralMng .ProfTyp_BMS2	Protodol for actual port communication	HoldingRegister	36	1	USInt	ReadWrite	1
GeneralMng .Second	Actual second	HoldingRegister	37	1	UInt	ReadWrite	
GlbAlrm	Global alarms (at least one active alarm)	DiscreteInput	4	1	Bool	Read	
Main .AAValveOpen_ByMinAllowTemp	Valve status - on/off by min allow temp	DiscreteInput	5	1	Bool	Read	
Main .Adiabatic_OffBy	0: Valve open, 1: Not Enabled, 2: Unit Off, 3: Off By Min Ambient Temp, 4: Off By Ambient Temp SP, 5: Off By BMS, 6: Off by ManualMode	InputRegister	4	1	Int	Read	1
Main .DryoutBySch_En	Dryout mode enable	Coil	13	1	Bool	ReadWrite	

Variable Name	Variable Description	Types	Index	Size	Data Type	Direction	Default Value
Main .DryoutBySch_EndHour	Dryout mode end hour	HoldingRegister	38	1	Int	ReadWrite	
Main .DryoutBySch_EndMin	Dryout mode end minute	HoldingRegister	39	1	Int	ReadWrite	
Main .DryoutBySch_Started	Dryout mode has started	DiscreteInput	14	1	Bool	Read	
Main .DryoutBySch_StartHour	Dryout mode start hour	HoldingRegister	40	1	Int	ReadWrite	
Main .DryoutBySch_StartMin	Dryout mode start minute	HoldingRegister	41	1	Int	ReadWrite	
Main .En_SpecialModeSel_UI	0: Off, 1: EnergySaveMode, 2: WaterSaveMode	HoldingRegister	42	1	Int	ReadWrite	0
Main .PID_ACC_Kp	Air Cooled Condenser Proportional PID Coef .	HoldingRegister	43	2	Real	ReadWrite	0.2
Main .PID_ACC_Td	Air Cooled Condenser Integral PID Coef .	HoldingRegister	45	2	Real	ReadWrite	0.1
Main .PID_ACC_Ti	Air Cooled Condenser Derivative PID Coef .	HoldingRegister	47	2	Real	ReadWrite	300 .0
Main .PID_ACC-DeadBand	Air Cooled Condenser PID Deadband	HoldingRegister	76	2			
Main .PID_DC_DeafBand	Dry Cooler PID Deadband	HoldingRegister	49	2	Real	ReadWrite	0.1
Main .PID_DC_Kp	Dry Cooler Proportional PID Coef .	HoldingRegister	51	2	Real	ReadWrite	0.3

Variable Name	Variable Description	Types	Index	Size	Data Type	Direction	Default Value
Main .PID_DC_Td	Dry Cooler Integral PID Coef .	HoldingRegister	53	2	Real	ReadWrite	0.1
Main .PID_DC_Ti	Dry Cooler Derivative PID Coef .	HoldingRegister	55	2	Real	ReadWrite	300 .0
MaxAllowRefrigPress_SP_UI	Maximum Allowable (Design) Refrigerant Pressure, SP1, measured at the condenser inlet .	HoldingRegister	57	2	Real	ReadWrite	
MinAllowTemp_SP_UI	Low Ambient Adiabatic Limit Temperature Setpoint	HoldingRegister	65	2	Real	ReadWrite	50 .0
N_Alrms	Number of actual alarms	InputRegister	5	2	DInt	Read	
OnOffUnitMng .BmsOnOff	Unit On/Off by BMS	Coil	15	1	Bool	ReadWrite	
OnOffUnitMng .EnBmsOnOff	Unit On/Off by BMS enable	Coil	16	1	Bool	ReadWrite	FALSE
OnOffUnitMng .EnDInOnOff	Unit On/Off by Digital Input enable	Coil	17	1	Bool	ReadWrite	FALSE
OnOffUnitMng .EnManOnOff	Manual unit On/Off enable	DiscretelInput	7	1	Bool	Read	FALSE
OnOffUnitMng .EnSchedOnOff	Unit On/Off by scheduler enable	Coil	18	1	Bool	ReadWrite	FALSE
OnOffUnitMng .KeybOnOff	Unit On/Off by keyboard, master enable	Coil	19	1	Bool	ReadWrite	
OnOffUnitMng .OnBySch _EndHour	Schedule On/Off End Hour	HoldingRegister	67	1	Int	ReadWrite	
OnOffUnitMng .OnBySch _EndMin	Schedule On/Off End Min	HoldingRegister	68	1	Int	ReadWrite	

Variable Name	Variable Description	Types	Index	Size	Data Type	Direction	Default Value
OnOffUnitMng .OnBySch _StartHour	Schedule On/Off Start Hour	HoldingRegister	69	1	Int	ReadWrite	
OnOffUnitMng .OnBySch _StartMin	Schedule On/Off Start Min	HoldingRegister	70	1	Int	ReadWrite	
PLCout _ValveOpen _IO	Hardware variable for adiabatic valve open/close based on PLC logic	DiscreteInput	8	1	Bool	Read	
PS1 _Refrig _Press	Operational working fluid pressure w/offset applied	HoldingRegister	71	2	Real	ReadWrite	
RunFans	Internal command to run fans based on set of triggers	DiscreteInput	9	1	Bool	Read	
TempSP _DryCooler	Dry cooler target max operational temperature	HoldingRegister	73	2	Real	ReadWrite	100 .0
TS1 _Refrig _Outlet	Operational fluid outlet temp w/offset applied	InputRegister	7	2	Real	Read	0 .0
TS2 _Ambient _Air	Operational ambient temp w/offset applied	InputRegister	9	2	Real	Read	0 .0
UnitOff	Unit Off status: TRUE = Unit OFF	DiscreteInput	10	1	Bool	Read	
UnitOn	Unit On status: TRUE = Unit ON	DiscreteInput	11	1	Bool	Read	
UnitStatus	Unit status	InputRegister	11	2	DInt	Read	
UnitType _UI	0: Dry Cooler, 1: Air Cooled Condenser	HoldingRegister	75	1	Int	ReadWrite	0



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