



CLIMATEWORX
INTERNATIONAL

MISSION CRITICAL Air Conditioning Systems

In-Row, Microprocessor

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Sequence of Operation

The following is an outline of the operation of the unit. Not all units have all options.

1. Unit powered
2. ClimateWorx Banner appears.
3. Microprocessor initializes and runs self check.
4. Random start timer activates
5. Restart delay counts down

Analogue and digital outputs for functions

Cooling 0-10 vdc (2 Analogue outputs for fans 1 to 8 on Chilled water or fans 1 to 6 on Direct expansion (DX) unit)

DX Demand (Cooling)

Cycles on compressor as demand for cooling increases from 0 to 100%. The compressor will continue to run for a minimum time of 30 Seconds (range adjustable 0 – 250) to allow oil return to the compressor. Compressor minimum runtime is adjustable from keypad.

Fan speed is increased to 100% or 10vdc when the system demand calls for cooling i.e. when compressor is on. The system will run at minimum speed when the compressor is OFF or fan speed is increased when the rack temperature is above the set point temp. (Sensor feedback between J6-B8 and GND) to the IR unit about the condition of air entering the server racks.

Demand for compressor:

Compressor contactor receives signal from microprocessor. Positive Start timer (Pos. start delay) starts and bypasses LP switch for cold start-up. When HP switch is closed the start circuit is complete and the compressor starts.

Pre-action - Prior to activating compressor check state of Low Pressure input. If open then display "check Refrigerant system" alarm and do not start compressor. If closed, proceed to start compressor.

Compressor stops when:

- Loss of demand
Compressor contactor opens
- Low pressure condition
Low Pressure Alarm. Compressor stops when LP SW. opens. (Automatic reset) compressor contactor opens. Automatically resets after compressor elapse time delay.
- Short cycling alarm
After 10 consecutive starts in 1 hour period will display Compressor Short Cycle Alarm.
- High pressure condition
Compressor stops when HP SW. opens. (Manual reset)
Compressor contactor opens. Compressor will not start until HP SW. and alarm is reset.
- Thermal protection opens (automatic reset)
Line voltage cut-outs on all compressors except compressor where the compressor causes a Compressor Overload alarm and stops the compressor through the microprocessor. Compressor resets after 30 minutes.

Note: Anytime the contactor opens the minimum OFF time of compressor keeps compressor off for 30 seconds (adjustable)

Chilled Water

On demand for cooling chilled water valve opens as demand signal ramps up from 0 to 100%. Valve operates on 0-10 VDC.

Valve closes when:

Loss of demand, signal diminishes to 0 Vdc

Fan Control

- Fans continue to run until commanded to stop by on/off state.
- At start fan will run at the minimum fan default speed setting. Fan speed is increased when the rack temperature is above the set point temp. (Sensor feedback between J6-B8 and GND) to the IR unit about the condition of air entering the server racks, each rack sensor will monitor 1 server rack. User defined settings options are Minimum and maximum speed parameters included, with the default minimum speed set to 30% or 3vdc and maximum speed set to 100% or 10vdc
- Once a unit off command is made cooling stops/ Digital and analogue CW signal goes to zero. Fan speed remains constant for Fan Purge Delay.
- The fan speed is modulated based on the Control Air Temp (Which is the Return Air Temperatures selected a maximum or average of the two).
- If fan overload alarm is raised then display "Fan Overload". Audible alarm shall annunciate in the event of any individual fan breaker trip. In the event one or two fan breaker trips activates fan overload alarm and the system will remain ON running with the rest of the fans to satisfy the demand. Fan speed on the rest of them will be ramped up when the rack temperature is above the set point temp. Alarm has options for - Enable option key, Unit shutdown, Standby Enable, Common alarm, Event log and audible warning option with no sound, 1, 2 and 3 beeps.

Alarms

All alarms should be recorded in log and have 5 programmable actions:

- Enable Alarm
- Turn off machine
- Stand-by enables output energized. (pLAN function)
- Activate common alarm
- Event log
- Set audible Alarm urgency
 - 1 beep per sec = Low Priority
 - 2 beeps per sec = Medium Priority
 - 3 beeps per sec = High Priority

pLAN Connection

Controllers on pLAN must be able to be grouped. A group of controls will operate independently as long as there are no Alarms on any unit in that group. Once a unit in the group goes into Alarm and that alarm has standby enable selected the sensors from the group get included in highest value (or average) for control. Two sensors will be remote

mounted and will be monitored for Highest or Average (selectable) and will vary the fan speed. One sensor will be in the return air and one sensor will be in the supply air. The cooling demand is controlled by the return air. On the display we can select the label under manufacture level configuration system settings the temperature as supply or return air based on which one is controlling cooling demand.

In a situation where the a machine in the group is in alarm and the alarm is set for Standby Enable contact enables the control to other units cooling by the highest of the sensors in that group and control the fan speed by the highest of all the remote sensors in that group.

pLAN Addressing - Display to Main controller

1. Press the up, down, and enter keys (3 keys on the right hand side of remote display) for approximately 3 seconds.
2. This will take you to a screen that displays "Display address setting." Press the enter key and change this value to 1-32. This address must be different then the address of the PCO3 control, address 32 is reserved specifically for remote displays (pGD)
3. Press enter.
4. Press the up, down, and enter keys (3 keys on the right hand side of remote display) for approximately 3 seconds.
5. You will be taken to the same screen as before, but this time you will see "I/O Board Address" displayed underneath "Display address setting."
6. Press the enter button 2 times so the text box is blinking beside "I/O Board address."
7. Change this to the value you addressed the PCO3 control to.
8. Press enter.
9. The next screen displayed will show "Terminal config" press enter to continue.
10. The following screen will show P:(address of PCO3 control) in upper left corner.
11. Trm1 None will be blinking. Change "none" to the addressed you entered in step 2 (address of PGD remote display.)
12. Press enter 1 time and change the next field to Pr or Sh (Private or Shared, shared is used when sharing 1 display with multiple controllers).
13. Press enter 5 times and change OK? From No to Yes.
14. The PGD remote display is now addressed to your PCO3 control.

Need a communications Bridge (protocol translator gateway) which enables devices using one protocol to communicate with devices using another protocol.

PID

The InRow microprocessor uses PID (Proportional–Integral–Derivative) control logic to maintain the set point conditions. The following parameters are adjustable so the controller can be fine-tuned to specific site conditions.

- Fan
- Mixing Valve (liquid cooled DX units)
- Compressor
- CW Valve

Internal Safety Controls

Circuit breakers (50 and 60 Hz) on all components

DC Fan overload relay

Condensate pump auxiliary float

Dirty filter switch

High pressure refrigerant (manual reset)

Low pressure refrigerant (Automatic reset)

Internal thermal protection compressor and motor

Compressor elapse timer (Minimum OFF time of compressor – 30 secs default)

Crank case heaters

On/Off Control

Service level – Manual management:

When the controller is set to Manual management and unit control changed from Auto to Hand, On/Off control of the unit is controlled by the keypad

Back up Capability

Standby Enable:

Each unit sends an output to start a back up unit in the event of an alarm condition as configured in the Alarm Response menu. Terminals 11 and 12

Powering Up / Powering Down

The first powering up must be performed by CLIMATEWORX authorized personnel only. Failure to do so may damage the unit and void the warranty.

To power up the unit:

The main power switch (rotary disconnect) is located on the side of the unit (electrical panel)

Immediately after turning on the main power switch, the control system will perform the following power up sequence:

1. The control system will then perform a self-test and verify all stored setting and data are within valid range.
2. After the self-test, the control system will count down the programmed “Start delay” time and then put the system into normal operation.

To power down unit:

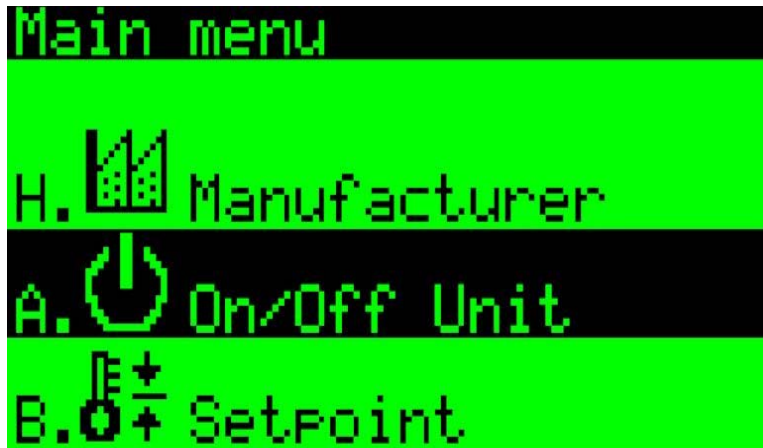
For units in Manual management On/Off control is from keypad. Once fan stops, open disconnect.








The Control Panel Menu Layout

In addition to the Menu structure below there are also Status and Alarm screens. All menu names and corresponding information on each individual screen can be customized to reflect a more unique menu structure. Each section contains different information.



Main Menu

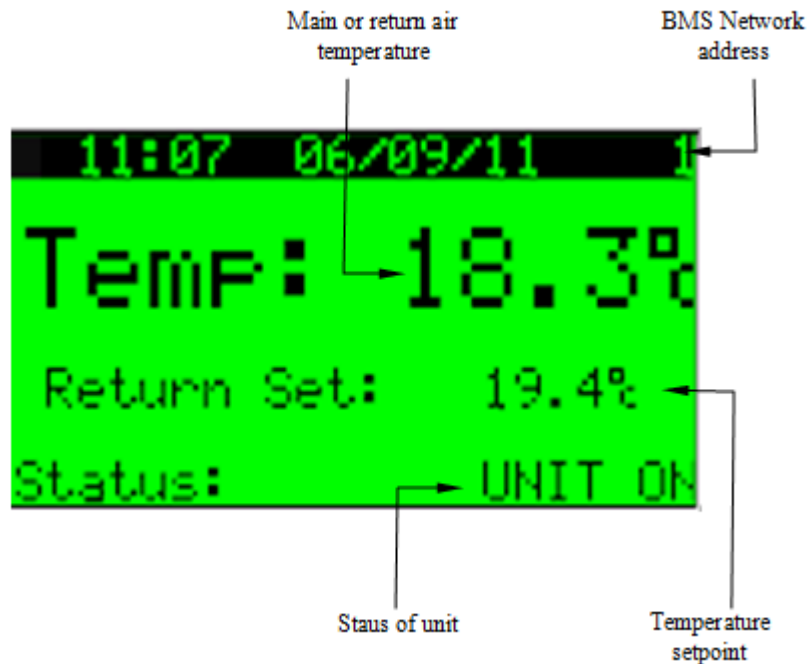


- A.  On/Off Unit
- B.  Setpoint
- C.  Clock/Scheduler
- D.  Input/Output
- E.  Data Logger
- F.  Service —→
 - a.Information
 - b.Working Hours
 - e.BMS Config
 - f.Service Settings —→
 - a.Probe Adjustment
 - b.Thermoregulation
 - c.Alarm Settings
 - d.User DEV/change PW1
 - g.Manual Management
- H.  Manufacturer —→
 - a.Configuration
 - b.I/O Configuration
 - c.Initilization

Banner line

The Banner line shows the system type and the current date and time. Date is in DD/MM/YY, MM/DD/YY and YY/MM/DD format and time in 24-hour HH:mm format.

Operating Status



Main Return Air Temperature Readout

The Status screen could also be referred to as the home screen and will return to this position when inactive, default five minutes. This screen displays time, date, temperatures, setpoint and Status of the unit. There also could be other status screens accessed by pressing the UP or DOWN arrows on the display. Pressing ESC from the Main Menu will take the user back to the Status Loop.

Temperature readout can be displayed in either °C or °F depending on the system setting (Manufacture ->Configuration -> System settings) "Temp Units".

BMS Network Address

This shows the Network address set in Service menu BMS Config setting "Network address". Every unit in the network must be set to a unique address. This address relates to the RS485 serial communication buss.







Alarm Icon

The alarm button (bell in flashing RED) shows up if there is any active alarm in the system. You can review the details of the alarm in the Alarm page by pressing the alarm button.

Security

To prevent unauthorized interference with the system operation and settings, the IR Microprocessors have three levels of security that can be assigned to different personnel having different responsibilities.


The menu template encompasses three levels; User, Service and Manufacturer. The first is the User level and requires no password to be entered; intended for anyone who will use the display on a regular basis. The second level is the Service and requires Password 1 (PW1), intended for anyone performing installation or service maintenance on the equipment. The third and highest level is Manufacturer and requires Password 2 (PW2), intended for configuration parameters defined by the manufacturer when equipment was built. PW 1 and 2 can be adjusted to desired values.

- A.  On/Off Unit
- B.  Setpoint
- C.  Clock/Scheduler
- D.  Input/Output
- E.  Data Logger
- F.  Service → a.Information
b.Working Hours

User (no password)

- c.BMS Config
- d.Service Settings → a.Probe Adjustment
- e.Manual Management b.Thermoregulation
- c. Alarm Settings
- d.User DEV/change PW1

Service (PW 1)

- H.  Manufacturer → a.Configuration
b.I/O Configuration
c.Initilization

Manufacturer (PW 2)

When entering a level that a password is required the user will be prompted by the below masks, password level will be reset after the display has been inactive for five minutes.



The following pages will outline each mask within the template and what each feature will do. Any mask that has a **STANDARD** notation means that this mask is fixed for the template; all other masks can be customized.

Log-in Security

On the first power-up, you can log-in to security by using the factory preset password (PW1) "1024" for security service level.

Change Password

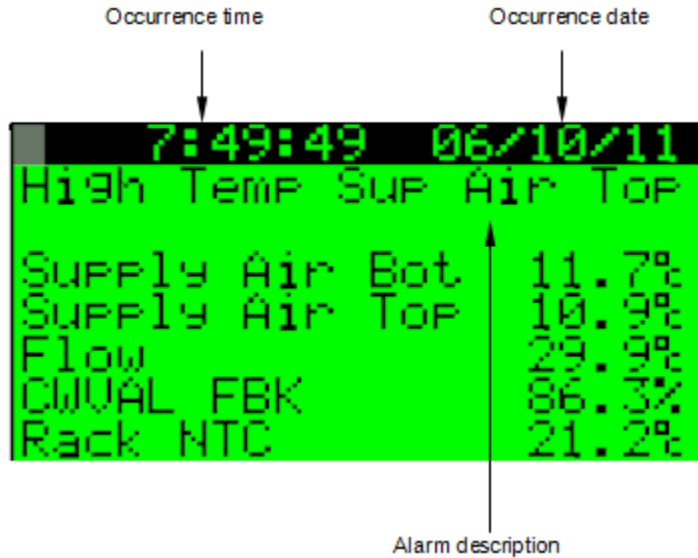
After logging-in to security service level, you can change password screen. You have to key in the new 4 digit password to confirm the change.



Alarms

Review Active Alarm Queue

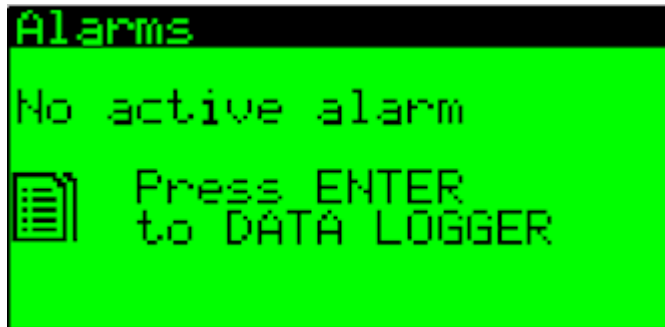
Active alarms and their date & time of occurrence can be reviewed under the alarm tab. The active alarms are displayed chronologically with the latest alarm at the top.



Clear Alarm Message

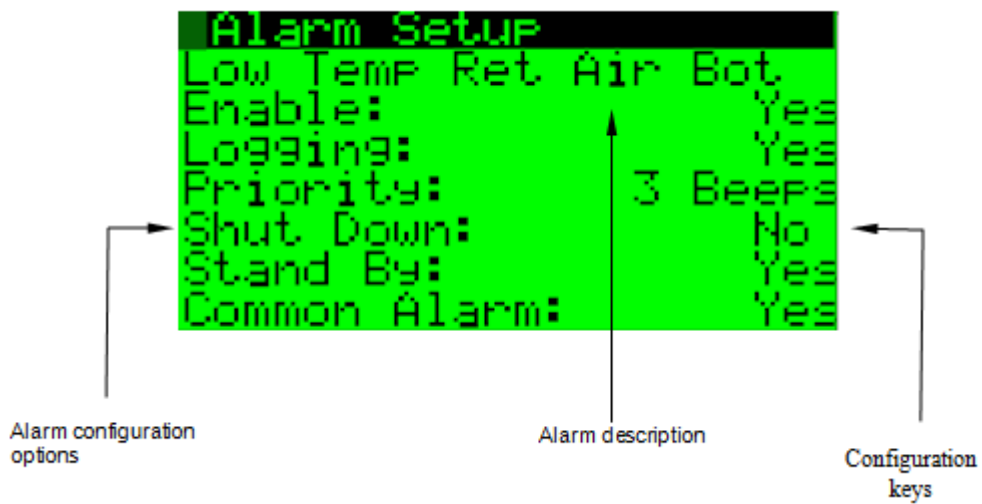
Alarm message in the active alarm queue can only be cleared by:

- Current Alarms will lit the red led alarm bell button on the pGD display and when pressed will display current alarms, if alarm state is corrected and the user is currently looking at the alarms then user will need to press the ALARM button to clear the alarm. If the user is at another part of the menu then the alarm will go away and led will turn off.
- Alarm Logger is where you can see the history of the alarms and is a running log of the last 100 alarms that occurred. If you press and hold the ESC+PRG key it will clear the Alarm Logger.



Alarm Configuration

The alarm configuration screen is under the service menu alarm settings. You can switch to alarm configuration screen by pressing the [UP arrow] and [Down arrow] keys.



Every alarm has a number of configuration options. You can customize the way alarms are reported and what automatic actions will be performed.

YES/NO	Enable option key - alarm will only be monitored if this option is selected.
YES/NO	Unit shutdown option key - if this option is selected, unit will be automatically shutdown under alarm condition.
YES/NO	Standby enable option key - if this options is selected, standby enable output will be activated under alarm condition.
YES/NO	Common alarm option key if this options is selected, common alarm output will be activated under alarm condition.
YES/NO	Event log option key - if this options is selected, the alarm events will be logged in the historical event log.
NONE/1 BP 2 BP/ 3 BP	Audible warning option keys - provides selection of three different audible warning sound (BP - BEEPS).

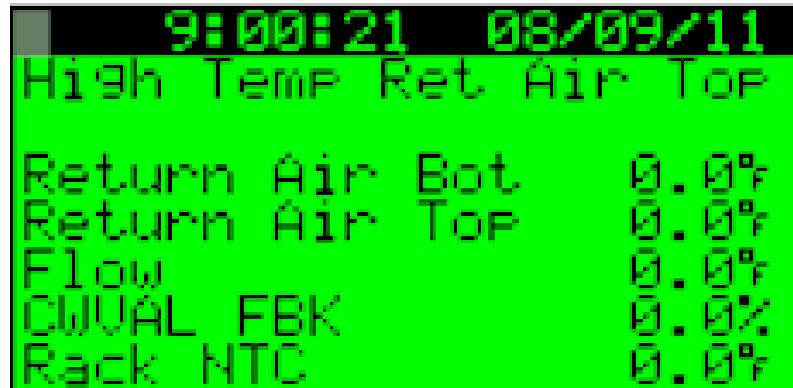
Alarm Response Summary

The following table summarizes the default configuration for all the alarms and their corresponding system action:

<u>Alarm Message</u>	<u>Default Configuration</u>	<u>Mandatory System Action</u>
Low Temperature Return Air - Bottom		Shutdown???
High Temperature Return Air - Bottom		
Low Temperature Return Air - Top		
High Temperature Return Air - Top		
Low Temperature Supply Air - Bottom		
High Temperature Supply Air - Bottom		
Low Temperature Supply Air - Top		
High Temperature Supply Air - Top		
Filter dirty		
Power Up		
DC Fan		
Power Supply		
Float		
Condensate Pump		
Return Air Temperature Sensor Fail - Bottom		
Return Air Temperature Sensor Fail - Top		
Supply Air Temperature Sensor Fail - Bottom		
Supply Air Temperature Sensor Fail - Top		
Flow Sensor Fail		
Chilled Water Valve Sensor Fail		
Entering Water Temperature Sensor Fail		
Leaving Water Temperature Sensor Fail		
Rack NTC Sensor Fail		
Compressor Short cycling		
High Refrig. Pressure		Immediate compressor shutdown
Low Refrig. Pressure		Immediate compressor shutdown
Compressor overload		Immediate compressor shutdown
Condenser Overload		
Pressure Sensor Fail		
Mixing Valve Feedback Sensor fail		

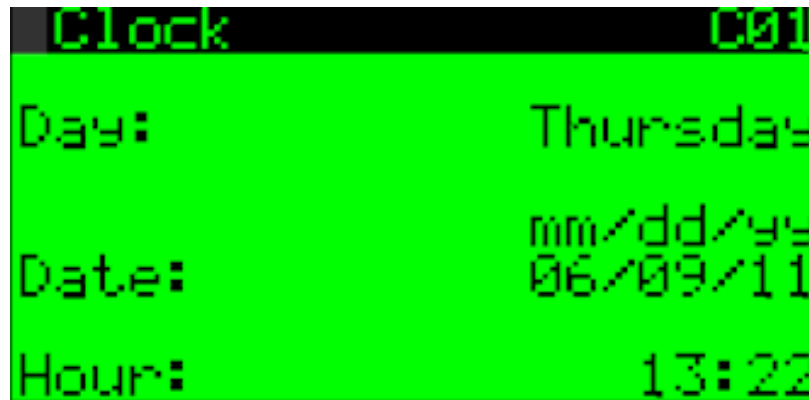
Historical Event Log

For fault analysis, the system maintains the latest 100 historical events logged in the memory. The logs are ranked chronologically with the latest event at the top.



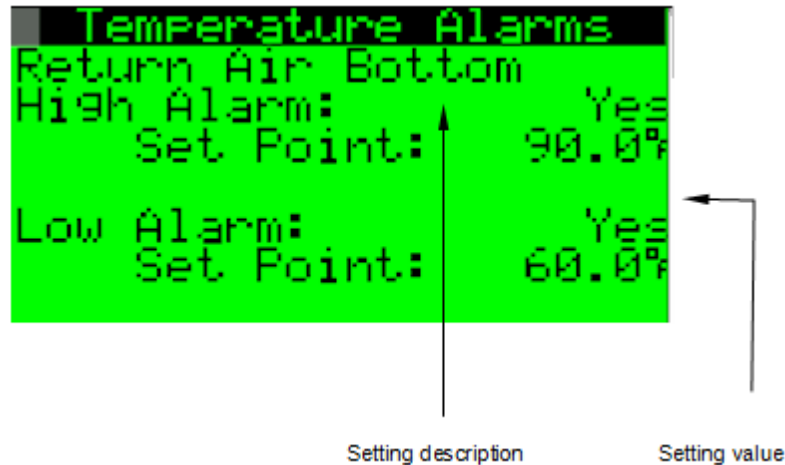
Set Clock

You can go to Service settings to clock key to adjust the date and time display.



Settings

System settings can be reviewed and altered in the service settings. You can switch the display by pressing the down arrow key.



Programming Settings

You can alter any keycode setting only if you have gained access to the appropriate security level.

After gaining the programming right, you can change the settings by using the [UP arrow] and [Down arrow] keys.

Settings Summary

The following tables summarize the settings in each page:

Description	Range	Default	Units
Temp. setpoint	0-50	0	°C
Temp. Hi limit	7-50	0	°C
Temp. Low limit	0-32	0	°C
Temp. setpoint	32-122	0	°F
Temp. Hi limit	44.6-122	0	°F
Temp. Low limit	32-86	0	°F
Temp. display	°C / °F	°C / °F	-
Start delay	1-9999	10	seconds
Low pressure start delay	30-9999	30	seconds
Air flow delay	0-180	30	seconds
Minimum ON time of compressor	0-250	30	seconds
High pressure alarm delay	0-99	30	seconds
Fan purge delay	0-9999	120	seconds
Minimum OFF time of compressor	0-600	30	seconds
Warm-up delay	0-9999	120	seconds
DC fan runtime	0-999,999	0	hours
Compressor runtime	0-999,999	0	hours

Settings Summary Glossary

The following provides a definition of the parameters used in the Settings section:

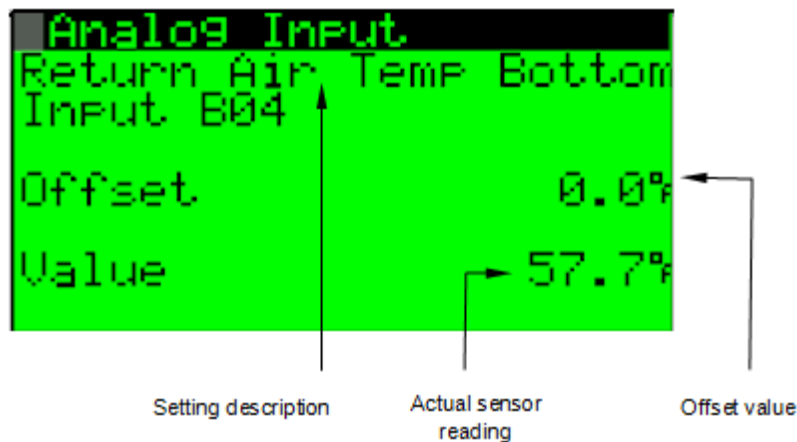
Parameter	Definition
Temp. setpoint	Units required to run together in a <i>Co-Work</i> network to satisfy the load.
Temp. Hi limit	Controls space temperature base on return air temperature.
Temp. Lo limit	Maximum return temperature before activating alarm ¹
Temp. display	Sets temperature display on Status page to °F or °C
Manual control test time	Maximum time that output will stay in manual control set time
Start delay	Delays the unit from starting until the time limit expires.
Low pressure start delay	Low pressure bypass delay time
Air flow delay	Air flow alarm delay period
Minimum ON time of compressor	Minimum time for compressor to run
High pressure alarm delay	High pressure start delay time
Fan purge delay	Runs fan for minimum time to dissipate heat in components before fan shutdown.
Minimum OFF time of compressor	Minimum time for compressor to remain before restart
Warm-up delay	Allows sensor reading to stabilize before tripping alarms
DC fan runtime	Totals DC fan run time.
Compressor runtime	Totals compressor run time.

Notes: ¹ Alarms activate only if they are enabled in the Alarm Configuration section.

Sensor Calibration

The sensor calibration can be done by inputting the offset values based on the actual measured from service menu -> Service settings -> probe adjustment page for all the analog inputs as follows:

1. Return air temperature (bottom)
2. Return air temperature (top)
3. Supply air temperature (bottom)
4. Supply air temperature (top)
5. Flow
6. Rack temperature sensor
7. Entering chilled water temperature
8. Leaving chilled water temperature



Under the sensor calibration page, you can:

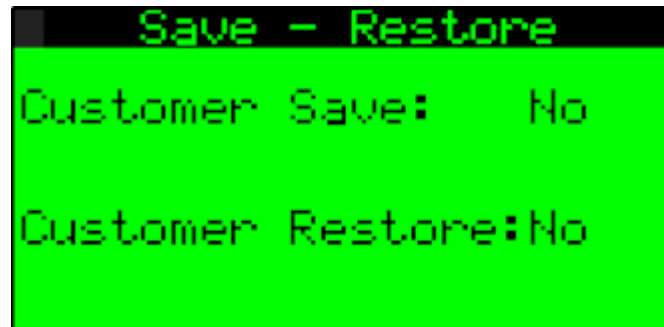
- Review the current temperature inputs, adjust the 0°C reference and restore temperature input offsets to default value.
- Review the current humidity inputs and restore humidity input offsets to default value.
- Review the supply voltage percentage.
- Sensor Calibration

Temperature

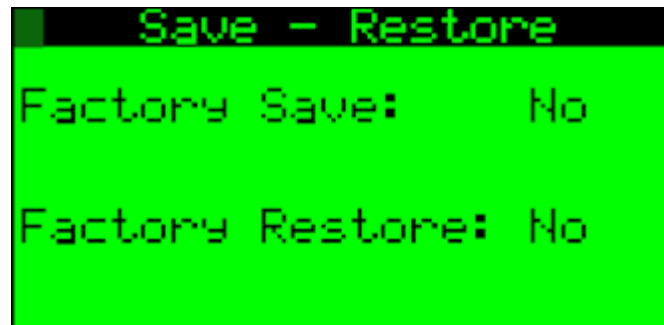
Sensor fault alarm for NTC sensors is triggered if the sensor reading would indicate below -60°C or above °C. The bios will sense that the sensor is reading out of range, and it will display -999.9 or 999.9 on the display screen. This will then trigger the alarm page in the application program.

Data Re-initialization

The data re-initialization page is under Service menu -> Service settings -> User DEV/change PW1 can be restored to previous customer settings selecting the parameter by using the [UP arrow] and [Down arrow] keys.



```
Save - Restore
Customer Save:  No
Customer Restore: No
```



```
Save - Restore
Factory Save:   No
Factory Restore: No
```

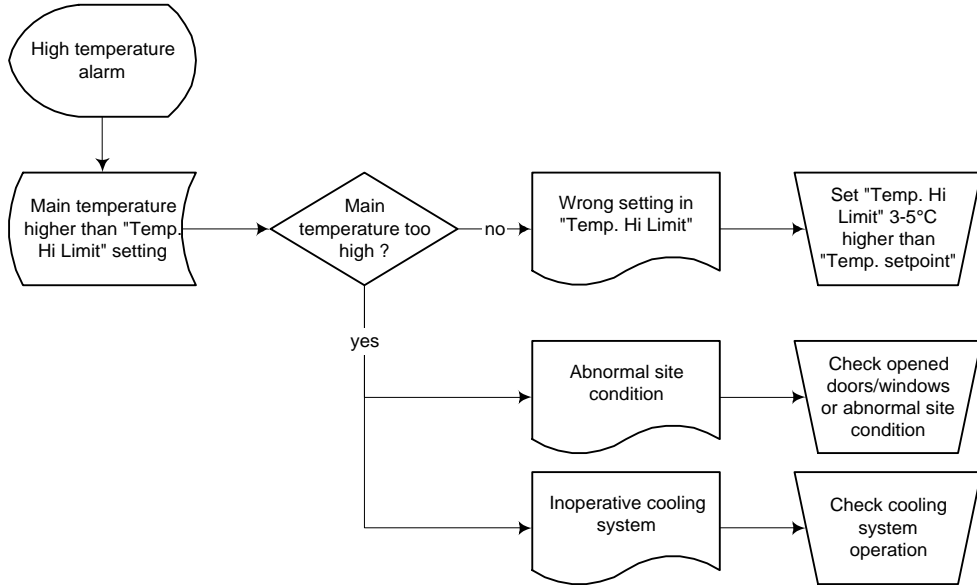
Under this page, you can:

- Set alarm configurations to default configurations
- Set system configuration and control settings to default configurations (See Setting Summary)
- Clear log data in historical event log.

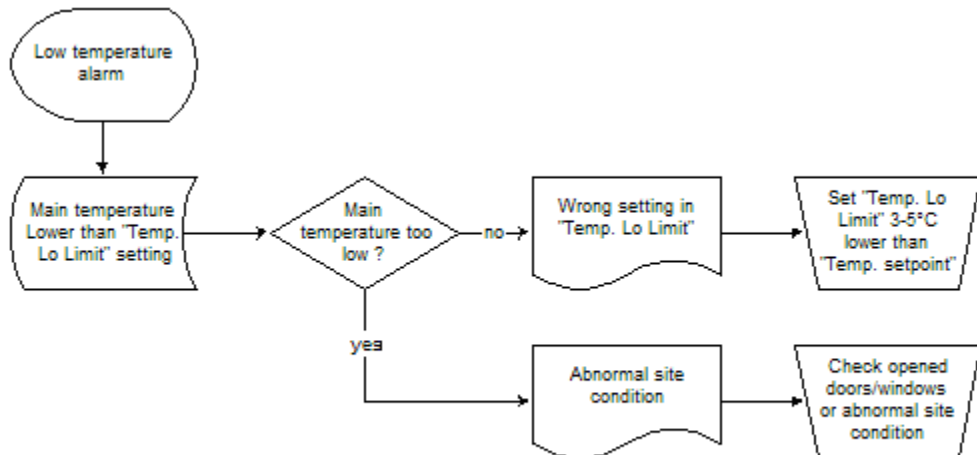
Fault Finding

In some cases, determining the cause of a fault requires a fair amount of technical knowledge and skill. The following fault finding charts are given as a guide for the service personnel to locate the common faults which may be encountered in the unit.

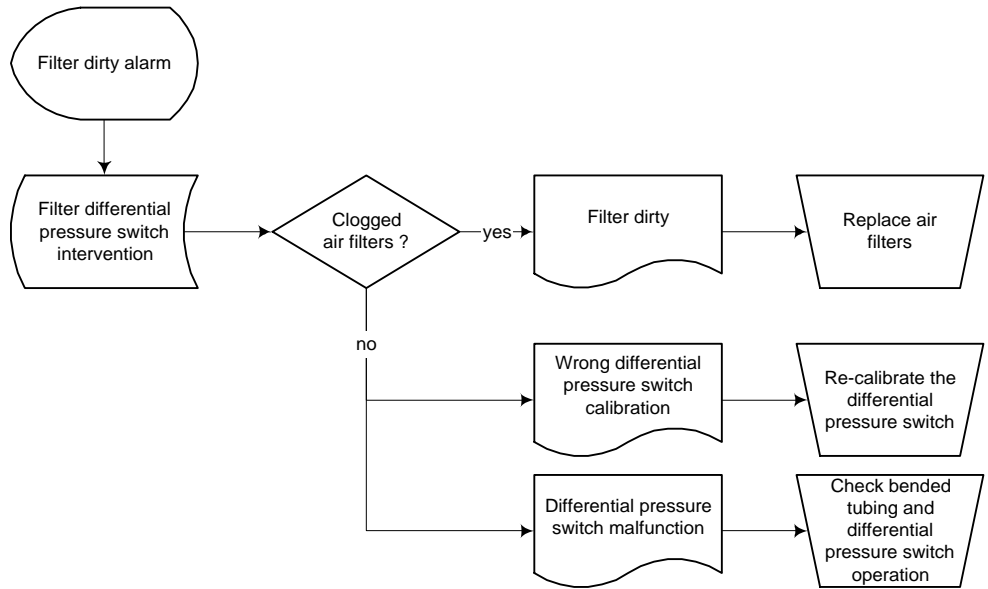
High Temperature Alarm



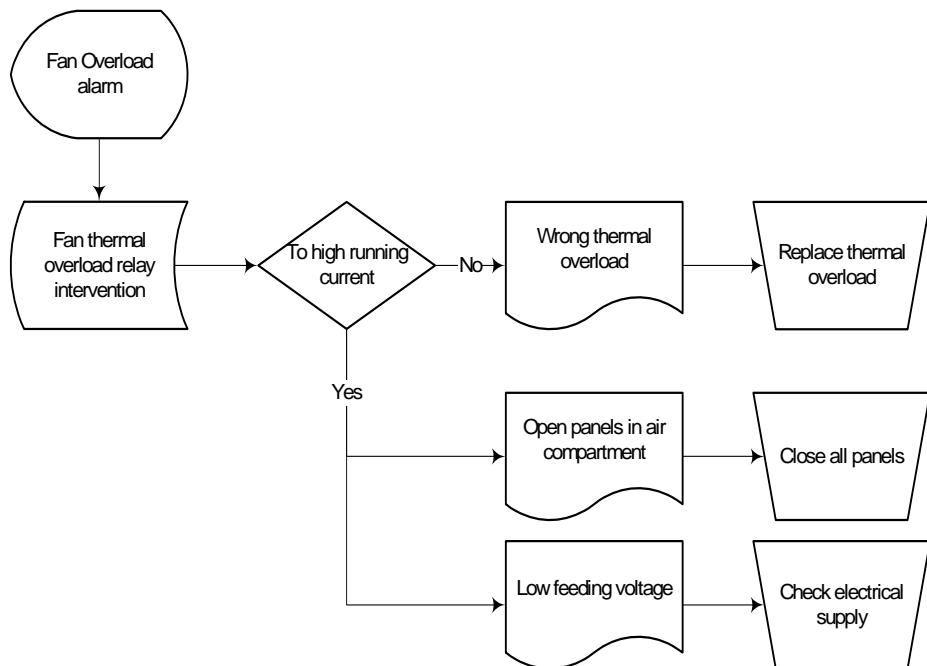
Low Temperature Alarm



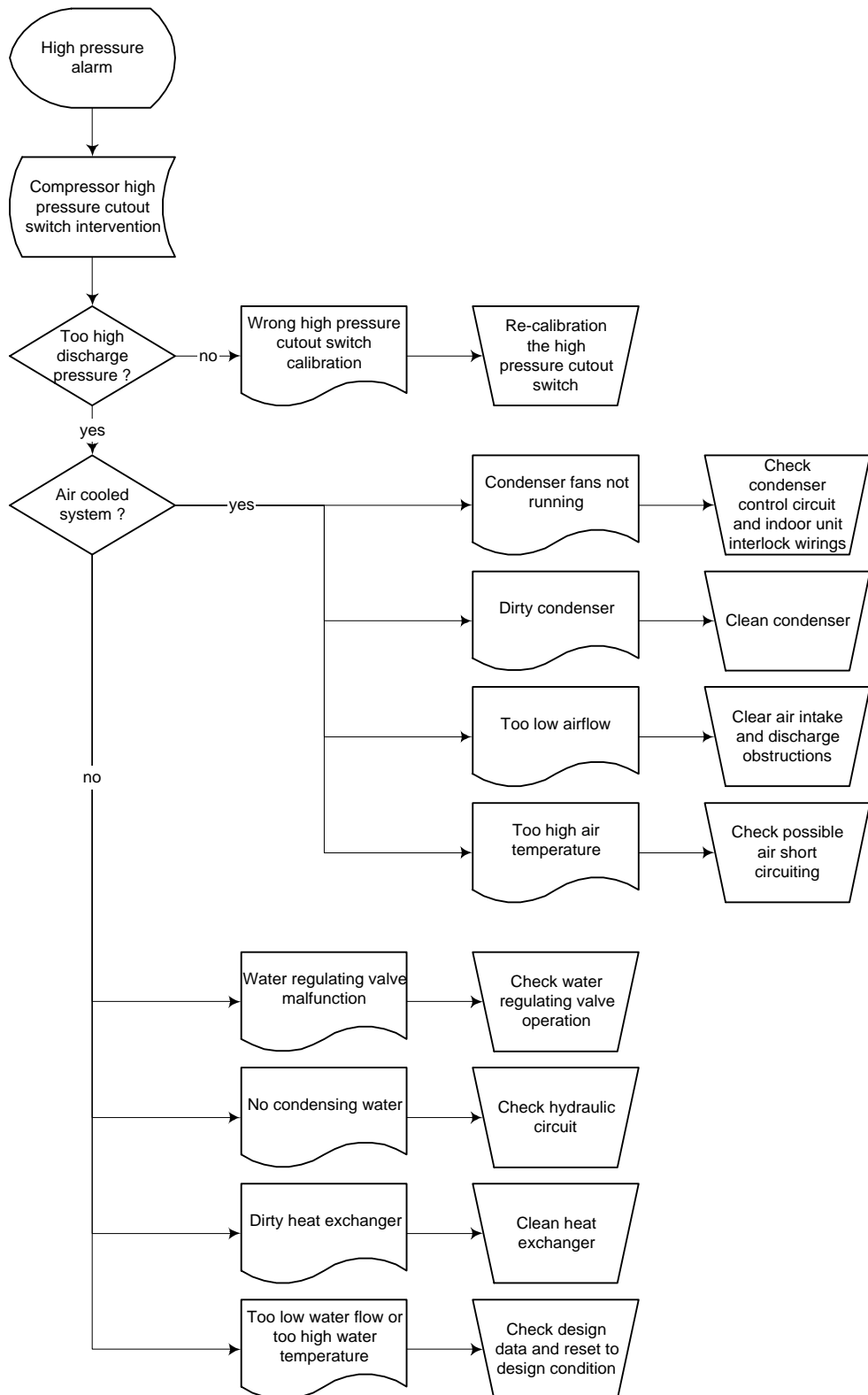
Filter Dirty Alarm



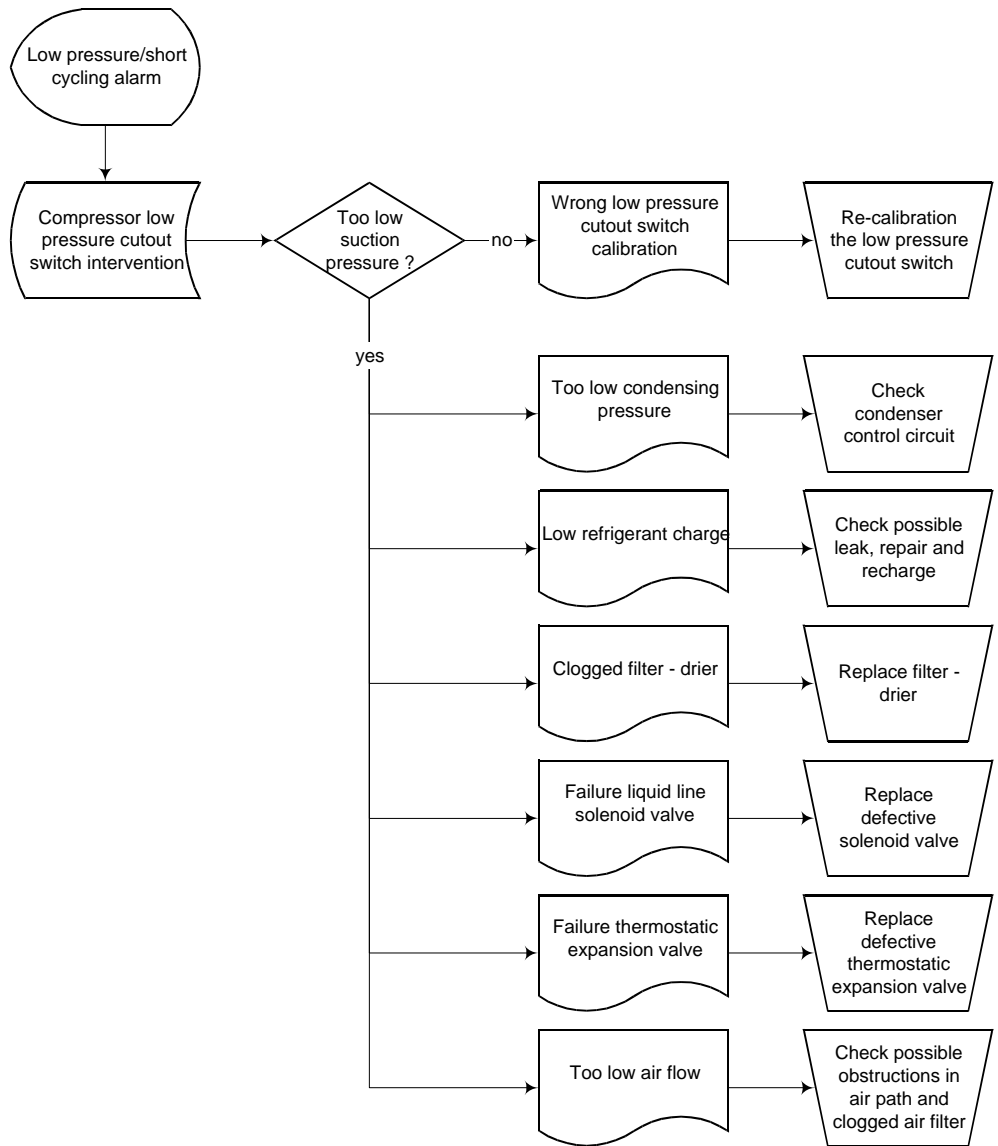
Fan Overload Alarm



High Pressure Alarm



Low Pressure or Short Cycling Alarm

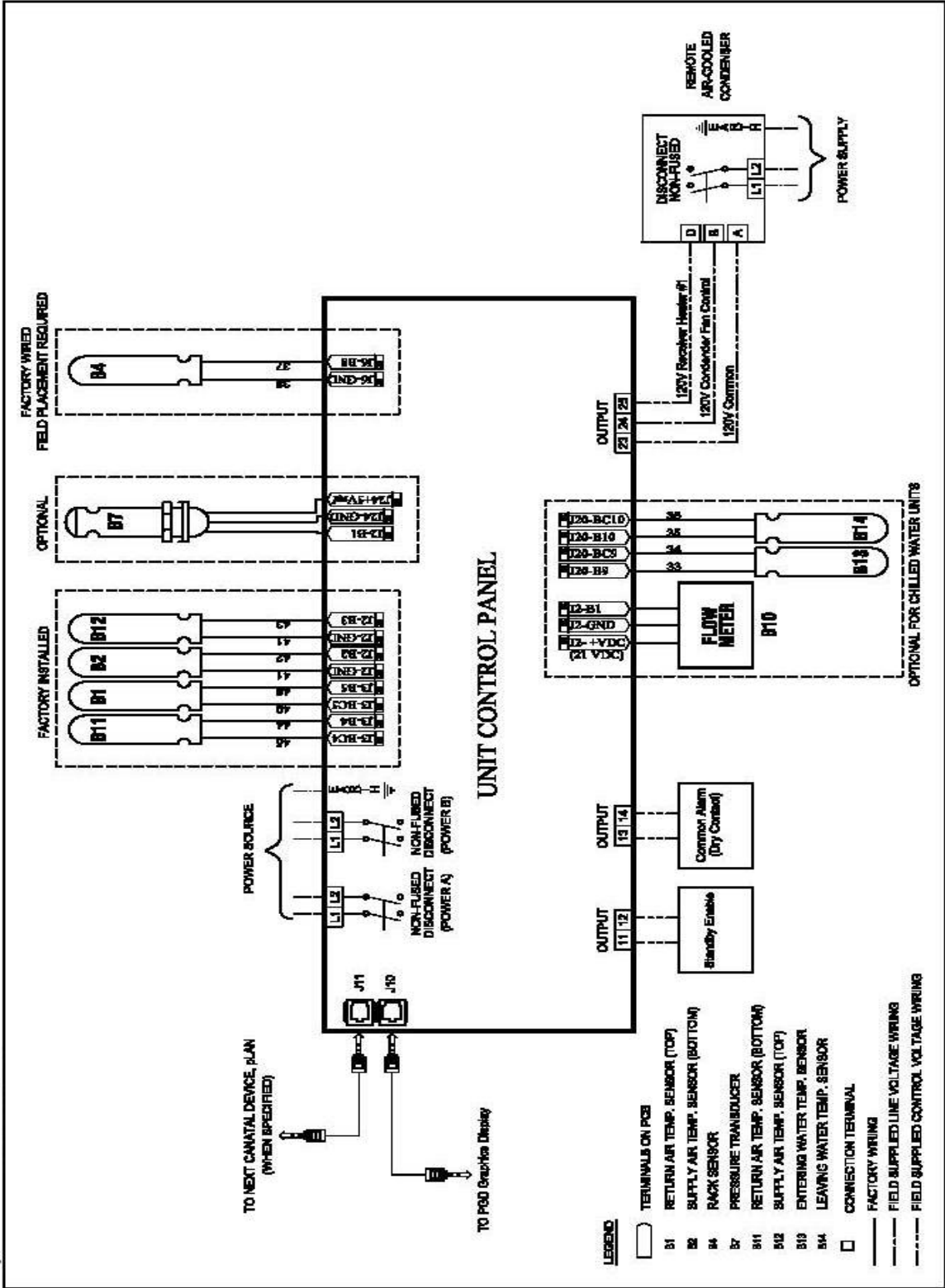


Appendix A: Electrical Schematic Diagrams

<u>Drawing Title</u>	<u>Drawing no.</u>	<u>Page No.</u>
SERIES IN ROW – Master Air Cooled Unit Control Panel (North America)	IREDN101	27



**IN ROW - GENERAL ELECTRICAL CONTROL PANEL DIAGRAM
MASTER - AIR/WATER COOLED & CHILLED WATER UNITS**



NORTH AMERICA

14 FEBRUARY 2012

IREDD101