Adiabatic Cooling System (ACS)

The Güntner Adiabatic Cooling System (ACS) is an accessory which can be incorporated within the design and construction of Güntner’s Air Cooled Condensers and Dry Coolers (Fluid Coolers) either at the time of purchase or at a later stage as a retrofit.

Güntner’s product portfolio for heat rejection equipment presents the end user with a choice of anything from a fully dry to fully wet solution or an “in between” indirect wet system. Energy efficiency and utility costs, associated with the system design, challenge the end user with a variety of possible solutions for the heat rejection equipment being selected. Specific job site location and the relevant utility costs will ultimately be the deciding factor when selecting the optimum equipment for any project.

When an Adiabatic Cooling System is selected it is essential to comply with the following guidelines. This manual should be read in its entirety prior to the start-up of the equipment. This manual will form the basis for implementing a maintenance program specific to the location and the anticipated run hours of the Adiabatic Cooling System in order to promote safe, efficient and longstanding operation.
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1. Safety Information

1.1 Safety Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚨</td>
<td>Addresses a hazardous situation which, if encountered, will result in death or serious injury.</td>
</tr>
<tr>
<td>🚨</td>
<td>Addresses a hazardous situation which, if encountered, might result in death or serious injury.</td>
</tr>
<tr>
<td>🚨</td>
<td>Addresses a hazardous situation which, if encountered, could result in minor or moderate injury.</td>
</tr>
<tr>
<td>🚨</td>
<td>Indicates instructions that pertain to safe equipment operation. Failure to comply with these instructions could result in damage to the equipment.</td>
</tr>
</tbody>
</table>

1.2 Safety Instructions

- Installation and maintenance must only be carried out by qualified personnel who are familiar with this type of equipment.
- Always wear safety glasses, gloves and head protection when working on the equipment.
- Avoid contact with sharp edges and exposed finned surfaces as these can cause painful lacerations.
- All units must be properly evacuated prior to charging the system.
- Ensure all power sources are disconnected prior to any service work being done on the units.
- Never apply heat to a sealed refrigeration system.
- Keep hands away from fans when the unit is running.
- Ensure all mounting bolts are tight and are the correct length for the specific application.
- Maintain all safety labels on the unit in good condition: If required replace with new.
### 1.3 Refrigerant/Fluid Safety

Although halocarbon refrigerants are classified as safe refrigerants; certain precautions must be observed when handling them. Refrigerant can be harmful if inhaled. When released to the atmosphere in the liquid state refrigerants evaporate rapidly freezing anything they contact. Refrigerants must be used and recovered responsibly.

*Failure to follow this warning may result in personal injury or death.*

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Anhydrous Ammonia (NH₃):
Specific precaution must be adhered to when people are working with or are exposed to Anhydrous Ammonia.

Ammonia is considered a high health hazard because it is corrosive to the skin, eyes and lungs. Exposure to 300 parts per million (ppm) is life threatening. Ammonia is also flammable at concentrations of approximately 15% to 28% by volume in air. When mixed with lubricating oils, its flammable concentration range is increased. It can explode if released in an enclosed space with a source of ignition present or if a vessel containing anhydrous ammonia is exposed to fire.

Personal protective equipment must be worn at all times when working with Ammonia. For systems that have an operating charge greater than 10,000 lbs a process safety management program is mandatory. More information on this topic is available from OSHA.

*Failure to follow this warning may result in personal injury or death.*
2. General Information

Güntner Adiabatic Drycoolers are designed to provide optimum efficiency and an extended life when properly installed, operated and maintained. It is therefore highly recommended that a comprehensive maintenance schedule be developed and undertaken on a regular pre-determined basis. This manual will assist in developing such a schedule.

This equipment is relatively complicated and the installation, operation, maintenance and servicing should only be carried out by suitable individuals who are qualified to carry out these functions. These individuals shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to these functions.

**2.1 Warranty Statement**

Guntner U.S. LLC ("Güntner") warrants the product to be free from defects in workmanship and materials under normal usage for a period of 24 months from the date of purchase (the “Warranty Period”), provided that the product is correctly installed and operated within the recommended limits of Güntner’s technical documentation. This warranty is only valid if the product is given normal and proper use and complies with Güntner’s installation and maintenance instructions. Güntner assumes no responsibility for repairs to a product sustaining damages resulting from user modifications, attachments to the product, misuse, alteration or negligent use.

Güntner, at its option, shall repair or replace, free of charge to the buyer, all components of the product which are or become defective during the Warranty Period as a result of defects in design, workmanship or materials; ordinary wear and tear excluded; provided however, that:
• The product is applied correctly.
• All operating and installation instructions for the product are complied with.
• System component and piping design is in accordance with state of the art HVAC practice.
• Nitrogen, or an inert gas, is introduced into the piping during the brazing of the piping installation.

In all instances, industry standard refrigeration practices must be observed and utilized by certified refrigeration technicians, mechanics, pipe fitters, design engineers, etc. when installing and servicing Güntner products. This warranty shall not include ordinary maintenance or cleaning of the product, defects in the installation of the product, or defects in turning and moving parts. This warranty also does not cover physical damage to the product during transit; or otherwise, after purchase of the product but before installation.

The buyer must request repair or replacement of the defective component through a written notice delivered to Güntner no later than two business days after the buyer becomes aware of the defect and the buyer must provide Güntner with the time and opportunity to make such repair or replacement. Otherwise, Güntner will be released from liability for the defect. Under no circumstances will Güntner make any repair or replacement without Güntner’s prior written consent; except to the limited extent permitted by Güntner’s Service Policy.

Any transport and exchange costs for the repair or replacement shall be borne by the buyer. Güntner shall also not be liable for costs incurred in dismantling or fitting replacement parts or for any independent inspection undertaken by the buyer. The buyer shall return any allegedly defective goods, postage or freight paid to Güntner at the address below. Upon receipt of the goods and inspection thereof, Güntner shall repair or replace, at Güntner’s discretion, the defective components and shall return the same to the buyer, return postage and freight paid. This shall constitute full compliance with Güntner’s warranty obligations hereunder. Güntner accepts no liability for the direct or indirect consequences of any modifications of or repairs to the product made by the buyer or by a third party without the prior consent of Güntner. Güntner reserves the right to inspect the product for customer abuse during the warranty period if abnormal claims against the equipment should arise. This warranty shall not apply to Güntner products which have been improperly installed or repaired; or altered in any way, outside of the manufacturer’s factory; or have been subject to misuse, negligence or accident. Equipment or component parts such as valves, electric motors, electric heaters, and electric accessories manufactured by others and used as part of or in connection with Güntner products, carry only the warranty of the manufacturer thereof. This warranty shall be void if equipment has been
subjected to negligence, abuse, misuse, low voltage, corrosive chemicals, excessive pressure, accident, outward damage, or hidden damage while in transit, or if operated contrary to the manufacturer’s recommendations.

THIS WARRANTY APPLIES ONLY TO THE REPAIR OR REPLACEMENT OF THE PRODUCT AND/OR ITS COMPONENTS AND EXPRESSLY EXCLUDES RESPONSIBILITY FOR DAMAGES NOT OCCURRING TO THE PRODUCT AND/OR ITS COMPONENTS THEMSELVES AND FOR CONSEQUENTIAL DAMAGES. THIS WARRANTY IS THE BUYER’S EXCLUSIVE REMEDY AND ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS EXCLUDED. GÜNTER SHALL NOT BE LIABLE TO THE BUYER OR TO ANY CUSTOMER OF THE BUYER; UNDER ANY CIRCUMSTANCES FOR ANY DIRECT OR INDIRECT DAMAGES, INJURY TO PERSONS OR PROPERTY OR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES, OR LOSS OF PROFITS INCLUDING, WITHOUT LIMITATION, LOSS OF REFRIGERANT, LOSS OF STORED GOODS, LOST SALES, ORDERS, PROFITS OR INCOME, EITHER GROSS OR NET, ARISING DIRECTLY OR INDIRECTLY, FROM DEFECTIVE GOODS OR WORKMANSHIP OR FROM ANY OTHER CAUSE WHATSOEVER.

3. Receiving and Inspection

All equipment is packaged for easy handling and storage. Upon delivery inspect all components for possible shipping damage and/or shortages.

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NOTICE

A specific visual inspection of the cooling pads (media) should be done to confirm that these have not been damaged during shipment.

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NOTICE

Record any unit damage or shortages on the Bill of Lading and report to the carrier and Güntner factory immediately. Shipping and handling damages are not warranty items.

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Take photos of all damaged equipment and components. Damaged items are the responsibility of the designated carrier and should not be returned to the manufacturer unless prior approval is given to do so. Confirm that all items listed on bill of lading are received; especially all components required for the water distribution system and any loose items such as media pads, when shipped loose.

The unit(s) can be lifted using extended forks underneath the skid completely traversing the width of the unit and generally centered along its length. Do not allow the forks to make contact with the unit. Refer to the rigging instructions applicable to the specific condenser or dry cooler for greater detail.
4. Rigging

4.1 Pre-Rigging Inspection

Confirm that all components are secured in position and that nothing has come loose during shipment.

Confirm all fasteners, brackets and piping connections are tight.

Ensure that the cooling pad supports are firmly in place and all cooling media pads are securely in position.

4.2 Rigging and Installation

Refer to the rigging and installation instructions within the IOM for the respective unit (e.g. GF/VD or GF/VW).

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**NOTICE**

Ensure that the unit is level. This is critical for the ACS as the gutter has an inclination to allow the water to free drain. If the unit is not level this inclination could be compromised to a point where water is allowed to stand in the gutter.

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5. Start–Up

Ensure that all piping and components for the water distribution system are tight and secure.

Check to ensure that all media pads are securely held in position and that there are no visible gaps between the pads.

If required, clean the media pads using a soft bristle brush or low pressure water.

Check to ensure the drain valve is closed.

Confirm that all drain piping has been completed and water flows freely out of the gutters.

Check that the ambient temperature probe is secured in position.

To activate the operation of the water distribution system:

- Enter a temperature set point lower than the ambient temperature on the GMM controller.
- Refer to the Adiabatic Cooling System Controls section on page 18 in this manual to confirm if the controller is set up in the water or energy saving mode; adjust accordingly to override the system for start-up and set-up. Once completed, return settings to normal.
- Once the temperature set point is entered, the solenoid valve will open automatically.
• Adjust the balancing/flow valves (with a 6mm Allen key) to establish equal distribution to each side of the unit.

Balancing valve with integral flow meter (one per branch)

• Check to confirm that the water is being well distributed over the pads (the discoloration of the media, once wetted, will be clearly visible).

• If water distribution is not uniform, remove the water distribution header cover and confirm that all orifices are open and not clogged.

Water distribution header, with cover opened:

• If the unit has been in prolonged storage it is recommended to clean and flush the distribution headers prior to allowing any water to flow over the pads.

• This can be accomplished by opening the removable cap at the end of the distribution header on the opposite end to the water inlet side and allowing water to flow through the headers until no dust, dirt or debris is visible.
Removable cap for cleaning and flushing distribution headers

- Ensure that there is no water carry over outside of the pad area.
- Confirm that all water caught in the gutters is able to free drain unobstructed.
- If the adiabatic system has been isolated, or inactive for an extended time; open the drain valve to purge the water from the distribution headers.

6. Prolonged Storage

All electrical components must be disconnected from any power source.

Venting caps and drain valves must be removed and opened to ensure all water is completely drained from the system.

During times of prolonged storage the system must be fully drained.

Once drained, the valves and caps should be left slightly open to allow the system to breathe, but tight enough to prevent debris and vermin from entering the system.
The media pads should be removed from the unit and placed in a well-ventilated storage area and not exposed to sunlight.

To remove the cooling pads:
- Remove the thumb screws and lift to open the header cover.
• With the header cover open, remove the top cooling pads by simply lifting them up and out.

• Loosen the thumb screws on the cooling pad support and slide the cooling pad support out and down to create space for the removal of the bottom cooling pads.

• Lift the bottom cooling pads up out of the gutter and then out to remove.
7. Water Distribution System

Major components of the Güntner Adiabatic Cooling System (ACS):

- Water Distribution System with Inlet Solenoid Valve, Strainer, Balancing/Flow Valves, Drain Valve, and Piping
- Ambient Temperature Probe
- Evaporative Cooling Pads
- Water Collection Gutter
- Single Drain Connection
- Güntner Motor Management (GMM) Controller (an option which is factory wired and mounted)

The majority of these components can be identified in the figure above.

Components by others will include: anti-siphon/air break measures, heat tracing (if required), water distribution pump, and more depending on the specific system layout.

NOTICE

All connecting piping to the water distribution system must be supported independently. The unit and associated piping is not designed to bear any additional piping loads. Failure to comply with this will result in damage to the system and void all warranties.
8. Adiabatic Cooling System (ACS) Operation

The principle behind the adiabatic cooling process is that as water evaporates the surrounding air becomes cooler and more humid. This is a natural occurrence. Therefore, a portion of the water which is distributed over the media pads will evaporate. The heat that is needed for the evaporation process is removed from the air. The air that leaves the pad is therefore cooled and humidified simultaneously resulting in the temperature of the air entering the finned heat exchange surface being closer to the wet bulb temperature. This process permits a lower entering dry bulb temperature onto the finned heat exchange surface; effectively creating a greater approach and thereby utilizing less finned surface for the heat rejection requirement(s).

Each unit fitted with the ACS media pads has a recommended water flow rate for optimum operation. This water flow will provide a protective coating on the surface of the pad. Only a portion of the water will evaporate. The remainder of the water will flush the pad. This water that is not evaporated flows into the gutter from the drain connection and can be routed to a waste water outlet.

*In order for the system to function proficiently, the complete wetting of the media pads is a fundamental requirement for optimum performance.*
Design Water Flow Rates for the Respective Unit(s)

Determine the number of fans from the model nomenclature as underlined in the following examples:

- GFW ###.#/2-*(*)-*#/## has 2 fans (e.g. GFW 090.1/2-L(L)-F4/01)
- GFD ###.#*/2x2-**#* has 2x2 fans, or 4 fans total
- AGVD ###.*/2x6-**#* has 2x6 fans, or 12 fans total

### Design Water Flow Rates

<table>
<thead>
<tr>
<th>Design Water Flow Rates</th>
<th>GFW / GVW Series</th>
<th>GFD Series</th>
<th>GVD / AGVD Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model(s)</td>
<td># Fans</td>
<td>gpm</td>
<td>Model(s)</td>
</tr>
<tr>
<td>GFW or GVW</td>
<td>1</td>
<td>2.1</td>
<td>GFD</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>6.4</td>
<td></td>
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<tr>
<td></td>
<td>4</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>10.7</td>
<td></td>
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<tr>
<td></td>
<td>6</td>
<td>12.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>14.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>17.1</td>
<td></td>
</tr>
</tbody>
</table>

Table 1

The Güntner ACS is offered as a once–through system; thereby minimizing water treatment requirements and the associated water treatment expenses.

The use of raw source water however, also has its own set of requirements in order to ensure the longevity of the media pads.

9. Water Quality Guidelines

Typical municipal and well water supplies are suitable for use on the ACS. The application of other water sources, cleaning agents, or treatments must be compatible with the materials of construction. The ACS components include polypropylene piping, brass valves and fittings, PVC distribution headers, cellular media, and type 304L stainless steel frames and gutters.
10. Cooling Pad Media Guidelines

The functionality of the Adiabatic Cooling System (ACS) is such that the evaporation of the water occurs at the media surface as it flows over and through the pads. Standard water treatment practices are therefore somewhat different to standard heat exchanger practices. The primary control method is to provide sufficient water to the media to keep it flushed. If sufficient water is not provided to completely wet and flush the entire surface, deposition will occur.

Many water related problems can be avoided if good system design and basic housekeeping practices are followed.

- Provide good, even water distribution over entire surface area of pads.
- Avoid having any dry areas on the pads.
- Wetting and drying of the media – on a regular basis – will promote scaling of the media.
- The water flow over the media should have a minimum duration of thirty (30) minutes per cycle to help control scale build up.
- The Güntner ACS is not designed to evaporate all the water. Excess water will flow into the gutter(s).
- Clean and flush distribution headers on a regular basis to prevent build-up of deposits or microbiological growth.
- Replace damaged or spent media.
- At times or specific locations when the media experiences extreme evaporation, a flush cycle is recommended every 24 hours with the air flow off.
- Locate the equipment and use appropriate water sources to minimize or avoid ingestion of contaminants that can clog or damage the media pads. Some examples include airborne dust/debris and exhaust air from other processes or equipment.

11. Cooling Pad Media Maintenance

- Reduce the number of on-off cycles.
- Allow the pads to dry out completely once every 24 hours (with the fans running).
- Avoid harmful contaminants including dust, dirt, fumes and harsh cleaners.
- Use only mild and environmentally responsible cleaning agents that are compatible with the materials of construction.
- Drain and disinfect the entire water distribution system quarterly with compatible concentrations of disinfectants.
12. Maintenance

<table>
<thead>
<tr>
<th>Recommended Inspection and Maintenance Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inspect and Clean as Required</strong></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Visually inspect cleanliness and stability</td>
</tr>
<tr>
<td>Inspect gutters and remove any debris</td>
</tr>
<tr>
<td>Check water distribution system for leaks and clogged orifices in the distribution header</td>
</tr>
<tr>
<td>Flush water distribution system</td>
</tr>
<tr>
<td>Check water flow rate and adjust if necessary</td>
</tr>
<tr>
<td>Check water distribution is even across entire length of unit</td>
</tr>
<tr>
<td>Remove all dirt and debris from the media pads</td>
</tr>
<tr>
<td>Flush water distribution headers</td>
</tr>
<tr>
<td>Drain and disinfect the entire water distribution system</td>
</tr>
</tbody>
</table>

Table 4

13. Adiabatic Cooling System Controls

13.1 Operating Modes

There are three possible operating conditions when the Güntner ACS accessory is included on a GF/VD or GF/VW unit when utilizing the Güntner Motor Management (GMM) Controller:

- **Dry mode**
- **Energy Saving Mode**
- **Water Saving Mode**

13.1.1 Dry Mode

This is the standard operating mode for the unit when ambient temperature and process are within the design operating conditions. In this operating mode the GMM controls the motors and regulate the speed to achieve the desired process set-point, no water is used in this operating condition.

13.1.2 Wet Mode

The GMM controller can be adjusted to operate into two additional modes – depending on the customer requirements – by a simple change to the parameter settings using the controller display. These two operating modes are either the Energy Saving Mode or the Water Saving Mode.
13.1.2.1 Energy Saving Mode

The Energy Saving Mode is concentrated on reducing the electrical consumption of the motors by favoring the wetting of the pads in order to reach the condensing temperature or leaving fluid temperatures; thereby requiring less airflow and consequently lower electrical consumption. In the Energy Saving Mode the pads are kept wetted while the speed of the motors are regulated which allows the unit to operate below the switch point with reduced power consumption.

In the Energy Saving Mode the following two conditions must be met for the water inlet solenoid valve to open:

1. Motor speed must be above 40% of full speed.
2. Ambient dry bulb temperature is within 5°F of the control set-point that helps to determine dry mode or wet mode, sometimes referred to as the wet/dry switch point (this value can be adjusted in the GMM).

To minimize the possibility for scale build up on the pads a minimum of 30 minutes is pre-set as the default operating duration for the wet mode. Not allowing the pads to be fully wetted will result in severe deposition on the pads and quickly shorten the life of the pads. This deposition may block the air flow causing bowing of the media pads which can allow the media to fall out of the framing.
Energy Saving Mode Control Methodology:

1. Ambient temperature rises to within 5°F of switching set point.
2. The GMM controller’s signal to the motors is > 40% rpm and ambient temperature is within the 5°F switching set-point; the solenoid valve will open, initiating the wet mode and the 30 minute timer starts.
3. After the 30 minutes the GMM is operating at less than 40% rpm, therefore the solenoid valve will close.
4. The ambient temperature increases; GMM signal to motors rises above 40% rpm.
5. After the next 30 minutes, the GMM signal is still above 40% rpm; ambient temperature is within the 5°F of switching set-point: The solenoid valve will remain open until the GMM signal to the motors is less than 40% rpm.
6. The solenoid valve will close once the GMM signal to the motors is less than 40% rpm.

13.1.2.2 Water Saving Mode

The Water Saving Mode is concentrated on reducing the water consumption required by the ACS. In the Water Saving Mode the pads are kept dry while the speed of the motors is allowed to increase to 100% speed; which results in the unit operating dry for as long as possible while still maintaining the condensing temperature or leaving fluid temperature. The wet mode is only activated once the ambient temperature reaches the switching set-point.

In the Water Saving Mode the following two conditions must be met for the water inlet solenoid valve to open:
1. All fan motors operating at 100% rpm (this also implies that the fluid outlet, or condensing temperature, is higher than the set point entered in the GMM).
2. The ambient temperature is higher than design condensing temperature (to be adjusted in GMM).

To minimize the possibility for scale build up on the pads, a minimum of 30 minutes is pre-set as the default operating duration for the wet mode. Not allowing the pads to be fully wetted will result in severe deposition on the pads and will quickly shorten the life of the pads. This deposition may block the air flow causing bowing of the media pads which can allow the media to fall out of the framing.

Water Saving Mode Control Methodology:

<table>
<thead>
<tr>
<th>Control Logic Sequence (Water Saving Mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
</tr>
<tr>
<td>&gt; Set Point</td>
</tr>
</tbody>
</table>

1. The ambient Temperature rises above the set-point.
2. The GMM controller is operating at 100% rpm and ambient temperature is above the set-point; the solenoid valve will open, initiating the wet mode and the 30 minute timer starts.
3. After 30 minutes the GMM is operating at less than 100% rpm, therefore the solenoid valve will close.
4. The ambient temperature increases above the set-point; the GMM signal to the motors is also at 100% rpm.
5. After 30 minutes the GMM is at 100% rpm; ambient temperature is higher than set-point: The solenoid valve will remain open until the GMM signal to the motors drops below 100% rpm.
6. The solenoid valve will close once the GMM signal to the motors is less than 100% rpm.
13.2 Adjusting Settings on the GMM

Energy and Water Saving modes are adjustable directly on the GMM controller. There are two (2) values that need to be adjusted depending on the operating mode desired, these values are easily adjustable via the GMM display. Adjust both values depending on the required operating mode as per the set-points below.

Default set points for:
- Energy Saving mode:
  - Border control value (ctr.val) = 40%
  - Ambient temp = 86°F
- Water Saving mode
  - Border control value (ctr.val) = 99%
  - Ambient temp = 83°F

13.2.1 How to adjust ACS setpoint

Main display

<table>
<thead>
<tr>
<th>Setpt.</th>
<th>90°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act. Val.</td>
<td>100.0°F</td>
</tr>
</tbody>
</table>

Scroll down to Setpoints

Press right arrow

Setpoints >

Alerts >

Setpoint 1 >

Threshold >

Scroll down to Threshold

Press right arrow

Threshold >

Setpoint 1
For more information on the set-up and functioning of the GMM, please refer to the IOM for the GMM.
14. Electrical Control Schematics

Generic: for ACS control with GMM

Customer Interface Input
Class 2 Control Circuit
Air Cooled Condensers
Air Cooled Fluid Coolers
Air Coolers
Evaporators
Evaporative Condensers
Evaporative Fluid Coolers
Closed Circuit Fluid Coolers