



CTM MARINE CHILLED WATER SYSTEMS

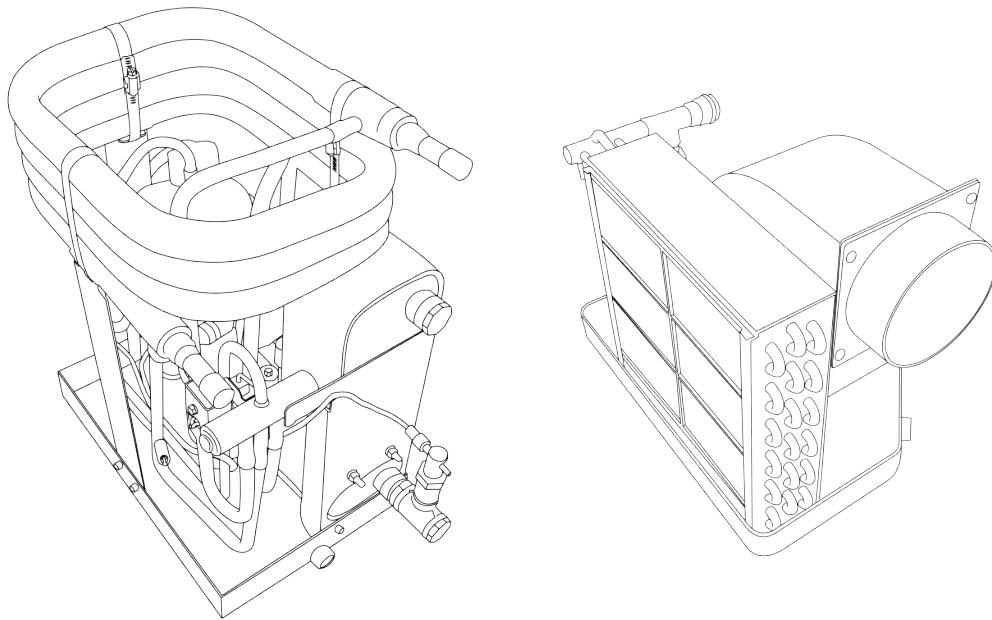
CW MODELS

(24,000 / 36,000 / 48,000 / 60,000 / 72,000 BTU)

AIR HANDLER MODELS

(6,000 / 8,000 / 12,000 / 16,000 / 24,000 BTU)

INSTALLATION & USER MANUAL



CTM-MARINE

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www.ctm-marine.com

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Please read and follow the safety information and instructions carefully before installing your unit. You can always contact Customer Service if you have any doubts, concerns or questions about the contents in this instructions manual. Failure to heed these warnings and instructions could not only result in malfunction of the product, but also result in death serious injury.

CTM Marine does not accept liability for damage in the case of:

- > Failure to assemble or connect the unit properly following the instructions in this manual.
- > Damage to the unit and its accessories resulting from mechanical influences and excess voltage.
- > Any alternation to the units without permission from CTM Marine.
- > Use for purposes other than the purposes described in this manual.

In the interest of product improvement, the specifications and design are subject to change without prior notice.

HOW TO READ THIS MANUAL

This manual provides proper installation information of CTM-Marine Chilled Water Systems. Improper installation procedures can result in unsatisfactory performance and / or prenature failure of these a/c units as well as serious injury or death. Before proceeding please read this manual completely.

Throughout this manual you will find a few signaling symbols. Please take a time to read and understand what each signaling symbol means:



Used to indicate a dangerous situation where, if not followed carefully, could result in serious injury or death.



Used to indicate important and useful information.



Used to indicate additional information.





QR Code for access to virtual content such as tutorial videos.

Pay attention to signalling symbols throughout this manual with important information.

Some sections of this instructions manual have QR codes that you can easily scan with your Smartphone. They generally contain tutorial videos following the instructions in this manual or additional information.

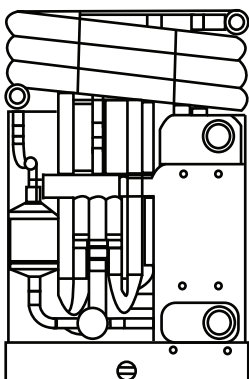
UNIT INSTALLATION

 Read these instructions completely and then plan all connections which must be made to the unit including ducting, condensate drain line, seawater inlet and outlet hoses, electrical power connection, location of control, and seawater pump placement, to assure easy access for routing and future servicing for both chilled water and air handler units.

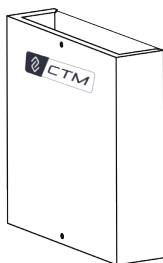
 Installation and servicing of this system can be hazardous due to system pressure and electrical components. When working on this equipment, always observe precautions described in the literature, tags and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves and place a fire extinguisher close to work area.



MOUNTING THE CHILLED WATER SYSTEM AND THE ELECTRICAL BOX



CHILLED WATER SYSTEM





ELECTRICAL BOX


1 - The chiller unit is usually installed in the engine room. Make sure to install the chiller unit in a horizontal surface strong enough to hold the unit when the boat is in motion, choose a location where it will be dry and able to be serviced easily. Allow at least between 3 - 4 feet (0.9 - 1.2m) of space around the unit and at least 3 feet (0.9 m) above the unit.

2 - The control panel or electrical box which contains all the controls to operate the chiller should be installed on a dry and flat horizontal or vertical surface where it could be accessed easily for installation and servicing. Make sure the location of the control panel is free of water spray and moisture.

Refer to the illustrations throughout this manual for guidance.

 **ELECTRICAL SHOCK HAZARD**
 > Ensure power source is OFF or disconnected at main panel before opening any electrical boxes. Failure to comply may cause serious injury or death.
 >It is imperative that the components of this system are properly grounded to minimize any electrical shock hazard and / or personal injury.

 **REFRIGERANT SAFE HANDLING**
 Because refrigerants are heavier than air, they can push out oxygen from your lungs or from enclosed spaces. To avoid death or difficulty breathing, take the following precautions:
 1- You should never sniff a refrigerant
 2- No refrigerant should ever be purged into an enclosed space or room. By law, all refrigerants must be reclaimed.
 3- If you suspect an indoor leak, you must thoroughly ventilate the area before you begin work.
 4- If you do get contact with liquid refrigerant, wear gloves and goggles to avoid frostbite or blindness. If liquid refrigerant does get in your eyes or on your skin, seek medical attention immediately.
 5- Refrigerant can cause poisonous gas to be released if it is burned.
 6- Always follow EPA regulations.

 **EXPLOSION HAZARD**
 Do not apply flame or steam to a refrigerant cylinder. If heat is needed to change faster, partially immerse the cylinder in warm water.
 > A cylinder should never contain more than 80% of liquid refrigerant.
 > Add only R-410A to an R-410A cylinder. It operates at much higher pressures than R-22. Service equipment used with R-410A must be listed.
 >Do not use a cylinder as a platform or roller. Always store a cylinder in a cool, dry place.


Some pages have a boxed section on the right to indicate potential physical injury hazards and potential damages to the units. It's important to read, understand and obey safety instructions.

UNIT LABEL INFORMATION


HOW TO READ YOUR LABEL

CHILLED WATER SYSTEMS - CW

H = 230 V



PRODUCT NO.
31221W



MODEL
CW-24H

COOLING CAP. (BTU) 24,000	VOLTAGE/HERTZ 208-240V / 50-60	PHASE 1
FUSE MAX./MIN. (AMP) 25 A / 16 A	INPUT : COOL/HEAT (AMP) 7.6 A / 9.0 A	REFRIG. OZ/GR. R410A 28.2 / 800
SUGGESTED WATER FLOW (GAL/H) 500	WATER IN/OUT 5/8 / 5/8	CHILL WATER IN/OUT 3/4 / 3/4
	DIAGRAM XXXXX	NET WEIGHT 75 LBS


CE **RoHS** **SERIAL NO.**
COMPLIANT CTMXXXXXX

Miami, FL 33172 USA
www.ctm-marine.com
Assembled in China


*Unit Label Data Changes By Model

AIR HANDLER UNITS - AH

H = 230 V



PRODUCT NO.
75201A



MODEL
AH-16H

COOLING CAP. (BTU) 16,000	VOLTAGE/HERTZ 208-240 V / 50-60	PHASE 1
FUSE MAX. (AMP) 5 A	INPUT : ROTOR (AMP) 0.9 A	BLOWER CAP 5uF / 450 V
CNTRL. BOARD U-BOARD	WATER IN/OUT 5/8" / 5/8"	DIAGRAM XXXXX
		NET WEIGHT 28 LBS

CE **RoHS** **SERIAL NO.**
COMPLIANT CTMXXXXXX

Miami, FL 33172 USA
www.ctm-marine.com
Assembled in China

*Unit Label Data Changes By Model

WARNING LABELS**WARNING!**

THIS AIR CONDITIONER UNIT, INCLUDING DUCT WORK, MUST NOT BE INSTALLED IN A FUEL VAPOR AREA OR ENGINE ROOM WHERE ANY POSSIBILITY OF FUEL VAPOR, ENGINE EXHAUST OR ANY OTHER TOXIC GASES MAY EXIST. THIS UNIT IS NOT VAPOR PROOF AND COULD INTRODUCE DEADLY GASES INTO THE LIVING SPACE IF IMPROPERLY INSTALLED. THIS COULD LEAD TO DEATH OR DISABILITY OF THE OCCUPANTS. SEE OWNER'S MANUAL.

CAUTION!

HIGH COMPRESSOR
TEMPERATURE IS NORMAL
DO NOT TOUCH

DANGER

ELECTRICAL SHOCK HAZARD
DISCONNECT VOLTAGE AT MAIN PANEL
OR POWER SOURCE INLET BEFORE
OPENING ANY COVER
**FAILURE TO COMPLY WILL RESULT IN
INJURY OR DEATH**

WARNING

Cancer and reproductive harm
www.P65warnings.ca.gov

TYPE OF REFRIGERANT

R410A
REFRIGERANT

PRODUCT DESCRIPTION & FEATURES

Thank you for purchasing our CTM Marine Chiller Systems. The CTM Marine Chiller System is the best option whenever two or more independent areas need to be air conditioned throughout the vessel.

The CTM Marine **CW** chilled water air conditioning system consists of the following:

- **The Chiller (CW):** The compressor, the condenser, and the evaporator or heat exchanger.
- **The Airhandler(s) (AH):** The blower and the coil.
- **A Freshwater System:** Freshwater that circulates through the piping from the chiller to each airhandler and back.
- **A Saltwater System:** Seawater circulates through the condenser coil.

When the air conditioner is in cooling mode, the blower draws warm humid cabin air across the air handler unit (AH). The air transfers to the fresh water circulating through the coil, and the heat is removed from the air. The now warmed water pumps back to the chiller where it is cooled again by circulating through the evaporator, and transferring the heat from the water to the refrigerant in the evaporator coil. The heated refrigerant gas circulates back to the compressor where it is compressed and circulated through the condenser coil.

The heat from the refrigerant gas is then exchanged to the seawater and discharged overboard. The chilled freshwater then circulates back to the airhandlers through the freshwater pipe system in a continuous loop repeating the cycle again. The same process occurs for reverse-cycle heating, but backwards. The refrigerant flows in the opposite direction through the reversing valve and heat is transferred from the freshwater system which circulates back to the airhandlers.

BASIC CHILLED WATER A/C SYSTEM LAYOUT IN A MID SIZE BOAT

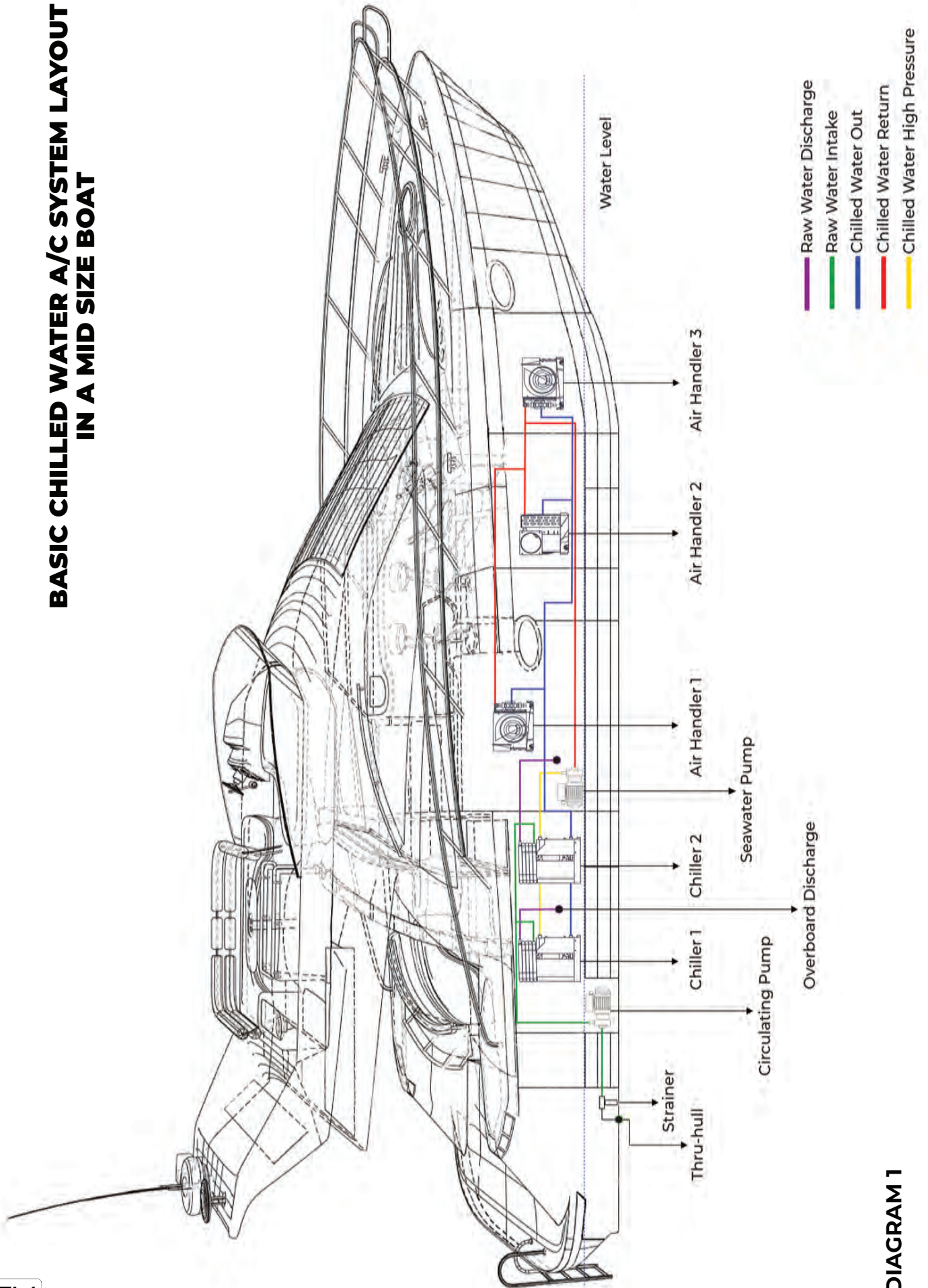
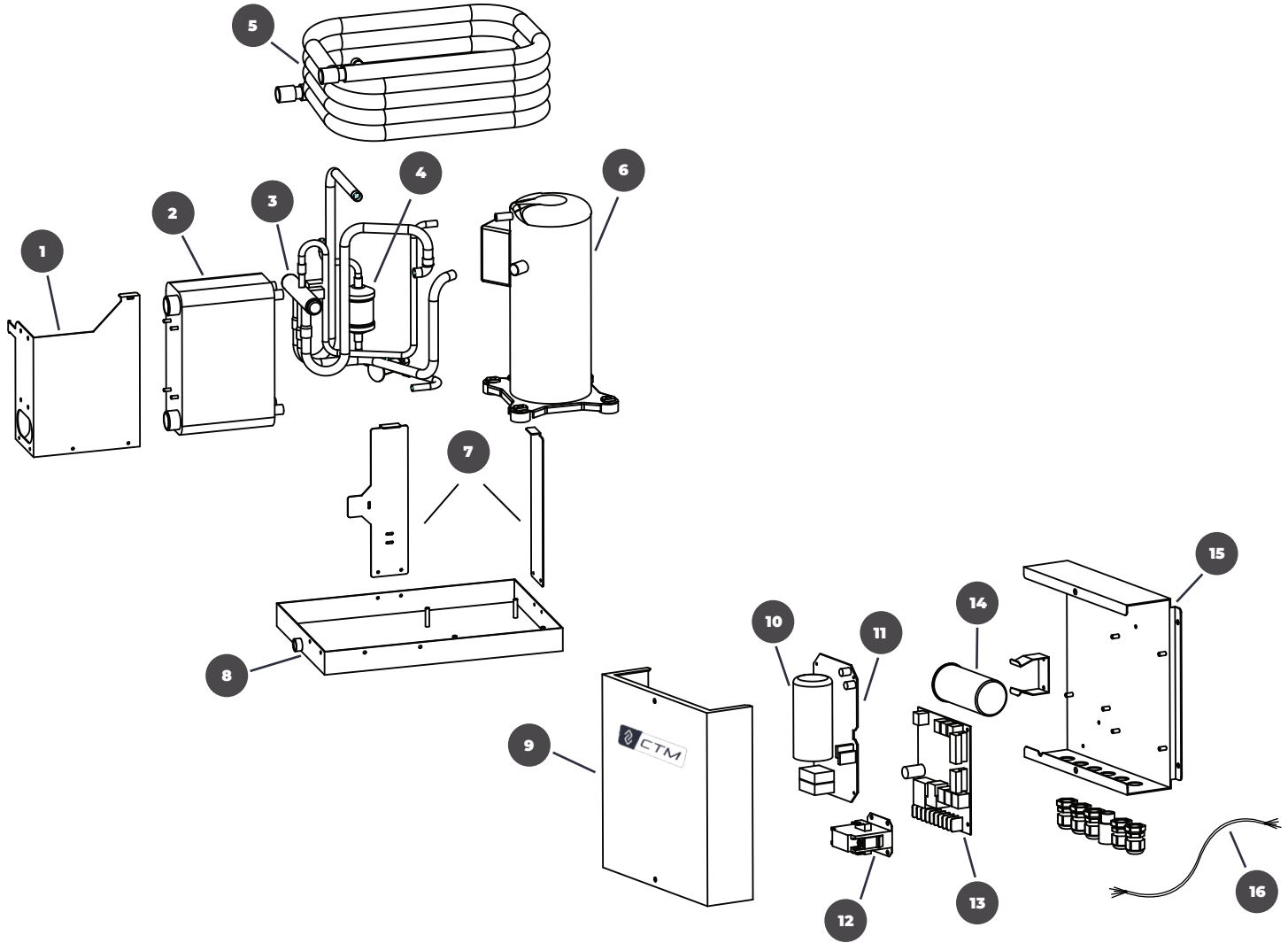


DIAGRAM 1

PARTS DIAGRAM

DIAGRAM 2

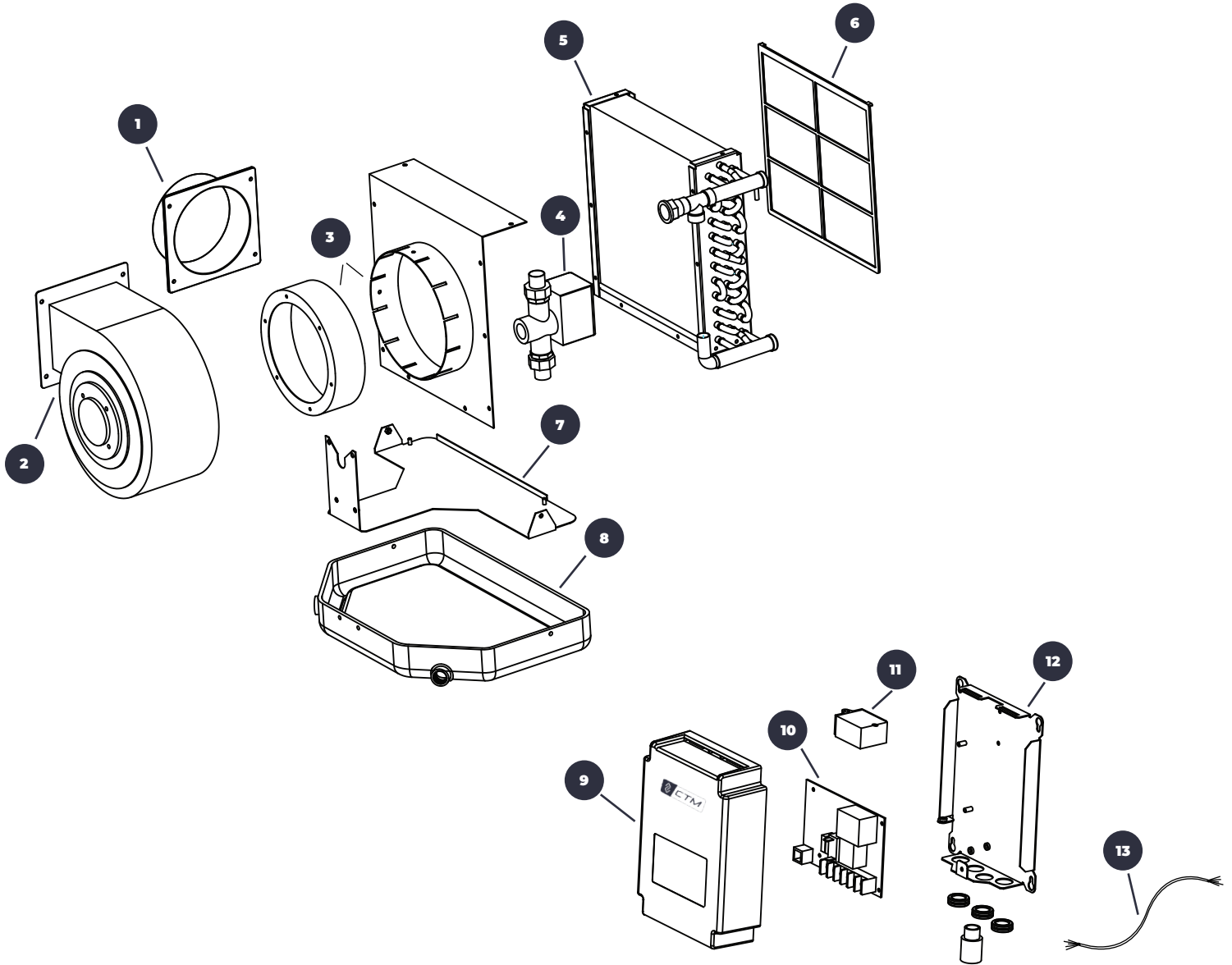
CW - CHILLED WATER SYSTEMS



- 1. Heat Exchanger Cover
- 2. Heat Exchanger
- 3. Reversing Valve
- 4. Dryer
- 5. Condensing Coil
- 6. Compressor

- 7. Structure Support Plates Kit
- 8. Drain Pan
- 9. Electrical Box Front Cover
- 10. Soft Start Capacitor
- 11. Soft Start Control Board
- 12. Solenoid / Contactor

- 13. DDC Control Board
- 14. Start / Run Capacitor
- 15. Electrical Box Back Plate
- 16. Electrical Harness

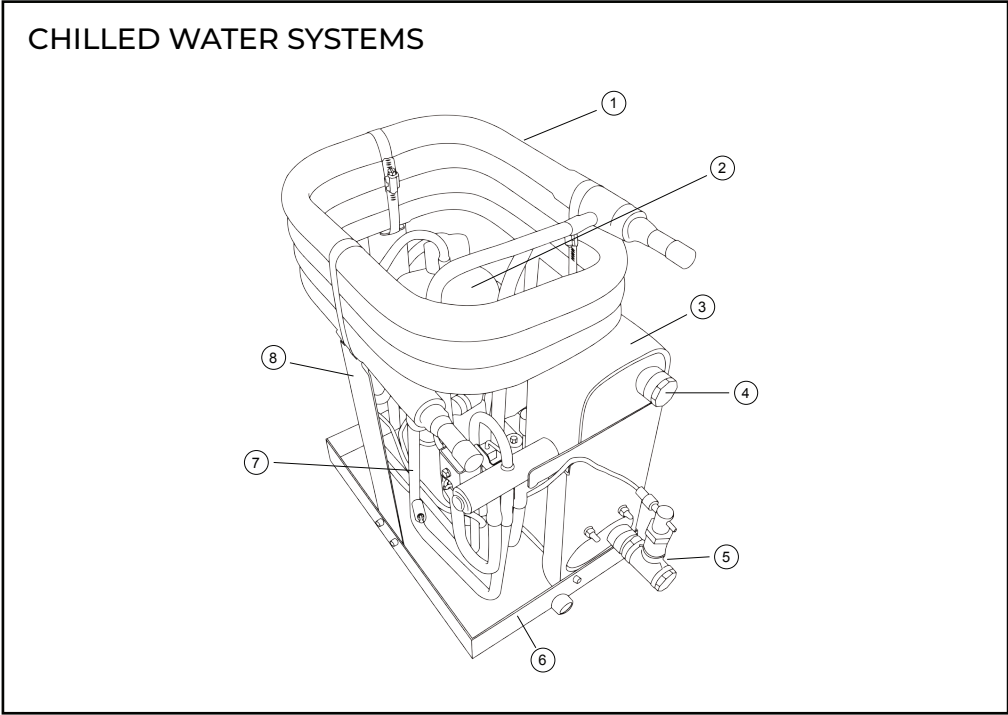
PARTS DIAGRAM**DIAGRAM 3****AH - AIR HANDLER(S)**

- 1. Mounting Duct Ring
- 2. Blower / Fan
- 3. Blower / Fan Plate Kit
- 4. Flow Control Valve
- 5. Evaporator Coil

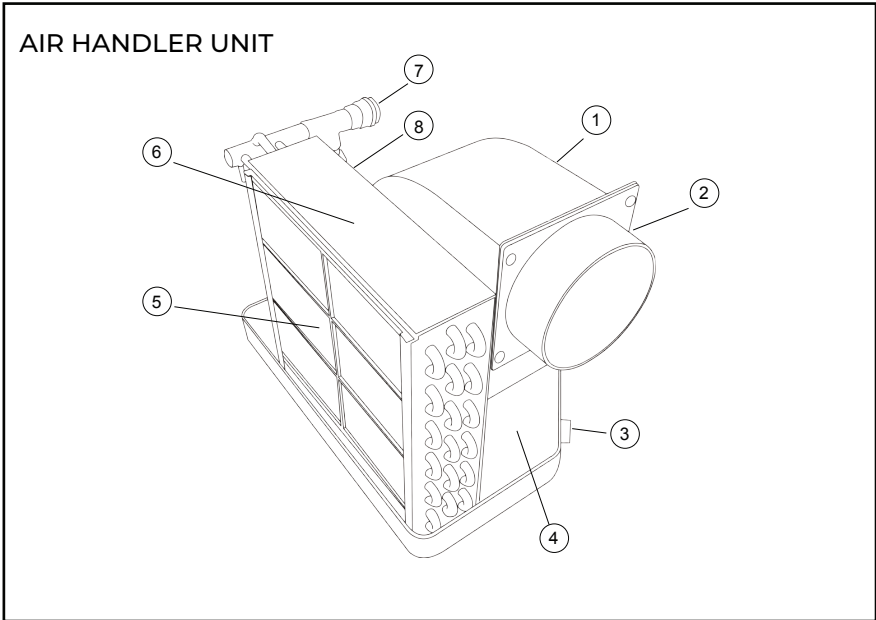
- 6. Air Filter
- 7. Base Frame
- 8. Drain Pan
- 9. Electrical Box Front Cover
- 10. Control Board

- 11. Compressor Relay
- 12. Electrical Box Back Plate
- 13. Electrical Harness

TECHNICAL DATA



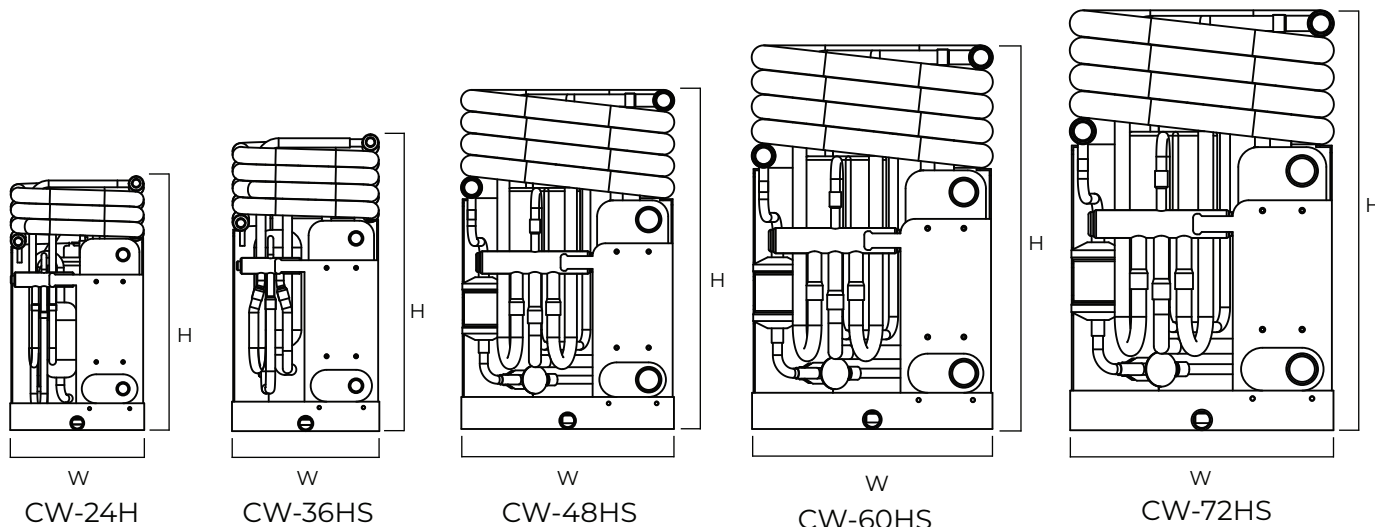
- 1- Condensing Coil
- 2- Compressor
- 3- Heat Exchanger
- 4- Circulating Inlet
- 5- Circulating Outlet
- 6- Drain Pan
- 7- Reversing Valve
- 8- Structure Support Plate



- 1. Blower Fan
- 2. Duct Ring
- 3. Condensate Drain
- 4. Base Drain Pan
- 5. Air Filter
- 6. Air Handler
- 7. Circulating Water Outlet
- 8. Circulating Water Inlet

CHILLED WATER SPEC SHEET

Model No.	CW-24H	CW-36HS	CW-48HS	CW-60HS	CW-72HS
Capacity (BTU)	24,000 BTU'S	36,000 BTU'S	48,000 BTU'S	60,000 BTU'S	72,000 BTU'S
Voltage (V)	208 - 240 V	208 - 240 V	208 - 240 V	208 - 240 V	208 - 240 V
Cycle (Hz) / Phase (Ph)	50 - 60HZ / 1Ph	50 / 60HZ / 1Ph	50 / 60HZ / 1Ph	50 / 60HZ / 1Ph	50 / 60HZ / 1Ph
Input: Cool (A)	7.6A / 9A	9.5A / 13A	14A / 19A	20A / 25A	23A / 30A
Input: Heat (A)	7.6A / 9A	9.5A / 13A	14A / 19A	20A / 25A	23A / 30A
Fuse Max / Mix (A)	25A / 16A	35A / 20A	65A / 40A	80A / 50A	90A / 60A
Locked Rotator Amps (A)	42 A	42 A	42 A	42 A	42 A
Suggested Water Flow (GAL / H)	500	750	1000	1250	1500
Water In / Out	5/8" / 5/8"	5/8" / 5/8"	3/4 " / 3/4"	3/4 " / 3/4"	3/4 " / 3/4"
Chill Water In / Out	3/4 " / 3/4"	3/4 " / 3/4"	1.0" / 1.0"	1.0" / 1.0"	1.0" / 1.0"
Refrigerant Type	R410A	R410A	R410A	R410A	R410A
Net Weight (llb/kg)	75 LBS	97 LBS	150 LBS	161 LBS	167 LBS
Width (W) in / mm	14.1" / 360 mm	14.1" / 360 mm	17.7" / 450 mm	20.2" / 515 mm	20.2" / 515 mm
Height (H) in / mm	18.9" / 480 mm	20" / 510 mm	19.6" / 500 mm	21" / 535 mm	21" / 535 mm
Depth (D) in / mm	9.8" / 250 mm	9.8" / 250 mm	13" / 332 mm	13" / 332 mm	13" / 332 mm



CHILLED WATER SYSTEM UNIT INSTALLATION

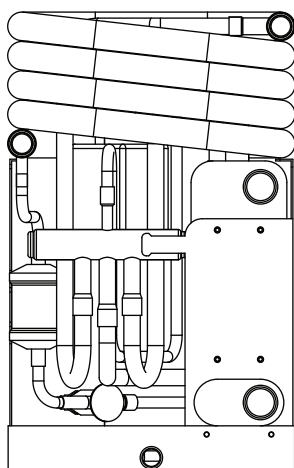


Read these instructions completely and then plan all connections which must be made to the unit including ducting, condensate drain line, seawater inlet and outlet hoses, electrical power connection, location of control, and seawater pump placement, to assure easy access for routing and future servicing for both chilled water and air handler units.

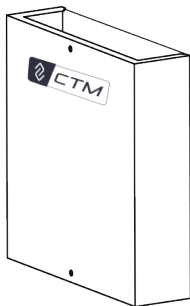


Installation and servicing of this system can be hazardous due to system pressure and electrical components. When working on this equipment, always observe precautions described in the literature, tags and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves and place a fire extinguisher close to work area.

MOUNTING THE CHILLED WATER SYSTEM AND THE ELECTRICAL BOX



CHILLED WATER SYSTEM



ELECTRICAL BOX

1 - The chiller unit is usually installed in the engine room. Make sure to install the chiller unit in a horizontal surface strong enough to hold the unit when the boat is in motion, choose a location where it will be dry and able to be serviced easily. Allow at least between 3 - 4 feet (0.9 - 1.2m) of space around the unit and at least 3 feet (0.9 m) above the unit.

2 - The control panel or electrical box which contains all the controls to operate the chiller should be installed on a dry and flat horizontal or vertical surface where it could be accessed easily for installation and servicing. Make sure the location of the control panel is free of water spray and moisture.



ELECTRICAL SHOCK HAZARD

>Ensure power source is OFF or disconnected at main panel before opening any electrical boxes. Failure to comply may cause serious injury or death.
>It is imperative that the components of this system are properly grounded to minimize any electrical shock hazard and / or personal injury.



REFRIGERANT SAFE HANDLING

Because refrigerants are heavier than air, they can push out oxygen from your lungs or from enclosed spaces. To avoid death or difficulty breathing, take the following precautions:
1- You should never sniff a refrigerant
2- No refrigerant should ever be purged into an enclosed space or room. By law, all refrigerants must be reclaimed.
3- If you suspect an indoor leak, you must thoroughly ventilate the area before you begin work.
4- If you do get contact with liquid refrigerant, wear gloves and goggles to avoid frostbite or blindness. If liquid refrigerant does get in your eyes or on your skin, seek medical attention immediately.
5- Refrigerant can cause poisonous gas to be released if it is burned.
6- Always follow EPA regulations.

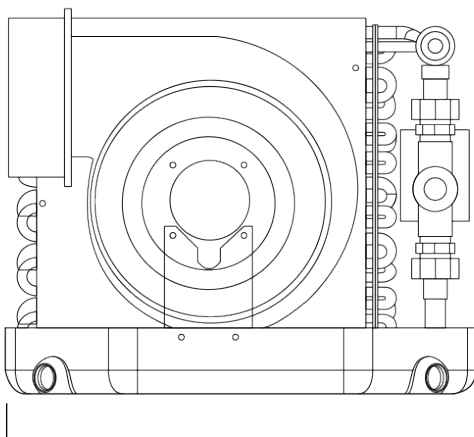


EXPLOSION HAZARD

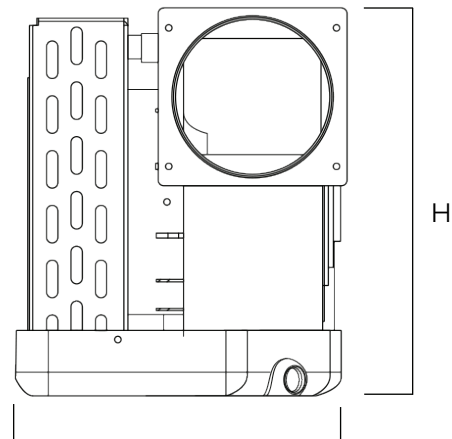
Do not apply flame or steam to a refrigerant cylinder. If heat is needed to change faster, partially immerse the cylinder in warm water.
>A cylinder should never contain more than 80% of liquid refrigerant.
>Add only R-410A to an R-410A cylinder. It operates at much higher pressures than R-22. Service equipment used with R-410A must be listed.
>Do not use a cylinder as a platform or roller. Always store a cylinder in a cool, dry place.

AIR HANDLER SPEC SHEET

Model No.	AH-6H	AH-8H	AH-12H	AH-16H	AH-24H
Capacity (BTU)	6,000 BTU'S	8,000 BTU'S	12,000 BTU'S	16,000 BTU'S	24,000 BTU'S
Voltage (V)	208 - 240V	208 - 240V	208 - 240V	208 - 240V	208 - 240V
Cycle (Hz) / Phase (Ph)	50 / 60HZ / 1Ph	50 / 60HZ / 1Ph	50 / 60HZ / 1Ph	50 / 60HZ / 1Ph	50 / 60HZ / 1Ph
Input: Rotor (AMP)	0.4 A	0.7 A	0.7 A	0.9 A	1.7 A
Blower Cap	2uF / 450 V	4uF / 450 V	3uF / 450 V	5uF / 450 V	8uF / 450 V
Fuse Max (AMP)	5 A	5 A	5 A	5 A	5 A
Control Board	U-BOARD	U-BOARD	U-BOARD	U-BOARD	U-BOARD
Seawater Inlet Connection (in/mm)	3/4"	3/4"	3/4"	3/4"	3/4"
Seawater Outlet Connection (in/mm)	3/4"	3/4"	3/4"	3/4"	3/4"
Diagram	10306	10306	10306	10306	10306
Refrigerant Type	R410A	R410A	R410A	R410A	R410A
Net Weight (lIb/kg)	16.5 LBS	22 LBS	23 LBS	28 LBS	39 LBS
Width (W) in / mm	12.5" / 320mm	16.1" / 410mm	16.1" / 410mm	16.9" / 430mm	20.8" / 530mm
Height (H) in / mm	11.1" / 283mm	12.1" / 308mm	13.3" / 338mm	13.8" / 353mm	17.5" / 445mm
Depth (D) in / mm	8.9" / 227mm	10.7" / 273mm	10.7" / 273mm	11.6" / 295mm	13.7" / 350mm



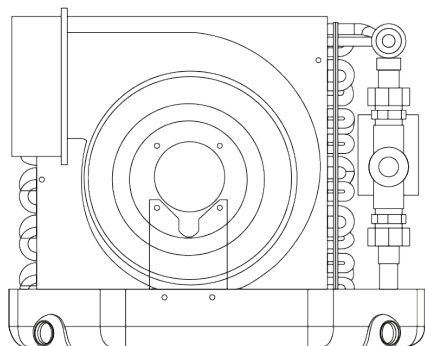
W



D

AIR HANDLER INSTALLATION

MOUNTING THE AIR HANDLER AND THE ELECTRICAL BOX



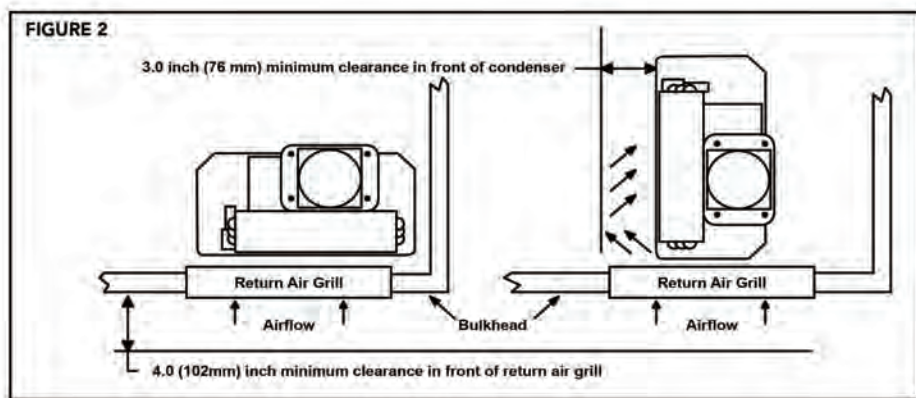
AIR HANDLER UNIT



ELECTRICAL BOX

1 - The Air Handler Unit should be installed as low as possible (under a V berth or in the bottom of a locker) and supply air duct should be installed as high as possible. This will ensure proper air flow and prevent short cycling of the system.

2 - Mount unit with air handler directly behind the return air grill or with at least 3" (76mm) of air circulation clearance if adjacent to a bulkhead or other obstructions.



3 - The Air Handler electrical box should be installed remotely to a bulkhead or sturdy frame. The AH, Air Handler electrical box contains the start capacitor of the air handler's blower fan.

! CARBON MONOXIDE HAZARD

> Never install your AH Air Handler Unit in the bilge or engine room. Make sure that the selected location is isolated from bilge and / or engine room vapors. Do not terminate condensate drain line within three feet (91 cm) of any outlet of engine or generator exhaust systems, nor in a compartment housing them either, nor in a bilge, unless the drain is properly sealed and connected to a condensate or shower sump pump.

> The AH Air Handler Unit should never be placed such that it can circulate carbon monoxide, fuel vapors or other noxious fumes into the boat's living spaces. Do not install or operate a AH Air Handler Unit in the engine room or near an internal combustion engine. Failure to follow this precaution could result in serious injury or death.

! ELECTRICAL SHOCK HAZARD

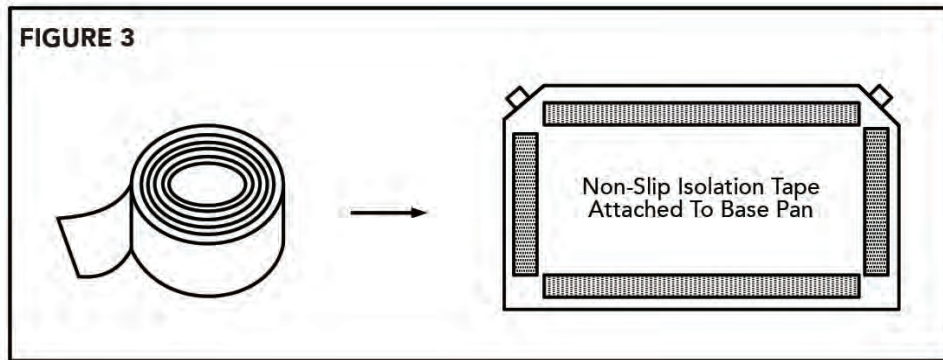
> Ensure power source is OFF or disconnected at main panel before opening any electrical boxes. Failure to comply may cause serious injury or death.
> It is imperative that the components of this system are properly grounded to minimize any electrical shock hazard and / or personal injury.

🔍 REFRIGERANT SAFE HANDLING

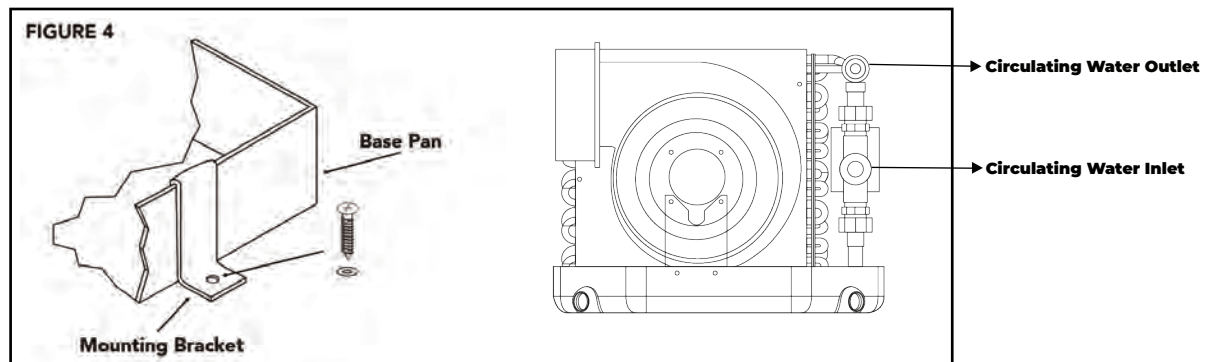
> This unit must be mounted to a low flat level surface, in bottom of locker, under a bunk dinette seat, or in a similar location. Failure to obey these installation notices could result in damage to the unit.

> To ensure proper air flow, allow minimum clearance of 3 in. (76 mm) in front of the evaporator, and a minimum clearance of 4 in. (102 mm) in front of the return air grille.

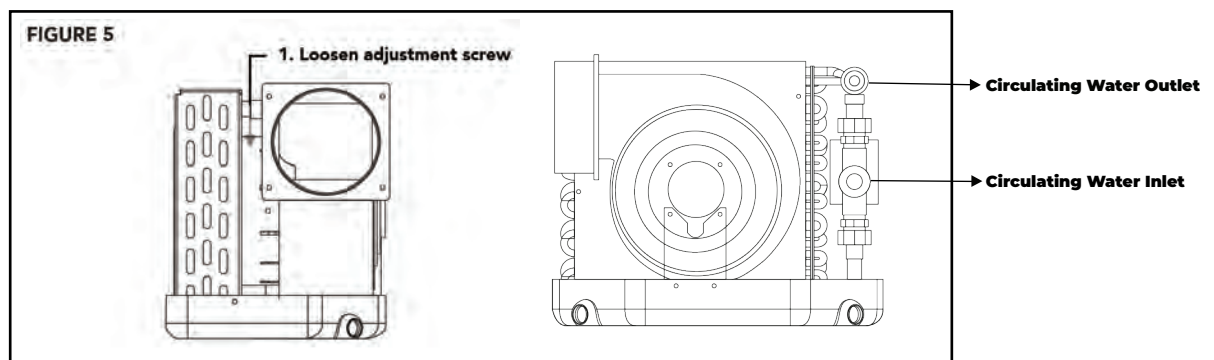
4 - Your unit comes with a separate non-slip isolator tape design to dampen the vibration caused by the operating unit. Proceed to place the tape on the base of the unit securely (See figure 3).



5 - The four mounting brackets provided should be placed around edge of drain pan as equally spaced as possible. Secure A/C unit to a flat level mounting surface. Brackets are provided. Customer is to supply the necessary hardware such as screw/bolts, and washers (See figure 4).



6- If needed, loosen the lock screw on the blower, and secure the screw tightly once the blower is adjusted at the optimal position with the most direct airflow discharge (See figure 5).



SALTWATER AND CHILLED WATER SYSTEMS

SALTWATER SYSTEM

Refer to the drawings below for an overview of how the saltwater system should look like:

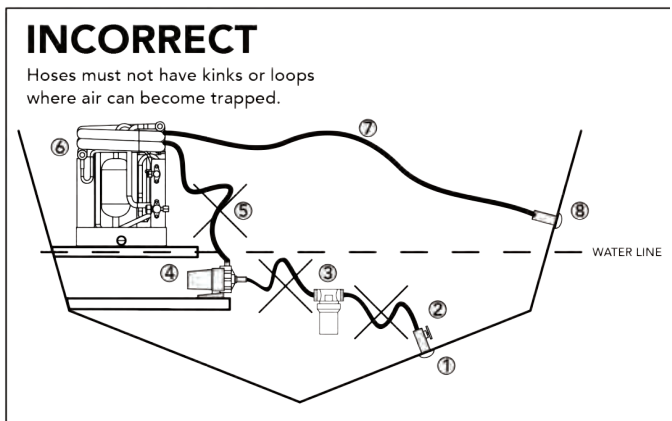
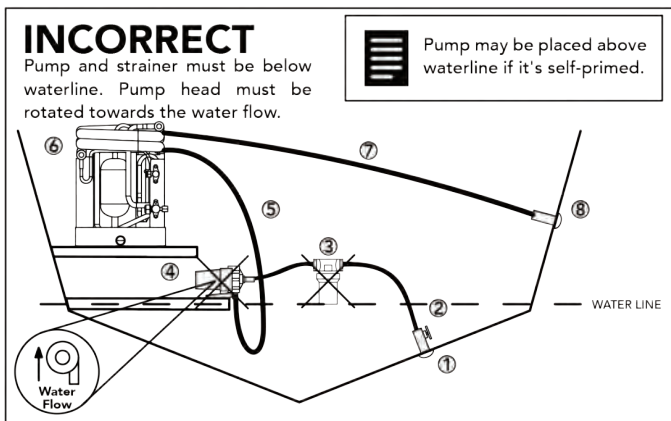
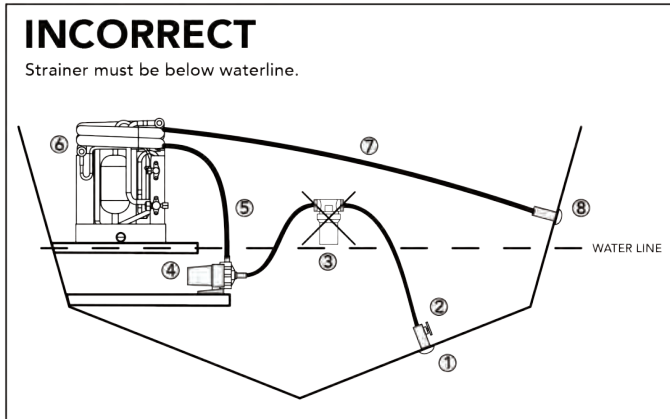
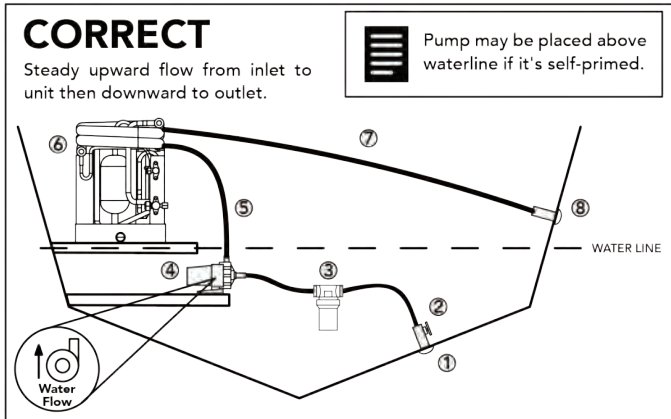
Consider the following instructions when setting up the saltwater system of your air conditioning unit. Failure to follow this procedure will void the warranty:

- 1- Place a clam-shell type thru-hull fitting as far away from the water line as possible. Slots should be directed towards the bow to obtain positive pressure in suction line.
- 2- Place a bronze seacock on the thru-full fitting.
- 3- Place a saltwater strainer below the level of the pump.
- 4- Connect the seacock and the strainer with a reinforced marine-grade hose.
- 5- The pump should be intall at least 30 inches below the waterline, except when a self-priming pump is used.
- 6- Connect the strainer and the pump with a reinforced, marine-grade hose.
- 7- Connect the pump's outflow to the coil inflow with a 5/8 inch reinforced, marine-grade hose.
- 8- Connect the A/C unit discharge from t he coil outflow with a 5/8 inch reinforced, marine-grade hose.



The A/C Saltwater system should have a dedicated thru-hull fitting for the pump.

- > The inlet for the thru-hull, seacock, hose, and strainer should not be smaller than the pump inlet.
- > The pump strainer assembly should be installed with a gentle upwards slope from the seacock to the pump.
- > Keep all the piping as short as possible without kinks or loops where air can become trapped.
- > Avoid 90° elbow fittings as much as possible.
- > Ensure that the pump head is rotated toward the direction of water flow.
- > Use sealtape on all threaded conections.
- > Double-clamp all hose connections with stainless steel clamps.
- > Connect all metallic parts in contact with saltwater to the vessel's bonding system.



- | | | |
|----------------------|-------------------|---------------------|
| 1. Thru-hull fitting | 4. Saltwater Pump | 7. Coil Outflow |
| 2. Seacock | 5. Coil Inflow | 8. Saltwater Outlet |
| 3. Strainer | 6. CW Unit | |

PLUMBING GENERAL CONSIDERATIONS

- 1-** The most common problems associated with chilled water systems is the plumbing system. Please pay careful attention to this section.
- 2-** If your plumbing system is equipped with automatic bleeders, make sure that an automatic fill is also installed in the chilled water loop. Pump cavitation can be caused by low water pressure in the system which can decrease the overall lifespan of the pump. The automatic fill valves should keep the pump's inlet pressure between 10-15 psi. In addition, they should be equipped with back-flow prevention valves. When using an automatic fill it's important to pay close attention to the glycol concentration level in the system to prevent freezing and ensure proper operation.
- 3-** Secure all piping with the correct fittings and add supporting equipment to the boat's structure to support the piping. Make sure the piping insulation is not pinched by any supporting hardware. Make sure connections and hose clamps are tightened and secured.
- 4-** Service valves should be added to make servicing the units easier; only use full-flow ball valves. Unions or flanges can also be added to your plumbing system. Make sure they are leak-tested after installing.
- 5-** The system flow of the chilled water system is crucial to the Chiller System operation. Refer to the spec sheet to make sure you have the proper flow.

CHILLED WATER SYSTEM

Notice: Failure to maintain glycol levels can result in damage and void the warranty of your CTM units.

Glycol must be added to the water after the bleeding process and any leaks have been fixed. You may use the brand of your choice, but make sure you follow the manufacturer's recommendations.

We recommend 20% by volume of non-toxic, inhibited propylene glycol.

DO NOT USE AUTOMOTIVE GLYCOL given that they commonly use additives that are more corrosive to copper.

It's important to keep the freeze point under 20°F (-7°C) and to check levels whenever water is lost or added, and at least once a year. You can use a refractometer to measure the concentration of glycol in the system, these are available through several online retailers.

For systems with PVC piping, do not allow the concentration of the glycol to exceed 30%, and for systems with CPVC, do not exceed 25% as greater concentrations may cause damage to these plastics.

- 1-** In the diagram in page #24 place close attention to the arrows and labels that indicate the direction where the water is flowing. Reversing this flow can cause problems to the system.
- 2-** Chilled water return lines or the lines flowing water back to the chiller should be installed above the chilled water supply lines.
- 3-** The circulating pump should be installed as low as possible in the water loop. The chiller should be the next highest equipment followed by the air handlers.
- 4-** All piping should have constant inclining and declining slopes to avoid any air and water traps. Air traps can cause noise and restrict or stop the free flow of water, so there should be a way to easily vent the air such as a bleeder or deaerator. Bleeders should be installed where air traps are more prompt to occur. The air handlers have bleeders and should always be installed at the highest point to maximize their usefulness. However, if you install automatic bleeders, they should be the highest point of the system.

STRAINER REQUIREMENTS

- 1-** Strainers should be installed between the seawater thru-hull and the condensing unit, as well as in the circulating system between the airhandlers and the circulating pump. Failure to do so will void the warranty of the units.
- 2-** The circulating water strainer should be a 20-mesh wye strainer.
- 3-** The seawater strainer should be a 10-mesh.
- 4-** Strainer baskets should be serviceable and with labels indicating the proper direction of the waterflow.
- 5-** The strainer must be positioned upstream of the chillers to protect the heat exchanger from debris.
- 6-** No airhandlers should be installed between the strainer and the chiller.
- 7-** Install pressure gauges before and after the circulating water strainer. This will help you understand where the system might need cleaning.
- 8-** Ball valves should be installed before and after the circulating water strainer to make it easier to clean and avoid releasing excessive water.

PIPE SIZE

The recommended pipe size depends on the total water flow requirements to maintain the pressure as stable as possible. Over-sizing pipes can be harmful and can lead to drastic changes in water velocity.

DRAIN

The system's drain is placed at the lowest point in the water loop to allow easy servicing. It's possible that other drains may be necessary if water traps are unavoidable throughout the system.

INSULATION

- 1-** Insulate straight lengths of pipe before a leak check. After everything checks during the leak test proceed to insulate joints or fittings.
- 2-** The recommended material is a closed cell insulation of at least 0.75 inch (1.9 cm) thick. Insulation on areas that are not air conditioned may need thicker insulation.
- 3-** Supply water pipes and return water pipes should be insulated and labeled separately.
- 4-** Make sure to be thorough with the insulation of the pipes. Condensation is a common problem with water chilled systems and can be hard to detect before water damage occurs. Cover all ends, use tape if you split-insulate, and make sure the insulation is not pinched or damaged by any supporting hardware.

CIRCULATION PUMP

- 1-** The circulating pump should be located near the chiller.
- 2-** To avoid air from becoming trapped in the pump head, the pump discharge should be directed in a vertically upward position, with a straight run of vertical pipe leaving the pump.
- 3-** The pipe at the end of the inlet and discharge of the pump should be straight for a length of at least 12 inches (30 cm) for a more uniformed flow of water entering the pump.
- 4-** Vibration isolation mounts are recommended to avoid any vibration to be transferred to the boat's structure.
- 5-** Service valves should be installed in the fittings connecting the pipe to the pump for servicing and pump removal.
- 6-** A pressure gauge at the pump inlet is mandatory. It should be allocated to allow good visibility when operating the fill valve. A pressure gauge is also recommended at the discharge of the pump. This will assist in properly filling the system and diagnosing flow restrictions.
- 7-** Pressure ports should be installed immediately upstream and downstream of the circulating pump to allow the pump flow to be deduced by comparing the pressure difference with the pump curve.

FLOW CONTROL

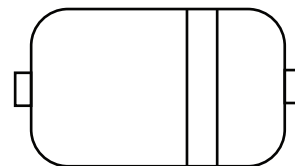
While the chillers do not need flow controls, it's recommended that each air handler has one. Each CTM Air Handler comes with its own flow control valve installed. If the capacity of the air handler is greater than a 10% of the capacity of the chiller, a bypass of the flow control valve might be needed, If the pump cannot force the flow of the liquid through the chiller. If the capacity of the chiller is greater than a 10% of the capacity of the air handler, a bypass flow control might be needed to balance the system and the liquid flow through the chiller.

EXPANSION TANK

An expansion tank should be installed on the inlet side of the circulating pump along with a service valve at the end of the expansion tank for future maintenance.

Please refer to diagram 5, page 24.

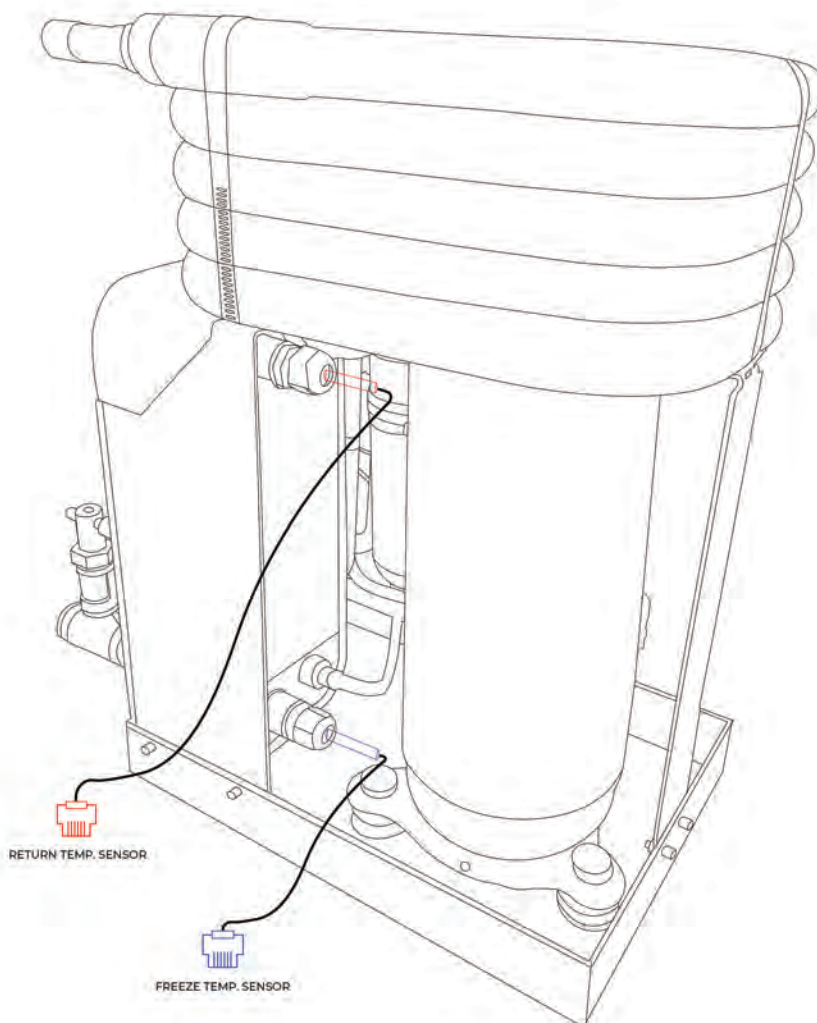
Expansion Tank




WATER TEMPERATURE SENSOR INSTALLATION


Here is the location to connect the water temperature sensors into the MCC Control Board and the heat exchanger of the chiller.


DIAGRAM 4



DUCTING

 Good airflow is critical for the performance of the entire system. It is highly dependent on the quality of the ducting installation. The ducting should be run as straight, smooth and taut as possible minimizing the number of 90° bends (two 90° bends can reduce airflow by 25%).

 **CARBON MONOXIDE HAZARD**
Do not route ducting through engine room or any area where it may be exposed to dangerous vapors or exhaust fumes. If you have any questions or concerns call CTM Marine customer service.

 If you install a transition box, make sure that the total area of supply air ducts going out of the transition box is at least equal to the area of the supply duct going into the box.

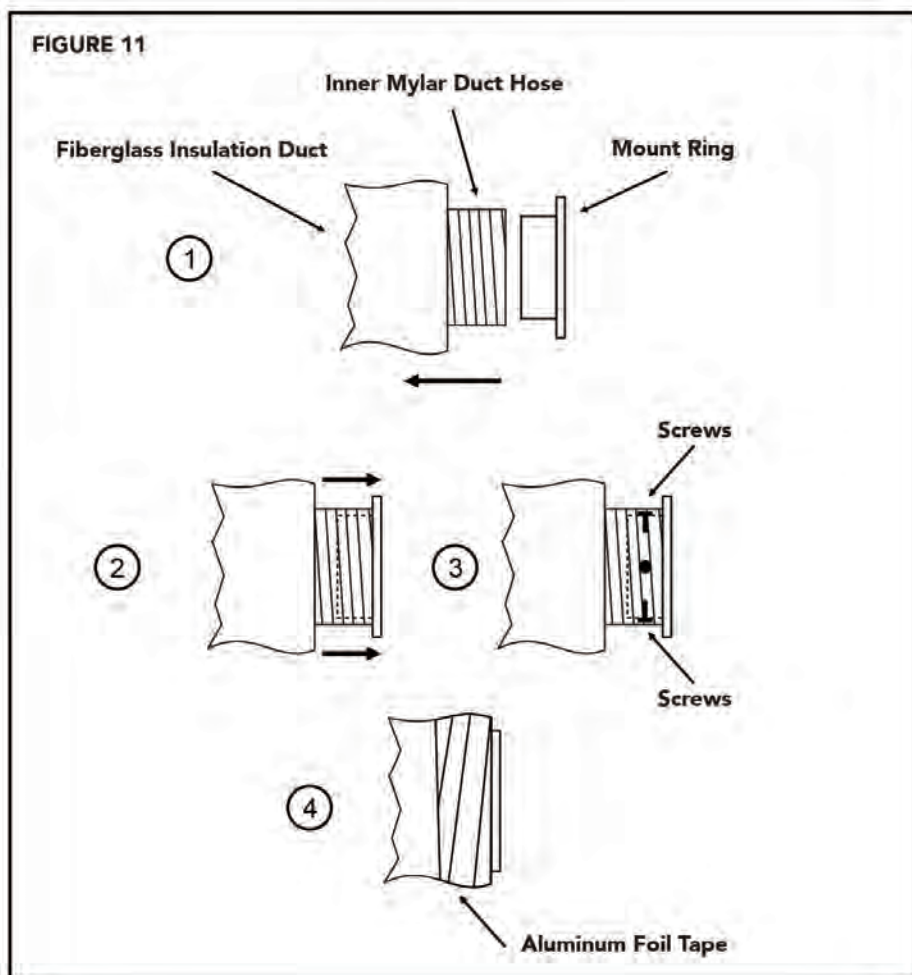
The ducting should be appropriately sized. Make sure it is run as smoothly as possible, so make sure to keep bends and loops as low as possible. Secure the ducting to all possible surfaces to prevent moving while the boat is operating, but be aware of flattening the ducting as this will reduce the air flow. If any ducting shall pass through an area where temperatures are high, make sure it's insulated.

1- Slide back the fiberglass insulation duct to reveal the inner mylar duct hose.

2- Put the mylar duct hose around the mounting ring.

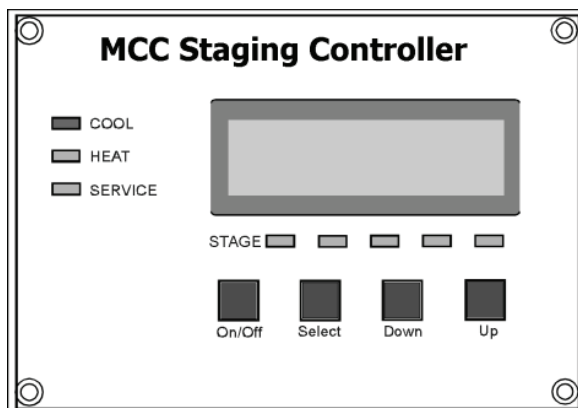
3- To make sure the mylar duct hose does not slide out, screw 3-4 stainless steel screws through the duct hose into the mount ring. Make sure a few wires from the mylar duct are captured by the screws.

4- Slide back the fiberglass insulation duct and cover the inner mylar duct hose, and mounting ring. Secure with high-quality aluminum foil tape or any condensation inhibiting tape.



MARINE CHILLER CONTROL

(The contents of this section have been developed by Micro-Air and added to this manual with their authorization. These contents have not been edited.)



INTRODUCTION

The Marine Chiller Control, identified in this document as MCC, can be used as a stand alone or staged chiller controller to regulate loop water temperature in tempered water systems. MCC also provides a level of protection against system damages caused by high or low refrigerant pressures, water flow problems, freezing of the compressor, and low line voltage. The MCC can be used to control directly connected compressors, VFD's, reversing valves, electric heaters and system pumps.

WIRING

Controls must be connected as shown in the wiring diagram contained in this manual. High limit, freeze and return sensors must be the appropriate Microair sensor listed in the diagram. Switch inputs are dry contact only and must not have any outside connections to voltage or current sources. External contactors must be used for water pumps over 1/2 HP, compressors over 2HP, and for electric heaters.

STAND ALONE OPERATION

POWER APPLICATION

When power is first applied, the display will show the firmware revision for 2 seconds and then go blank if the mode switch is in the off position. Change the mode switch to select heating or cooling.

REVERSING VALVE OPERATION

If a cycle is called within 75 seconds of a power restore or termination of a cycle, the reversing valve will toggle to equalize system pressures. This toggle will not occur if electric heat is enabled. The reversing valve will remain active when the compressor is active in heat mode.

WATER PUMP OPERATION

The circulating water pump (CWP) output will remain in operation whenever the mode switch selects heat or cool. The sweater pump (SWP) output will cycle with the compressor or run continuously depending on the "CON,dc" program parameter setting. See the program parameters section in this manual for more information.

OPERATING MODES

When heat or cool is selected on the mode switch, the display will alternate between showing "SUP" (supply or outlet temperature measured by the freeze sensor), followed by the temperature and "rtr" (return or inlet temperature) followed by the temperature. If the water temperature deviation is 2° or greater from the set point, then the MCC will start a cycle. The compressor will start and continue to operate until the loop return temperature reaches set point.

ERROR MESSAGES

Message	Definition
FLO	Flow switch has been open for over 10 seconds during the cycle. Operation will resume once the switch closes again.
HIP	The high refrigerant pressure switch was open. Operation will resume once the switch closes again. Four faults occurring in a cooling cycle will create a lockout. Lockouts can be cleared by switching the mode switch to off then back to the desired mode.
LoP	The low refrigerant pressure switch was open for more than 10 minutes. Operation will resume once the switch closes again. Four faults occurring in a cooling cycle will create a lockout. Lockouts can be cleared by switching the mode switch to off then back to the desired mode.
HIL	A water temperature of over 125°F (51.7°C) was measured at the high limit sensor with an electric heat enabled. The system will stop operation until the water temperature drops below 110°F (43.3°C)
HSC	A malfunction was detected in the high limit sensor. Repair the malfunction to resume operation.
FSN	A malfunction was detected in the freeze sensor. Repair the malfunction to resume operation.
SEN	A malfunction was detected in the return sensor. Repair the malfunction to resume operation.
FrE	A freezing temperature less than 38°F (3.3°C) was detected. Operation will resume once the water temperature is above 49°F (9.4°C).
LAC	A low AC line voltage condition was detected and the compressor was shut down. Line voltage must be below 85 VAC (120 volt units) or 170 VAC (208-240 VAC units) for 10 minutes for this fault to occur. Operation will resume once line voltage is above 100VAC (120 VAC systems) or 200 VAC (208-240 VAC systems).
PE	Program error. Control must be replaced or returned for servicing.

PROGRAM PARAMETERS

Certain operational attributes can be changed to configure the control. Press the “Select” button on the control to advance from one parameter to the next parameter. Press and hold the “set” button to decrement the parameter. Release the “set” button, then press and hold the button again to increment a parameter. The control will exit the program mode after 15 seconds without a button press.

Parameter	Definition	Range
CSP	Cooling set point: The control will operate the compressor from 2° above this temperature or higher and continue until the temperature is equal or below this temperature.	40°F to 58°F (4.4°C to 14.4)
HSP	Heating set point: The control will operate the compressor or electric heater from 2° below this temperature or lower and continue until the temperature is equal or above this temperature.	95°F to 120°F (35°C to 48.9°C)
dl	Staging delay: The amount of time the control must wait after a cycle completes or a power restoration before starting the compressor.	10 to 200 seconds
°F or °C	Fahrenheit or Celsius selection	°F or °C
rc or EH	Reverse cycle or electric heat selection: Select EH if there is an electric heater contactor connected to the EL. Heater dry contact relay.	rc or EH
dc or con	Cycled or continuous sea pump operation: When set for dc, the sea pump cycles with the compressor.	dc or con
LPE or LPd	Low pressure enable or low pressure disable: When set for LPd, the low refrigerant pressure switch is ignored.	LPE or LPd
AC	AC line voltage: This parameter displays the AC line voltage measured by the control. Adjustment is possible but should only be performed by knowledgeable service technicians. Improper adjustment will result in false detection of low voltage conditions.	Dependent on line voltage.

MCC STAGING CONTROLLER

INTRODUCTION

The MCC staging controller is a multi-stage controller capable of handling up to 6 chillers and two displays. The MCC staging controller system consists of a circuit board that connects to one or more MCC controls and a display. The display panel shows the active state of each MCC controlled compressor or heater connected, inlet and outlet temperatures for each stage, and the run time hours for each stage. Each compressor in the system is considered a stage.

OPERATING THE DISPLAY

When the system is off the display reads "SYSTEM OFF". Press and release the power button once to turn the system on. Use the SELECT BUTTON to obtain heating or cooling as required. Stages called for are indicated by the stage LED. The display back lighting is automatically activated when any button is pressed. Not pressing any buttons for sixty-seconds automatically turns OFF the back lighting.

When the system is active in heat or cool, the display will scroll information showing water in and out for each stage and the run time hours for the stage being displayed. If the optional refrigerant pressure transducers are installed, the pressure readings will also be displayed with each stage. A stage that has been bypassed will also display as "Stage x Bypassed". If the optional water pressure sensors are installed, the pressure information will display after the last stage data is displayed.

Display scrolling can be temporarily stopped by pressing and releasing either the up or down button once. The display will stop scrolling at the function where it's stopped. To move forward through the scroll functions press and release the up button. This moves the display forward one scroll item. To move backward through the scroll functions press and release the down button. This moves the display backward one scroll function. Exit the display scroll function by simultaneously pressing the up and down buttons. The display will also automatically resume normal scroll functions if no buttons are pressed for sixty-seconds (60).

MCC STAGING CONTROLLER PROGRAMMING

CAUTION!

Programming should only be performed by qualified service technicians, consult your CTM Marine representative before attempting to make any program changes.

ENTERING THE PROGRAM MODE

There are nine (9) programmable parameters. To enter the program mode turn the system off. With the word OFF visible in the display press and release the Select, Up, Down and Select buttons in the sequence described. Once in the program mode the first item, "BYPASSED STAGES", appears in the display. Press and release the select button to scroll through the parameters as shown in the table below.

Parameter	Default Setting	Range
BYPASSED STAGES	None	1-6
HEATING STAGES	All	1-6
HEATING SET POINT	104°F	95°F TO 120°F
COOLING SET POINT	45°F	42°F TO 58°F
HYSTERESIS	2°F	1°F TO 3°F
DIFFERENTIAL	2°F	1°F TO 3°F
STAGING DELAY	60 SECONDS	15 TO 200 SECONDS IN 5 SEC. INCREMENTS
SEA WATER PUMP	CONTINUOUS	CYCLE OR CONTINUOUS
SYSTEM UNITS	FAHRENHEIT	CELSIUS OR FAHRENHEIT
GANG STAGING	None	1 TO NUMBER OF STAGES
ZERO WATER TRANSDUCERS	PRESS AND RELEASE THE UP BUTTON	
AC TRIP POINT	OFF	OFF, 70 TO 100, 170 TO 200
SAVE SETTINGS AS DEFAULT	PRESS AND RELEASE THE UP BUTTON	
RECALL DEFAULT SETTINGS	PRESS AND RELEASE THE UP BUTTON	
VIEW HISTORY LOG	PRESS AND RELEASE THE DOWN BUTTON	

MCC STAGING CONTROLLER PROGRAMMING

BYPASSED STAGES

The display will show numbers 1 to 6, six dashes, or a combination of numbers and dashes for each of the possible stages that could be connected. Press and release the down button to advance through each of the six stages. Inactive stages will show as a number and active stages will show as a dash ("-"). Once the desired stage is selected, press and release the up button to change the stage selection.

HEATING STAGES

Not all stages are equally equipped in all installations. This parameter allows enabling only stages capable of providing heat during heat mode. The factory setting for all heaters is disabled. Stages are selected in the same manner as the "bypasses stages" parameter. Enable the heater by selecting the stage and change the dash "-" to a number.

HEATING SET POINT

Change this parameter to set the return loop heating temperature managed by the MCC staging controller.

COOLING SET POINT

Change this parameter to set the return loop cooling temperature managed by the MCC staging controller.

HYSTERESIS

The number of active stages is managed by determining the return water temperature deviation from set point. For each hysteresis interval deviation the return water moves toward set point, an additional stage is turned off until set point is reached. Select the number of degrees deviation to turn off stages with this parameter.

DIFFERENTIAL

The number of active stages is managed by determining the return water temperature deviation from set point. For each differential interval deviation from set point, an additional stage is added until all stages are active. Select the number of degrees deviation to start stages with this parameter.

STAGING DELAY

This time sets the minimum start time between compressors.

SEAWATER PUMP

This Parameter selects between continuous and cycled (if any compressors are operating) operation of the sea water pump.

SYSTEM UNITS

Select between Celsius and Fahrenheit temperature units.

MCC STAGING CONTROLLER PROGRAMMING

GANG STAGING

In some multistage systems it may be desirable for more than one stage to operate at a differential point. Access this parameter using the same method used to access bypassed stages. The first differential point is in the left. Select from 1 to 3 stages to operate with the first differential. Press the up button to move the selection to the second position and use the upbutton to change the selection for the second differential point.

ZERO WATER TRANSDUCERS

If the off pressure of the water transducers does not read zero, press the up button.

AC TRIP POINT

Set this parameter to the desired shutdown voltage to protect compressors from extended running with marginal AC power. The MCC staging controller will generate a Low AC fault if any stage reports below this set voltage for more than 10 minutes.

SAVE SETTINGS AS DEFAULT

Since most chilled water installations are not the same, standard factory default settings are not applicable to all systems. New defaults have to be programmed according to system requirements. Once the new requirements are programmed, press and release the Mode Button until “SAVE SETTINGS AS DEFAULT” appears in the display. Press the Up Button to save the current settings as the new default settings.

RECALL DEFAULT SETTINGS

The new defaults can be recalled at any time by entering the program mode and selecting this parameter and pressing the up button.

VIEW HISTORY LOG

The history log displays the last 16 faults from oldest (16) to newest (1). Press the up or down buttons to scroll through the entries.

MCC CONTROL PROGRAMMING

Only two program parameters are available on the connected MCC controllers with the MCC Staging Controller connected.

EH / rc

Press the select button once on the MCC controller to view the first parameter. Use the SET button on the MCC controller to change the value from EH (electric heat) to rc (reverse cycle) to select the correct heat mode. If there is no heat mode available, be sure to disable the heat for this stage in the MCC staging controller parameter menu.

LPd / LPE

Press the select button a second time on the MCC controller to view the second parameter. If the stage is equipped with a low refrigerant pressure switch, set the value to LPE (low pressure enable) otherwise set the value to LPd (low pressure disable) using the set button.

STAGING CONTROLLER FAULT PROTOCOL

The staging controller software includes a fault protocol designed to protect the system while, at the same time, allowing the operational stages to continue cooling or heating. The table below lists the fault and the action taken when the fault occurs.

Fault Protocol		
Fault	Stage	Action
Freeze Sensor	Any Stage	Compressor shut-Down
Flow Switches 1 - 6	Stages 1 thru 6	Compressor Shut-Down
High Pressure Switch	Any Stage	Compressor Shut-Down
Low Pressure Switch	Any Stage	Compressor Shut-Down
High Limit Reverse Cycle Temperature	Any Stage	Compressor Shut-Down Lockout after 4 Failures
High Limit Electric Heat Temperature	Any Stage	System Shut-Down
Freeze Limit	Any Stage	Compressor Shut-Down
Return Sensor	1 Required Any Stage	System Shut-Down Lockout after 4 failures
Stage 1 Not Responding	Pumps Connected to Stage One	System Shut-Down
Stages Not Responding	Stages 2 Thru 6	Compressor Shut-Down

ADDITIONAL FAULT TROUBLESHOOTING INFORMATION

The HIGH LIMIT SENSOR and RETURN WATER SENSOR are connected to stage one. Because the system cannot operate properly without these sensors, four consecutive high limit failures or four consecutive return sensor failures will cause the system to shut down and lockout.

Since all the systems critical components are connected to stage one, the entire system is shut down when stage one fails to communicate with the staging controller. Stage one compressor can be by-passed, however, stage one (1) will continue to operate the systems critical components.

The seawater pump, chill water pump, inlet water and outlet water sensor must be connected to stage one DDC. Stage one (1) is defined by plugging the assigned DDC module into number one location on the DDC interface board.

Fatal faults are defined as four (4) consecutive failures on a stage causing that stage to be locked out. The service light will flash; the display will indicate the fault and lockout condition. The stage can be cleared and restarted by pressing the SELECT BUTTON. Accumulated stage faults are automatically cleared, before fourth fault, if the stage operates four hours (4) without any new faults.

High Freon pressure lockout faults are ignored in the heat mode. The compressor will shut down, the stage delay timer will start when the fault clears and the compressor will start after the stage delay times out. Low Freon pressure fault has a ten (10) minute delay allowing the compressor to come up to normal operating pressures.

The water outlet temperature is acquired via the freeze-stat sensors.

When a stage is by-passed the staging temperature and staging delay are automatically adjusted so there is neither a timing nor temperature gap. The next stage in line assumes the by-passed stage's timing and staging temperature.

The stage controller is factory configured for standard reverse cycle heating. When installing electric heaters the reverse cycle feature is not available. The heating stages NOT equipped with electric heaters must be de-selected in the program mode. Use the standard by-pass method to de-select heater stages that are not installed. Electric heaters should be installed starting with stage one.

BIMINI JUMPERS

Four jumpers are provided on the board for troubleshooting and emergency operation. Moving the VLV (valve), SWP (sea water pump), and CWP (loop pump) to cover the two pins closest to the black electric power terminal strip will force those outputs on. Moving the COMP (compressor) jumper will force the compressor relay on only if the freeze temperature is above 42°F (5.6°C).

SPECIFICATIONS

MCC

Board Dimensions	5.25" x 5.875" x 2.0"(133mm x 149mm x 51 mm)
Mounting	4.75" x 5.20" (120.6 mm x 132 mm)
AC Line Voltage	85 to 240 VAC
AC Line Frequency	50 or 60 Hz
Sensor Accuracy	2°F at 77°F (1.1°C at 25°C)
AC Combined Current Limit	30 Amps
Compressor Output	2HP
Sea Pump Output (SWP)	1/2 HP
Loop Pump Output (CWP)	1/2 HP
Valve Output (VLV)	1/2 Amp
Compressor and Heater Signal Relay*	200VDC @ 1 Amp max
Ambient Operating Temperature Range	0°F to 180°F (-17.8°C to 82.2°C)
Maximum Rh Conditions	99% non-condensing
Pressure Transducer**	Sensata 2CP5B0520500SSN or 2CP5-71-47
Transducer Specification*	0.5-4.5 VDC output, 4.5-5.5 VDC input, 0-500 PSI (0-34.5 Bar) 1.0-5.0 VDC output, 4.5-5.5 VDC input, 0-500 PSI (0-34.5 Bar)

*Optional 250 VAC@2 amp heater relays are available by contacting CTM Marine

**Transducer data only available from master controller. Transducer offset is selectable in master programming permitting 0.5 or 1 VDC 0 readings.

MCC STAGING CONTROLLER

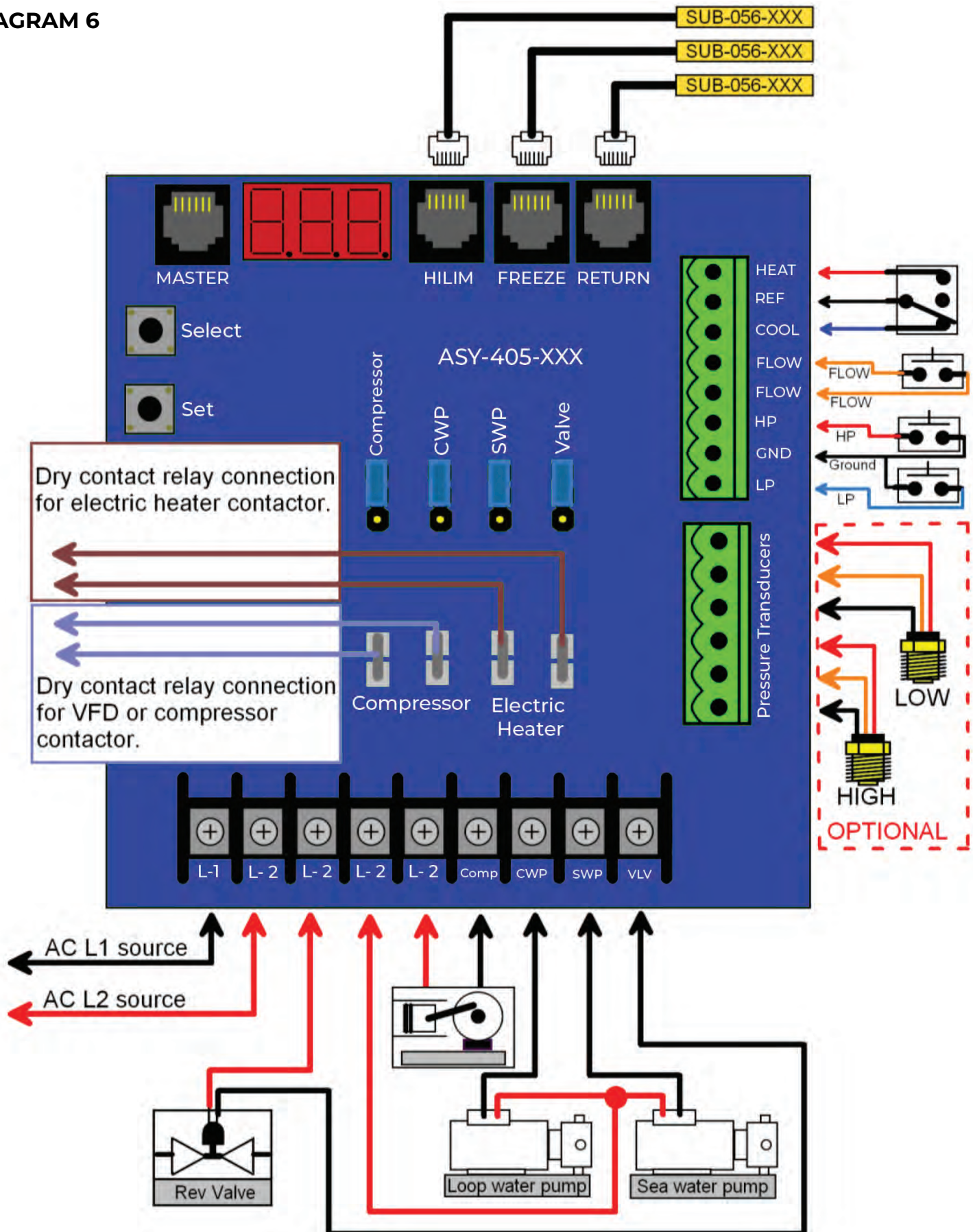
Alarm Relay Contacts	250 VAC 2A max
Water Sensors	0.5-4.5 0-500 PSI (0-34.5 bar)
Interconnect Cables	SUB-059-XXX
Board Dimensions:	4.30" x 3.90" x 2.0"(109mm x 99mm x 51 mm)

INTERCONNECT CABLE SPECIFICATION:

Flat (oval) multi-conductor shielded modular type cable consisting of stranded tinned copper conductors with thermoplastic insulation and a 22 AWG stranded fused tinned copper drain wire with an overall 100% coverage aluminum/polyester shield in a PVC jacket. Five conductors with drain wire (6 total) are used for the interconnect cables with 26 AWG 7/36 strand wire covered with .009in (Nominal) insulation. Adirondack wire and cable type AWC195 or similar type cable is acceptable.

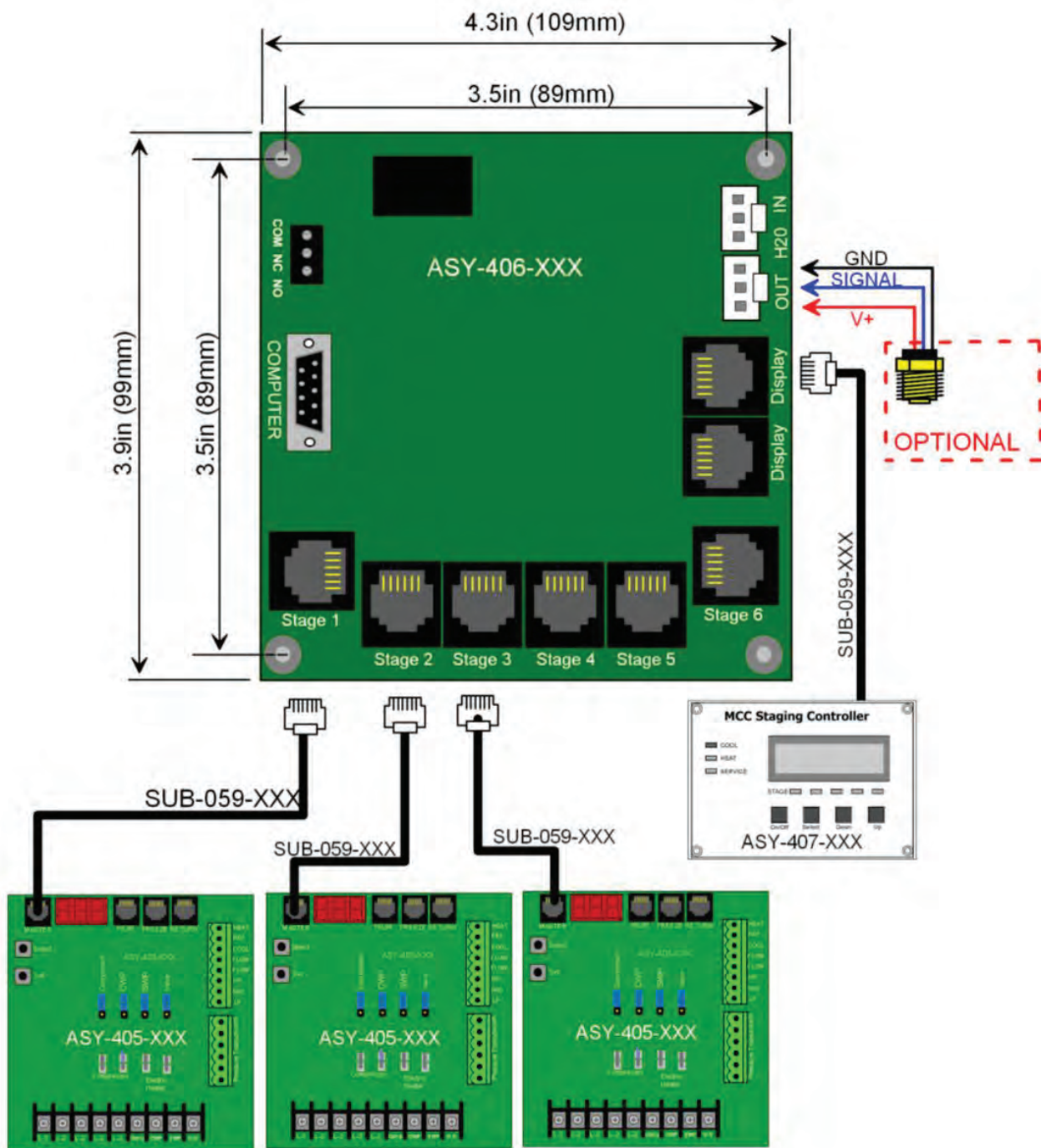
MCC WIRING DIAGRAM

DIAGRAM 6



MCC STAGING CONTROLLER DIAGRAM

DIAGRAM 7



Micro Air Corp.	
MCC Staging Controller Wiring	
December 8, 2015	Rev 1.01
Drawn By: Roger Krinic	
ASY-406-XXX	

Note: Three stages shown. One additional display and three additional controls can be connected. Relay contacts are for external alarm relay. Computer connection is for certain legacy systems only.

TWO SPEED OPERATION

This is a special purpose option that requires different software for the control board and the master controller interface. The option uses the two dry contact relays (COMP and EH on the board) to control the compressor start and low speed bypass operation. Please note that the heater relay is active when the low-speed operation is enabled. This is typically used with a frequency drive with the run input connected to the COMP relay and the low speed input enable connected to the EH relay.

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