Installation, Operation, and Maintenance

Thermafit™ Modular Water-Cooled Chiller/Water-to-Water Heat Pump

Models MWC and WXM

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

August 2024

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Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

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⚠ WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

⚠ WARNING

R-454B Flammable A2L Refrigerant!

Failure to use proper equipment or components as described below could result in equipment failure, and possibly fire, which could result in death, serious injury, or equipment damage.

The equipment described in this manual uses R-454B refrigerant which is flammable (A2L). Use ONLY R-454B rated service equipment and components. For specific handling concerns with R-454B, contact your local representative.

⚠ WARNING

Electrical Shock Hazard!

Failure to follow instructions below could result in death or serious injury.

Properly connect the system's oversized protective earthing (grounding) terminal(s).

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Revision History

Updated Thermafit™ MWC chiller table in General Data chapter.

Product Safety Information

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

Maximum altitude of use 3000 meters.

This appliance incorporates an earth connection for functional purposes only.

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Model Number and Coding

When contacting Trane for technical support, customer service, or parts information, be prepared to provide the model number and serial number of the chiller/heat pump modules in question. This information is located on the nameplate that is affixed to each module.

Chiller/Heat Pump Model and Serial Numbers

For future reference, record the model number and serial number for each module in the chiller/heat pump in the table below, Chiller/Heat Pump Reference Data. Refer to the Trane nameplate on each module in the installed unit for the serial number and model number.

Table 1. Chiller/heat pump reference data

Module	Model Number	Serial Number
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Model Number

Critical information for contacting Trane technical support. Reference to the actual chiller/heat pump module serial number may also be beneficial. Each module has its own unique serial number.

Model Coding Key

Model numbers assigned to Trane systems provide a wealth of information about the features for a chiller/heat pump's **as built** configuration.

Chiller/Heat Pump Description

Chiller/Heat Pump Scope

This manual provides relevant data to properly operate, maintain, and troubleshoot the Trane Thermafit™ MWC and WXM Chiller/Heat Pump. Operator and maintenance personnel must be a qualified refrigeration technician and have a working knowledge of high voltage systems, low voltage control circuits, and components and functions.

Chiller/Heat Pump Capacities

The Thermafit™ MWC model is available from 15 to 80 tons and the WXM model is available from 20 to 80 tons. Up to 12 modules may connect together in a standard primary/secondary control system. The system consists of a primary chiller/heat pump module that contains the primary microprocessor controller, the power distribution panel (if equipped), one or more secondary modules, an optional tank and pump module with a glycol feed system, and an expansion tank or sealed buffer tank. It is important to connect modules in the correct sequence as detailed in Handling of the Modules section of the Installation Mechanical chapter.

The MWC and WXM chiller/heat pump uses independent refrigeration circuits in each module using scroll compressors. The brazed-plate evaporator is typically made of SAE Grade 316 stainless steel and 99.9% copper brazing materials. Standard interconnecting headers are composed of carbon steel.

Water quality must be monitored and maintained by a water treatment professional familiar with the materials of construction and operation of the equipment. As required under Federal regulations, installation, initial start-up, and technical servicing must be performed by fully qualified personnel only.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Component Description

Every chiller/heat pump is comprised of four basic components: compressor, condenser, expansion valve, and evaporator. Each MWC and WXM module contains one or more of these primary refrigeration components.

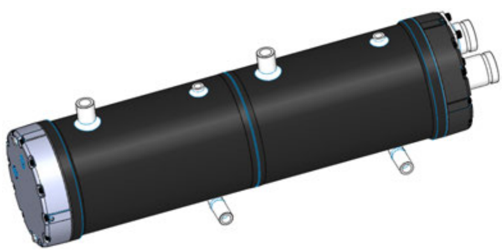
Copeland Compressor

The MWC and WXM chiller/heat pump uses a hermetically-sealed, scroll compressor on each refrigeration circuit. The Copeland scroll compressor is a state-of-the-art compressor with relay and overload monitoring capabilities designed to accommodate liquids (both oil and refrigerant) without causing compressor damage. The Copeland compressor uses CoreSense technology (available on select models) as a sensor to unlock advanced capabilities such as protection, diagnostics, communication, and verification. Technicians can make faster, more accurate decisions resulting in improved compressor performance and reliability.

Brazed Plate Condenser/Evaporator

The MWC and WXM chiller/heat pump uses a dual circuit, brazed-plate heat exchanger on each module constructed of 316 stainless steel plates and copper brazing. The supply and return fluid piping connections to each heat exchanger include manual isolation valves to allow servicing of each module individually while the remaining modules continue to operate. The fluid connections to each heat exchanger use roll grooved couplings for service convenience and ease of installation. Each heat exchanger is insulated with 3/4-inch closed cell insulation.

Optional Shell and Tube Condenser



The MWC model offers an optional compact shell and tube condenser to be included in each module in lieu of the standard brazed plate condenser. Their low susceptibility to fouling and the ability for the condenser tubes to be cleaned make the shell and tube heat exchangers ideal for applications where the fluid quality Is poor. The shell and tube condensers are dual circuit and have a carbon steel shell material and copper tubes.

General Data

Table 2. General data - Thermafit™ MWC chiller

Capacity (Tons)	15	20	25	30	40	50	60	80
General Unit								
Number of Independent Refrigeration Circuits	Dual	Dual	Dual	Dual	Dual	Dual	Dual	Dual
R-454B Refrigerant Charge (lbs/module)	12	14	16	18	30	36	44	52
R-454B Unventilated Room Area (sq.ft.)	743	1011	1321	1672	4645	6690	9993	13958
R-513A Refrigerant Charge (lbs/module)	-	18	-	22	30	50	64	-
Chilled Fluid Volume(gal/ module)	6.5[a]	6.9[a]	8.9[b]	9.2[b]	13.4[b]	14.6[b]	17.5[b]	20.7[b]/ 27.1[c]
Condenser Fluid Volume (gal/ module)	6.8[a]	7.5[a]	9.1[b]	9.4[b]	14.1[b]	15.1[b]	18.3[b]	24.3[b]/ 30.7[c]
Compressor								
Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Quantity	2	2	2	2	2	2	2	2
Evaporator[d]								
Type	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Quantity	1	1	1	1	1	1	1	1
Fluid Volume (gal)	1.75	2.3	2.5	2.7	4.6	5.5	8.5	13.31
Material (plates/brazing)	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU
Minimum/Maximum Leaving Water Temperatures for R-454B (°F)	42-65	42-65	42-65	42-65	42-65	42-65	42-65	42-65
Minimum/Maximum Leaving Water Temperatures for R-513A (°F)	42-100	42-100	42-100	42-100	42-100	42-100	42-100	42-100
Minimum/Maximum Leaving Brine Temperatures for R-454B (°F)	10-65	10-65	10-65	10-65	10-65	10-65	10-65	10-65
Minimum/Maximum Leaving Brine Temperatures for R-513A (°F)	30-100	30-100	30-100	30-100	30-100	30-100	30-100	30-100
Minimum Water/Brine Operating Pressure (psig)	0	0	0	0	0	0	0	0
Maximum Water/Brine Operating Pressure (psig) Standard Option	200	200	200	200	200	200	200	200
Maximum Water/Brine Operating Pressure (psig) Hi Pressure Option	300	300	300	300	300	300	300	300
Condenser[e]								
Type	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Quantity	1	1	1	1	1	1	1	1
Fluid Volume (gal)	1.75	2.3	2.5	2.7	4.6	5.5	8.5	13.31
Material (plates/brazing)	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU
Minimum Water/Brine Operating Pressure (psig)	0	0	0	0	0	0	0	0
Maximum Water/Brine Operating Pressure (psig) Standard Option	200	200	200	200	200	200	200	200

Table 2. General data - Thermafit™ MWC chiller (continued)

Capacity (Tons)	15	20	25	30	40	50	60	80
Maximum Water/Brine Operating Pressure (psig) Hi Pressure Option	300	300	300	300	300	300	300	300
Minimum/Maximum Leaving Water Temperatures for R-454B (°F)	N/A	N/A	90-140	90-140	90-140	90-140	90-140	90-140
Minimum/Maximum Leaving Brine Temperatures for R-454B (°F)	N/A	N/A	90-140	90-140	90-140	90-140	90-140	90-140
Minimum/Maximum Leaving Water Temperatures for R-513A (°F)	N/A	N/A	N/A	75-180	75-180	75-180	75-180	N/A
Minimum/Maximum Leaving Brine Temperatures for R-513A (°F)	N/A	N/A	N/A	75-180	75-180	75-180	75-180	N/A
Condenser								
Type	N/A	N/A	Shell and Tube	Shell and Tube	Shell and Tube	Shell and Tube	Shell and Tube	Shell and Tube
Quantity	N/A	N/A	1	1	1	1	1	1
Minimum Water/Brine Operating Pressure (psig)	0	0	0	0	0	0	0	0
Maximum Water/Brine Operating Pressure (psig) Standard Option	N/A	N/A	150	150	150	150	150	150
Maximum Water/Brine Operating Pressure (psig) Hi Pressure Option	N/A	N/A	300	300	300	300	300	300
Minimum/Maximum Leaving Water Temperatures (°F)	N/A	N/A	90-140	90-140	90-140	90-140	90-140	90-140
Minimum/Maximum Leaving Brine Temperatures (°F)	N/A	N/A	90-140	90-140	90-140	90-140	90-140	90-140

(a) 4-inch pipe headers.
(b) 6-inch pipe headers.
(c) 8-inch pipe headers.
(d) Evaporator Fouling Factor is 0.0001.
(e) Condenser Fouling Factor is 0.00025.

Table 3. General data - Thermafit™ WXM heat pump

Capacity (Tons)	20	25	30	40	50	60	80
General Unit							
Number of Independent Refrigeration Circuits	DUAL	DUAL	DUAL	DUAL	DUAL	DUAL	DUAL
R-454B Refrigerant Charge (lbs/ module)	16	20	24	32	40	48	63
R-454B Unventilated Room Area (sq. ft.)	1672	2064	2498	7454	10923	17365	23869
Load Fluid Volume(gal/module)	6.9[a]	8.9[b]	9.2[b]	13.4[b]	14.6[b]	17.5[b]	20.7[b]/ 27.1[c]
Source/Sink Fluid Volume (gal/ module)	6.9[a]	8.9[b]	9.2[b]	13.4[b]	14.6[b]	17.5[b]	20.7[b]/ 27.1[c]
Compressor							
Type	SCROLL	SCROLL	SCROLL	SCROLL	SCROLL	SCROLL	SCROLL
Quantity	2	2	2	2	2	2	2
Brazed Plate Heat Exchanger							
Type	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE
Quantity	2	2	2	2	2	2	2
Fluid Volume (gal)	2.3	2.5	2.7	4.6	5.5	8.5	13.31
Minimum/Maximum Leaving Water Temperatures (°F)	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140
Minimum/Maximum Leaving Water Temperatures (°F)	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140	42-65 / 90-140

Table 3. General data - Thermafit™ WXM heat pump (continued)

Capacity (Tons)	20	25	30	40	50	60	80
Fouling Factor (hr ft2-F/Btu)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Minimum Water/Brine Operating Pressure (psig)	0	0	0	0	0	0	0
Maximum Water/Brine Operating Pressure (psig) Standard Option	N/A	150	150	150	150	150	150
Maximum Water/Brine Operating Pressure (psig) Hi Pressure Option	N/A	300	300	300	300	300	300
Material (plates/brazing)	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU

(a) 4-inch pipe headers.
(b) 6-inch pipe headers.
(c) 8-inch pipe headers.

Unit Dimensions and Weights

Figure 1. MWC air-cooled modulars - 15 to 80 tons

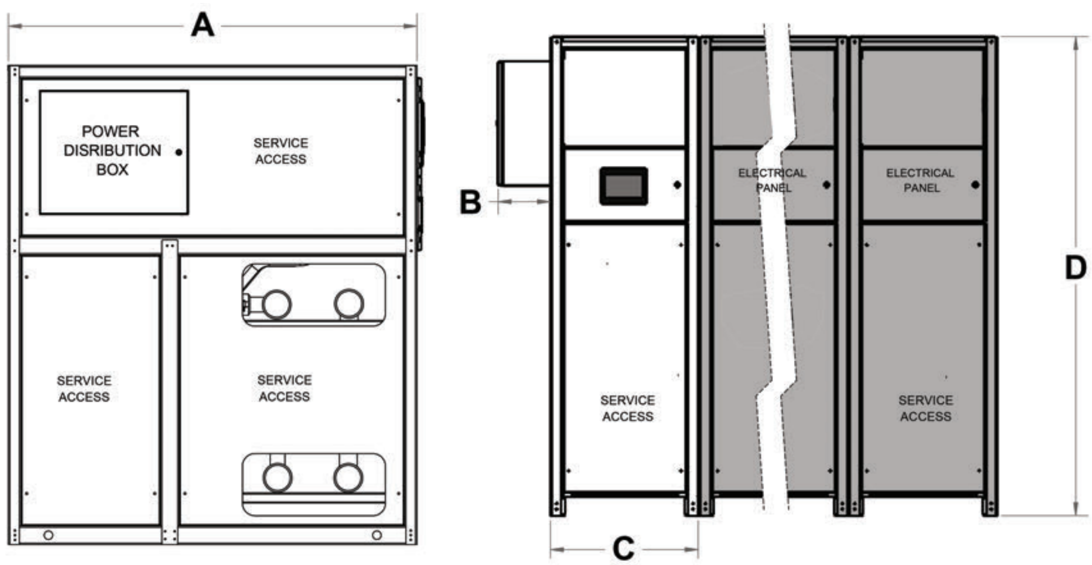


Table 4. Unit dimensions and weight - 15 to 80 tons (MWC)

Dim	Units	Unit Sizes and Weights Per Module							
		15 Tons	20 Tons	25 Tons	30 Tons	40 Tons	50 Tons	60 Tons	80 Tons
A	inch	66	66	66	66	66	66	66	79
B		8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
C		24	24	24	24	34	34	34	42
D		77	77	77	77	77	77	77	80
Weight	lbs	1400	1400	1500	1600	2100	2200	2400	2600

Figure 2. WXM water-to-water heat pump modulars - 20 to 80 tons

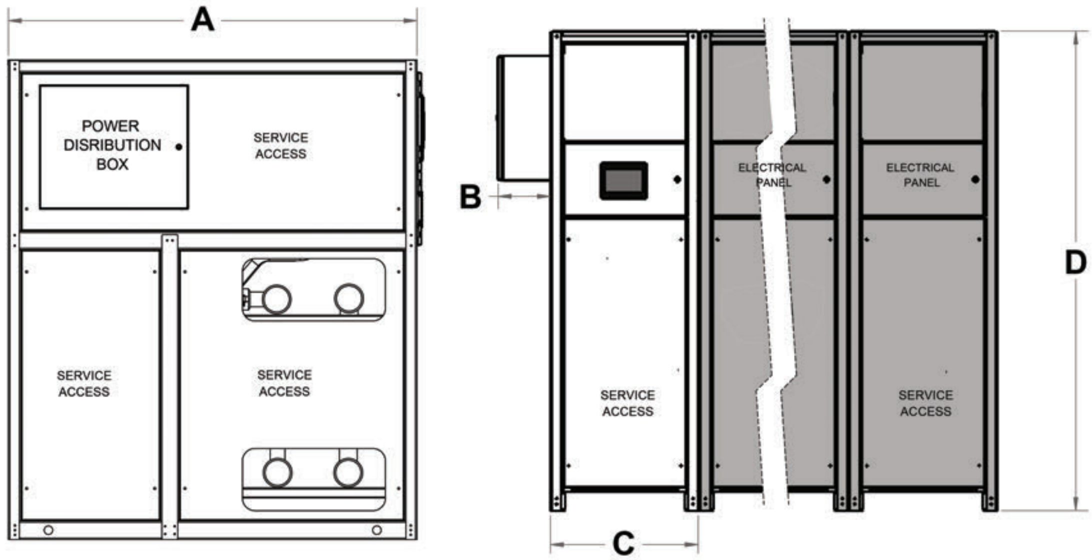


Table 5. Unit dimensions and weight: 20 to 80 tons (WXM)

Dim	Units	Unit Sizes and Weights Per Module						
		20 Tons	25 Tons	30 Tons	40 Tons	50 Tons	60 Tons	80 Tons
A	inch	66	66	66	66	66	66	79
B		8.5	8.5	8.5	8.5	8.5	8.5	8.5
C		24	24	24	34	34	34	42
D		77	77	77	77	77	77	80
Weight	lbs	1400	1500	1600	2100	2200	2400	2600

Pre-Installation

Unit Connections

See “Connecting Module Power and Control Wires,” p. 22 to determine the method of the connection of this unit.

Site Preparation and Clearances

Chiller/heat pump modules must be installed on 4-inch tubing or 6-inch I beams on a level surface that has been checked by a qualified structural engineer to support the weight of the fluid-filled modules and the connective piping to and from the chiller/heat pump. Installations must account for minimum service access clearances as may be practical or required by local building codes.

Chiller/Heat Pump Clearances

The National Electric Code or local, state, and regional building codes may require greater clearance for the modular chiller/heat pump than the figures listed in this publication. Always consult local regulatory agencies to ensure additional clearances are not required by building codes.

Minimum Clearances

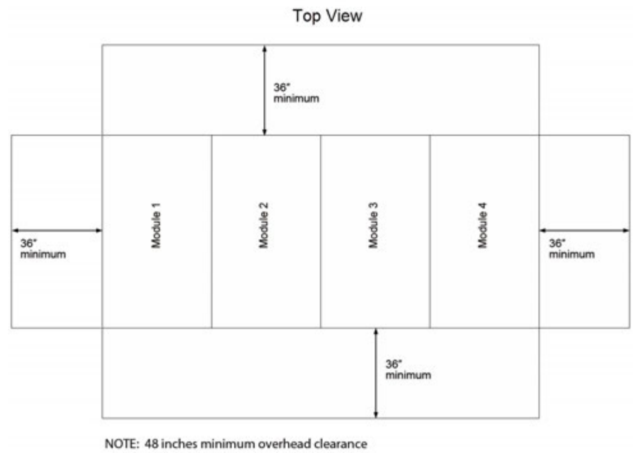
The unit must maintain a minimum of 36-inch clearance on all sides and a minimum of 48-inch overhead for compressor removal is recommended. See Figure 3, p. 13.

Note: *These clearances are general recommendations. Each installation has specific considerations. Contact Trane for definitive guidance and approval on a job-by-job basis.*

Service Access

Clearance must be maintained between the module and any nearby wall or impediment to provide sufficient room to open power distribution panel and electrical and control panel doors for routine maintenance and servicing. In general, 36 inches of space is required to allow panel doors to fully swing open and to meet local and national electrical codes. Compressors, filter-strainers, and liquid line shutoff valves are accessible on each side or end of each chiller/heat pump.

Figure 3. Recommended chiller/heat pump clearances



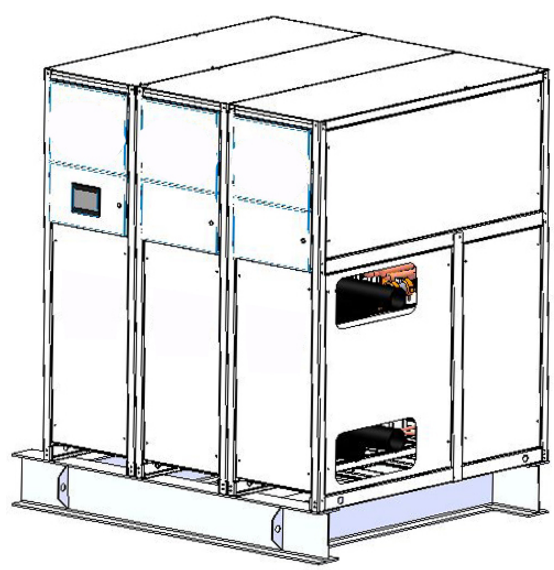
Mounting Rails

The chiller/heat pump must be positioned on a firm, level surface. All modules should be installed onto structural steel rails. The rails must be level, be a minimum of 4 inches wide (preferably 6 inch wide).

Custom modules may have different requirements. Consult submittal drawings to confirm dimensions. See Figure 4, p. 13.

After setting and lubricating the mounting rails, begin installing the modules. All of the modules arrive with labels on the electrical and control panel. Review the installation drawings to determine which is the first primary module. Typically, the primary module also has the power distribution panel attached to it.

Figure 4. Chiller/heat pump installation on mounting rails



For vibration isolation, spring isolators or rubber-in-shear isolator pads must be installed under the structural steel mounting rails. For modules mounted directly on concrete, vibration isolation pads can be installed under each module. After setting each module, remove front or rear access panels to improve access to components when making connections.

A2L Work Procedures

⚠ WARNING

Risk of Fire — Flammable Refrigerant!

Failure to follow instructions below could result in death or serious injury, and equipment damage.

- **To be repaired only by trained service personnel.**
- **Do not puncture refrigerant tubing.**
- **Dispose of properly in accordance with federal or local regulations.**

⚠ WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage.
System contains refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

The units described in this manual use R-454B refrigerant. Use ONLY R-454B rated service equipment or components with these units. For specific handling concerns with R-454B, contact your local Trane representative.

Installation, repair, removal, or disposal should be performed by trained service personnel.

At all times, Trane's maintenance and service guidelines shall be followed. If in doubt, contact Trane technical support for assistance.

Servicing

Prior to initiating work on equipment, check the area with an appropriate refrigerant detector. Ensure the service personnel are properly trained regarding work in potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed, or intrinsically safe. Be aware that the refrigerant does not contain an odor.

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available on hand. A dry powder or CO_2 fire extinguisher should be located adjacent to the charging area.

At all times, Trane's maintenance and service guidelines shall be followed. If in doubt, contact Trane technical support for assistance.

All maintenance staff and others working in the local area shall be instructed on the nature of the work being carried out. Work in confined spaces shall be avoided.

Ignition Source Mitigation

Do not use any sources of ignition when working on the refrigeration system.

Keep all ignition sources, including cigarette smoking, away from the site of installation, repair, removal or disposal, during which refrigerant can potentially be released to the surrounding space.

Survey the area around the equipment before initiating work to ensure no flammable hazards or ignition risks are present.

"No Smoking" signs shall be displayed.

Do not use devices that can be a source of ignition to accelerate defrosting of components. Use only defrost and cleaning procedures recommended by Trane. Do not pierce or burn.

Ventilation

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere. If present, check that the ventilation system, including outlets, are operating adequately and are not obstructed.

Refrigerating Equipment

Refrigerant piping or components should not be installed in locations where substances which may corrode them are present.

Check that equipment hazard markings are visible and legible. Replace them if they are not.

For equipment using secondary fluids, like water or glycol, check that refrigerant is not present in the secondary fluid loop before conducting any hot work.

Electrical Devices

Do not apply power to the circuit if a fault exists which compromises safety. If the fault cannot be corrected immediately, but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised.

Initial safety checks shall include:

- Cabling is not subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. Account for the effects of aging or continual vibration from sources such as compressors or fans.
- Capacitors are discharged. This shall be done in a safe manner to avoid possibility of sparking.
- No live electrical components and wiring are exposed while charging, recovering, or purging the system.
- Verify continuity of earth bonding.
- Replace electrical components with Trane replacement parts, or those meeting the same ratings and qualified for flame arrest protection, UL LZGH2 category.

Leak Detection

Never use an open flame to detect leaks. A halide torch should not be used. Use only approved leak detection methods per this instruction manual.

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL gas (25% maximum) is confirmed.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

Examples of leak detection fluids are:

- Bubble method
- Fluorescent method agents

If a leak is suspected, all naked flames shall be removed/ extinguished.

If a refrigerant leak is found which requires brazing, all refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.

Refrigerant Removal and Evacuation

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration.

The following procedure shall be adhered to:

1. Safely remove refrigerant following local and national regulations.
2. Evacuate.
3. Purge the circuit with inert gas.
4. Evacuate (optional for A2L).
5. Continuously flush or purge with inert gas when using flame to open circuit.
6. Open the circuit.

Prior to refrigerant removal, open all appropriate valves, including solenoid and electronic expansion valves (EXVs). Use control settings, where available. When not available, manually open all electronically controlled valves using acceptable service procedures.

The recovery equipment shall be in good working order with instructions available. Equipment shall be suitable for the recovery of the flammable refrigerant. For specific handling concerns, contact the manufacturer. Ensure all hose connections are checked for tightness to avoid refrigerant leaks.

The refrigerant shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. Do not mix refrigerants in recovery unit and especially not in cylinders.

Refrigerant recovery unit should be purged with an inert gas after each use or before using with a different refrigerant Class – for example, A2L to A1.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

The system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

The system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Refrigerant Charging

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment.
- Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.

- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigerating system.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Prior to refrigerant charging, open all appropriate valves, including solenoid and electronic expansion valves (EXVs). Use control settings, where available. When not available, manually open all electronically controlled valves using acceptable service procedures.

Decommissioning

Before carrying out the decommissioning procedure, it is essential that the trained service personnel is completely familiar with the equipment and all its details. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate system electrically.
3. Before attempting the procedure, ensure that:
   a. Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
   b. All personal protective equipment is available and being used correctly.
   c. The recovery process is supervised at all times by a competent person.
   d. Recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80% volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.
12. When equipment has been decommissioned, attach a signed label which includes the date of decommissioning.

Installation Mechanical

Inspect and Report Damage

Upon receipt, inventory the shipment against the Trane bill of lading to ensure all modules and components have been delivered.

Inspect each package in the shipment for visible damage. Verify the correct model number and that all skids and cartons have been delivered. Any damage must be reported to the motor carrier and Trane within five days of receipt of the shipment.

Inspect all exterior components for concealed damage as soon as possible. Do not proceed with the installation of damaged equipment without prior approval of Trane.

Do not refuse delivery of damaged goods without prior authorization. Unauthorized refusal of the shipment will result in a 20% restocking charge to the customer.

The ownership of the equipment is transferred to the consignee at point of shipment. Refusal of delivery may impede recovery of damages.

It is the consignee's responsibility to accept delivery of damaged goods unless permission to refuse delivery has been granted by Trane.

Inspection of Delivered Equipment

To report damage incurred in transit, complete the following:

1. Inspect each piece of equipment for visible damage before accepting delivery. Check for torn cartons, broken skids, bent metal, and torn shrink wrap.
2. Ensure the delivery driver notes any damage on the bill of lading and completes a Carrier Inspection Report. Failure to comply may result in difficulties in resolving any claims for damage.
3. Inspect each piece of equipment for concealed damage before storage or as soon as possible after delivery.
4. In the event of suspected concealed damage, ask the driver to wait until you inspect the equipment. Concealed damage must be reported within five days of receipt of equipment.
5. If concealed damage is found, stop unpacking the shipment. Do not remove damaged material from the receiving location, take photos of the damage. The owner must provide reasonable evidence that the damage did not occur after delivery.
6. Notify the carrier of the damage as soon as possible. Request an immediate joint inspection by the carrier and consignee. A determination of responsibility will be made, and the carrier will authorize repairs in the event of admission of fault.
7. Notify your local Trane CSO immediately. Trane will coordinate repairs with the owner and carrier. Do not attempt to make repairs locally without permission.

Warranty Issues

Trane is not responsible for damages or for filing damage claims. It is the customer's responsibility to ensure that the necessary long term storage procedures have been completed and any deviations are reported to Trane immediately.

Long Term Storage Requirements

Appropriate preparation and storage of Trane chiller/heat pump components during extended periods of dormancy is essential to ensure the equipment does not sustain damage or degradation due to inactivity and operates properly after installation.

The customer must notify Trane during the sales process that the chiller/heat pump system may be transported by ocean freight or placed in long-term storage under any of these conditions:

- The chiller/heat pump will not be placed into operation for a period exceeding six months after leaving the Trane factory. That is, the initial start-up date will not occur within a six-month maximum dormancy window.
- The chiller/heat pump will be shipped using ocean transit for all or part of the delivery process.
- Cold temperature storage conditions fall below -20 °F (-29 °C).
- Ambient temperatures from -20 °F (-29 °C) to 145 °F (63 °C) with relative humidity from 0% to 100%.
- The glycol should be removed from the chiller/heat pump if the unit is to be stored for extended periods.

Factory Preparation

Upon confirmation of an order requiring long-term storage or protection against extreme environments, Trane will inspect and protect vendor-supplied components before installation.

Prior to shipment, Trane will prepare each chiller/heat pump system for long-term storage in coastal or tropical environments by:

- Placing silica gel packs in all electrical panels and variable speed drive panels to prevent corrosion of electrical contacts and moisture from degrading sensitive controllers.
- Shrink-wrapping each chiller/heat pump using polyethylene film to limit environmental exposure and protect the chillers/heat pumps from damage during shipping.
- For multiple modular chiller/heat pump system assemblies shipped on a common skid, shrink wrap the entire skid rather than the individual modules.

Trane will document and photograph the status of the unit prior to shipment and carry out the instructions detailed in the factory order regarding in-shop preparation of units for long-term storage.

Customer Responsibilities

Upon receipt of a chiller/heat pump system, the customer must conduct thorough internal and external inspections, removing packaging material as needed for access to all components.

Visible damage must be noted on the signed and dated bill of lading. The customer may request a carrier inspection by telephone or in person, but any such request should be confirmed in writing. It is recommended that the customer request that the carrier inspect the damage within 72 hours of notification.

The customer must store the chiller/heat pump system in a dry, non-corrosive, dust- and vibration-free environment due to the exposure sensitivities of the microprocessor controllers and to prevent electrical terminations from deteriorating from non-use. Conditions in storage locations should not fall below -20°F (-29°C) or exceed 150°F (66° C).

Components sealed in plastic shrink-wrap are not exempt from these storage requirements. Moisture can potentially collect inside the plastic film, resulting in corrosion of the cabinet and electronic components. Any chiller/heat pump system packaging that is removed must be replaced with similar protective covering as soon as possible.

Failure to adhere to these long-term storage requirements may void the Trane warranty. Any component that is damaged or inoperable due to improper storage may have its warranty voided.

Handling of the Modules

The packaging from the factory permits lifting with a suitable crane. Ensure straps are in good working condition and that they are rated for the weight of the machines. Spreader bars may be required for effective rigging and to avoid damage to the chiller/heat pump modules.

The chiller/heat pump modules arrive fully charged with refrigerant. As required under Federal regulations, installation, start-up and service should be performed by fully qualified, factory-certified, personnel.

Note: *Damage from improper handling will not be covered by warranty.*

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Electrical Shock, Explosion, or Arc Flash Hazard!

Failure to follow these instructions could result in death or serious injury.

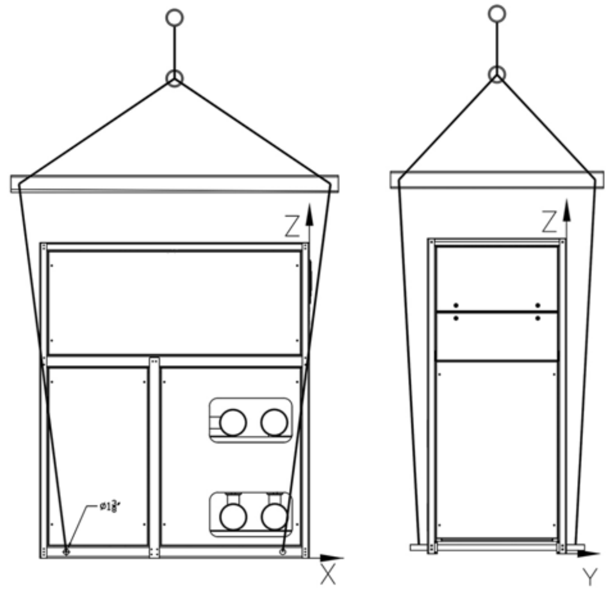
- **Install the product in an appropriate electrical/ fire enclosure per local regulations. Do not install the product in hazardous or classified locations.**
- **Do not use the product for life or safety applications.**
- **Do not exceed the product ratings or maximum limits. Products rated only for basic insulation must be installed on insulated conductors.**
- **Current transformer secondaries (current mode) must be shorted or connected to a burden at all times.**
- **Remove all wire scraps, tools, replace all doors, covers and protective devices before powering the equipment.**
- **Unventilated area where the appliance using flammable refrigerants is installed shall be so constructed that should any refrigerant leak, it will not stagnate so as to create a fire or explosion hazard.**

Rigging, Lifting, and Moving the Chiller/Heat Pump

The Thermafit™ modular water-cooled MWC and WXM chiller/heat pump can be delivered to the customer's site as individual modules. Limitations on the methods and materials that can be used to rig, lift, or move a chiller/heat pump system or an individual module include:

- Maintain the module in an upright position at all times.
- Certain configurations of modules can be top-heavy. Move modules slowly with consideration for each module's center-of-gravity.
- Rig, lift, and move by strapping and lifting using a properly configured floor jack or fork lift or by overhead means.
- Position lifting beams or spreader beams to prevent lifting straps from rubbing or contacting module side panels or electrical boxes. Attach rigging bar on each end of module where 1 3/8-inch holes are provided.
- Do not use cables, chains, or any other type of metalized strapping to lift a module.
- Do not push a chiller/heat pump module while directly in contact with the floor using manual or mechanical means.

Figure 5. Recommended chiller/heat pump rigging assembled unit

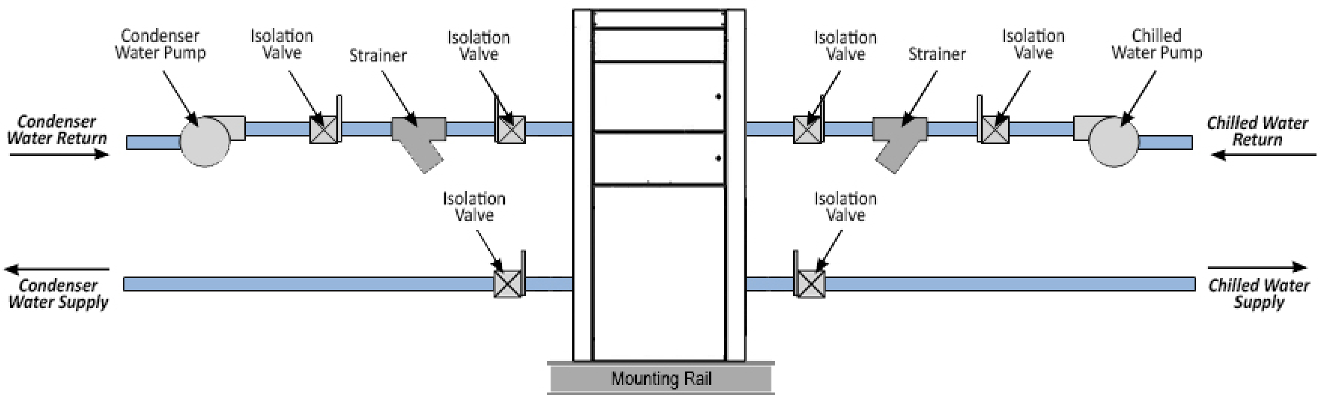


Installation Piping

Install Piping and External Components

Proper support of piping and pipe hangers must consider the weight of the piping as well as the water weight inside the pipes. A 40-mesh screen strainer must be installed in each water/liquid system piping inlet for proper filtration an protection of the heat exchangers. The following figure provides a recommended installation of components.

Figure 6. Recommended chiller/heat pump piping



Initial Flushing of Piping

After installation of system piping and before connection to the chiller/heat pump system, it is important to clean and remove debris, weld slag, and other contamination deposited during fabrication of the piping system.

Typical flushing includes hot water with mild detergent followed by a dilute phosphoric acid solution until all visible residue is removed.

Only cleaning liquids, acids, and detergents compatible with SAE Grade 316 stainless steel, copper, and carbon steel should be used. Consult a professional water treatment specialist when in doubt.

Flushing should take place across a filter/strainer with a maximum 40 mesh screen and continue for a minimum of six hours with frequent removal of the screen to capture residue or until the strainer is clean.

After detergent and chemical cleaning, flush the water piping with fresh water for one hour to remove any remaining cleaning compounds.

Fill with Water/Glycol Solution

The installing contractor is responsible for charging glycol into the chiller/heat pump hydronic system.

1. Mix the concentrate of propylene glycol in a tank or drum for transfer into the chiller/heat pump. Use to determine the appropriate glycol concentration for the chiller/heat pump.
2. Mix the glycol and water externally before filling the chiller/heat pump to prevent clogging of the chiller/heat pump piping with a heavy concentrate.
3. For chiller/heat pump systems with tank and pump module and sealed buffer tank, fill the chiller/heat pump using the manual fill port on the cabinet. Fill so that the mixture reaches near the top. Stop every so often so the fill level can be monitored.

Note: *Do not use the glycol feeder pump to fill the chiller/heat pump loop. It is not designed for continuous use and will fail.*

Only after the above steps have been completed should the water piping be connected to the chiller/heat pump system.

Dowfrost

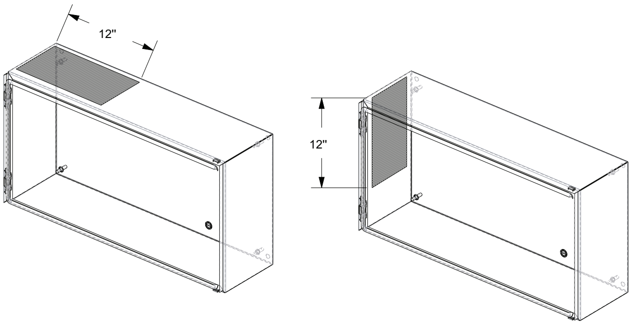
Important: *Dowfrost inhibited propylene glycol-based solution is listed as chemically acceptable by the US Department of Agriculture (USDA). The two ingredients in Dowfrost water/glycol mixture are generally recognized by the FDA as safe food additives under Parts 182 and 184 of the Food Additive Regulations.*

Installation Electrical

Connecting Module Power and Control Wires

Connections are typically made at the power distribution panel located on one end of the chiller/heat pump system or individually on each module at the high voltage panel depending on option(s) selected. Connection entries should be made in the upper left corner of the panel(s). See figure below.

Figure 7. Electrical supply connection location(s)



⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

Labeled control and communication cables are coiled inside each module and are connected to an Ethernet switch. The Ethernet cable turns from the switch to each modules microprocessor controller at the J30 connector.

This unit is equipped with a flow switch. The chiller/heat pump will not run unless the pump is circulating water through the system.

Customer-installed incoming disconnect switches should be designed for all pole disconnection and should be able to disconnect during Overvoltage category III.

Chiller/Heat Pump Module Main Power

Modular systems feature single-point power connection from the utility service to the power distribution panel on the primary module as standard. Main power phases A, B, and C are connected to terminals A, B, and C respectively from left to right. Some custom systems have individual power supplied to each module in lieu of single point power.

Phase Monitor Installation

The chiller/heat pump is equipped with a phase monitor on the power distribution panel. It is connected to the corresponding digital input of the primary microprocessor controller. Ensure that the wiring from the primary microprocessor controller and terminal blocks to the phase monitor are connected and secure.

The phase monitor continuously monitors each of the three phases. The microprocessor receives input from the phase monitor indicating whether the voltage is within acceptable values. The phase monitor is designed to protect against under-voltage, voltage imbalance, phase loss, and phase reversal.

Set voltage adjustment knob at the desired operating line voltage for the equipment. This adjustment automatically sets the under-voltage trip point. Check the phase monitor after initial start-up. If it fails to energize, (the LED glows red or blinks) check the wiring of all three phases, voltage, and phase sequence. If phase sequence is incorrect, the LED flashes green/red. To correct this, swap any two line voltage connections at the mounting socket. No further adjustment should be required.

Optional Disconnect Switch

Some chiller/heat pump systems are optionally equipped with a panel-mounted disconnect switch installed on the outside of the power distribution panel. The disconnect switch must be turned to the off position before the panel can be opened for service.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Single Point Connections

1. Open the power distribution panel. Power cable holes are accessible from inside module.
2. Remove cable strain relief from back of cabinet, feed cable end through strain relief.
3. Feed cable end through left most open cable access hole.
4. Push conduit sleeve to engage strain relief. Re-attach strain relief and tighten.
5. Attach and tighten cable ends to its numbered breaker. Each wire is labeled 1, 2, and 3.
6. After installation of the cable, attach conduit to a frame member near the coil using a wire tie.

7. Attach ground to lug/bar inside cabinet. Tighten after all grounds have been run.
8. Control wires are in series. Attach the control wires to the correct module microprocessor.
9. Feed control wire through rear of cabinet of the next module control cabinet. Note labels.
10. Connect the Ethernet cable to the J30 port on the microprocessor.

Module Control Wiring

The primary controller communicates with each secondary controller via an Ethernet cable wired to the Ethernet switch which is typically in the primary module.

Operating Principles

This section contains an overview of the operating principles of the Thermafit™ MWC (water-cooled modules) and WXM (water-to-water heat pump) modules equipped with Carel c.pCO™ controller.

Refrigeration Circuits

Each chiller/heat pump module has two refrigerant circuits, each with a scroll compressor. Each refrigerant circuit includes compressor suction and discharge service valves, liquid line shutoff valve, sealed filter drier, liquid line sight glass with moisture indicator, charging port, and a thermal (standard) or electronic (with compressor VFD) expansion valve.

Refrigeration Cycle

Each module uses a brazed-plate evaporator and a brazed plate condenser for the water-cooled chiller modules (MWC), and a brazed plate load heat exchanger and a brazed plate source/sink heat exchanger for the water-to-water heat pump (WXM). The suction lines are designed to minimize pressure drop. The scroll compressor pressurizes vaporized refrigerant from a low pressure and temperature to high pressure and temperature. De-superheating, condensing, and sub-cooling is accomplished in the brazed plate evaporator and source/sink heat exchanger where refrigerant is condensed. Refrigerant flowing through the system is balanced by thermal or electronic expansion valves.

Refrigerant R-454B

Trane believes responsible refrigerant practices are important to the environment, our customers, and the modular chiller industry.

Thermafit™ MWC water-cooled chiller module and WXM chiller/heat pump module use environmentally friendly, class A2L, R-454B refrigerant. R-454B is a zero-ozone depleting, zeotropic, hydrofluoroolefin (HFO) based refrigerant blend. It is designed to serve as direct replacement for R-410A, yet has 78% lower Global Warming Potential (GWP) (466). R-454B has similar capacity and has better efficiency to R-410A.

Compressor and Oil System

Each compressor is hermetic, scroll type, and has constant speed, and there is one on each refrigeration circuit.

An optional variable speed drive is available for use on standard fixed speed compressors and allows capacity modulation from 58% to 100% of the compressor capacity for MWC water-cooled chiller modules and 75% to 100% for WXM water-to-water heat pump modules.

Evaporator and Condenser (MWC)

The evaporator and condenser in each module are dual circuit, brazed plate constructed of 316 stainless steel plates and copper brazing. The fluid connections to each evaporator and condenser use roll grooved couplings for service convenience and ease of installation.

Evaporators are insulated with 3/4-inch closed cell insulation. Condensers will have 3/4-inch insulation only when the fluid entering the condenser will be lower than the anticipated dew point temperature of the room to prevent condensation from forming. The condenser is always insulated if the chiller is for heat recovery.

The maximum refrigerant working pressure is 650 psi. Optionally, a shell-and-tube condenser constructed with carbon steel shell and copper tubes can be provided for the MWC modules.

The shell-and-tube condenser is designed, tested, and stamped in accordance with the ASME Boiler and Pressure Vessel Code.

The shell and tube condenser is not insulated. Heat tracing can optionally be provided on the evaporators, condensers, and all fluid components for freeze protection. A factory-installed flow switch is installed on the branch line discharge of the evaporator and condenser (typical). A strainer is not included with a shell and tube condenser as they are not susceptible to fouling.

Load and Source/Sink Brazed Plate Heat Exchanger (WXM)

The load and source/sink heat exchanger are dual circuit and brazed plate constructed of 316 stainless steel plates and copper brazing. The fluid connections to each uses roll-grooved couplings for service convenience and ease of installation.

Load side brazed-plate heat exchangers are insulated with 3/4-inch closed cell insulation. Source/sink side has 3/4-inch insulation only when the fluid entering the condenser is lower than the anticipated dew point temperature of the room to prevent from forming condensation.

Maximum refrigerant working pressure is 650 psi and maximum fluid working pressure is 450 psi.

Heat Recovery (MWC)

The heat recovery chiller uses a brazed plate condenser to recover sensible and partial latent heat of refrigerant during condensing process. Hot fluid connecting piping include inlet and outlet water temperature sensors and electronic and manual isolation valves.

The heat recovery capacity and outlet temperature varies mostly due to variations of cooling load and the outlet evaporator fluid temperature. There cannot be heat recovery unless there is a cooling load.

Operating Procedures

Operator Interface

Thermafit modular water-cooled units, whether they are composed of a single module or up to 12 modules, are automated systems that use a main electrical panel to monitor, report, and modify critical system functions.

Chiller/Heat Pump Power Panels

There are two different electrical panels used in the Thermafit MWC and WXM chiller/heat pump. The main power distribution panel receives power from the building source and distributes it to individual modules. The electrical and control panel receives power from the power distribution panel and provides power to the individual electrical components in that module.

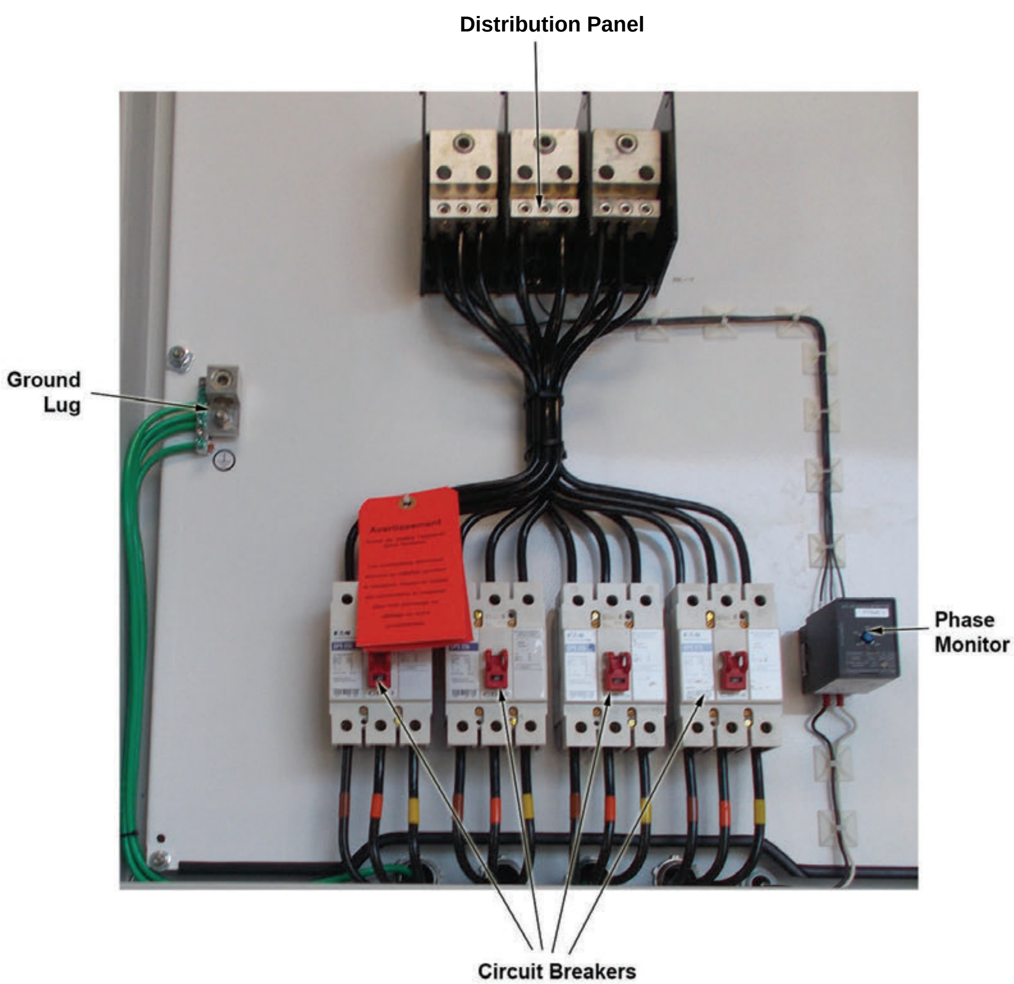
Panel-Mounted Disconnect Switch

Some chiller/heat pump optionally equipped with a panel-mounted disconnect switch installed on the outside of the power distribution panel (or a circuit breaker disconnect on the high voltage electrical panel of each module if the chiller/heat pump has power supplied to each individual module). The disconnect switch must be turned to the OFF position before the panel can be opened for service. When the panel door is open, the power is disengaged.

Power Distribution Panels

The power distribution panel receives power from the building source and distributes it to individual modules. It also houses a circuit breaker for each module, a phase monitor, and an optional main power disconnect switch. See following figure.

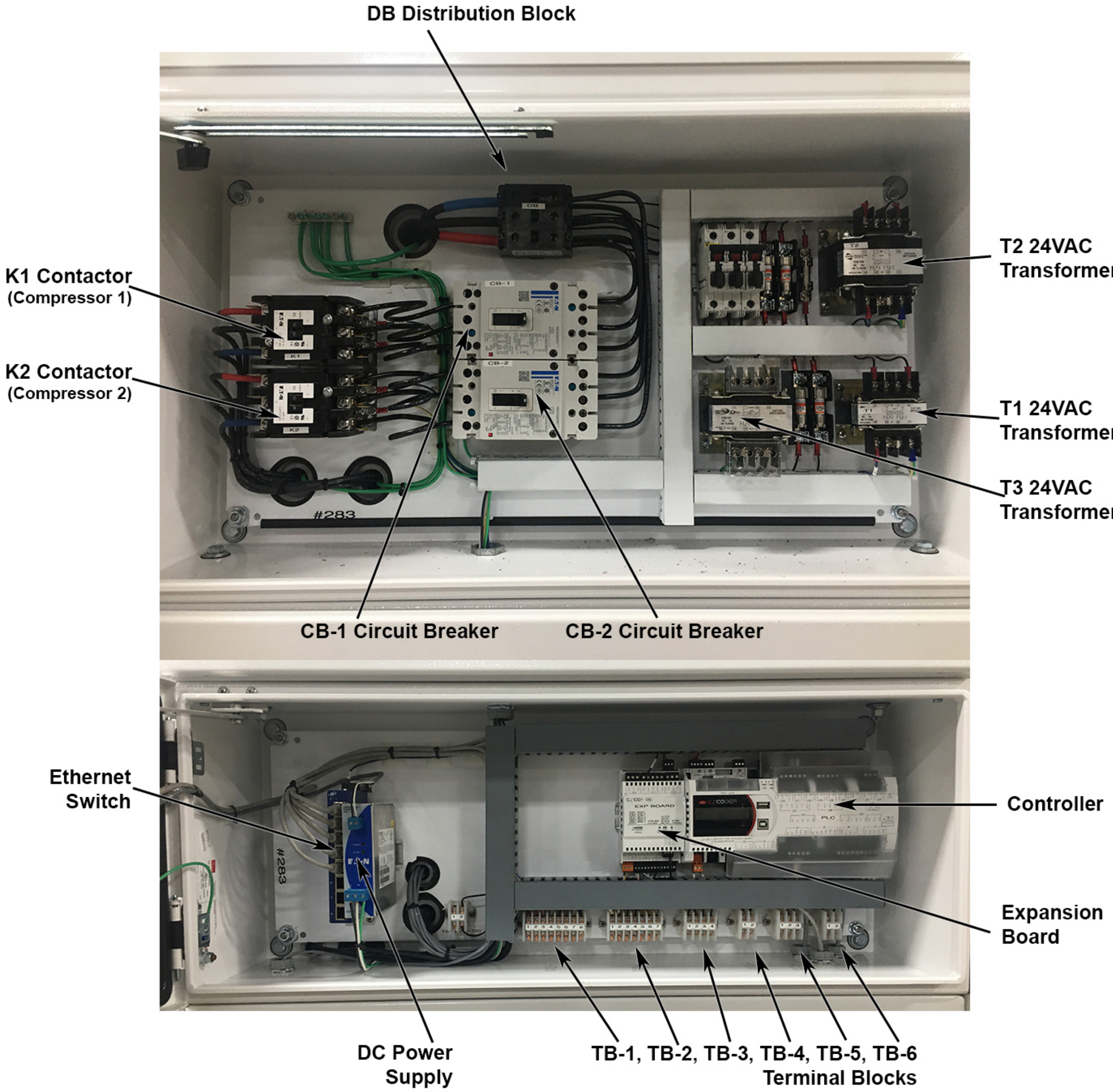
Figure 8. Power distribution panel



Module Electrical and Control Panel

The electrical and control panel receives power from the power distribution panel and provides power to the individual electrical components in that module. Each module has its own high voltage electrical panel and low voltage control panel that distributes electricity to individual components. It also has fuses and breakers, compressor switches, and the microprocessor controller.

Figure 9. MWC Module electrical panel



Electronic Control

The Thermafit MWC and WXM chiller/heat pump models use Carel c.pCO series microprocessor controllers to monitor and report critical operating parameters. See Figure 11, p. 28. A main controller is used to control and coordinate the functioning of all the modules that make up the chiller/heat pump unit. For units consisting of more than a single chiller/heat pump, each module has its own controller.

There are five BMS communication options:

Note: *BMS is not included as standard, but available as an option.*

1. BACnet® MS/TP - Connection through built-in BMS2 port.
2. BACnet IP - BACnet router is used.
3. Modbus® RTU - Connection through built-in BMS2 port.
4. Modbus IP - Modbus router is used.
5. LonWorks® - LonWorks router is used.

Controllers

The distributed primary microprocessor control system enables all secondary modules to operate independently in the event that the primary microprocessor controller fails. All chiller/heat pump safeties including temperature set point, refrigerant pressures, and freeze protection are preserved.

In a normal configuration, a secondary controller controls the single module to which it is dedicated.

The secondary controller monitors key performance parameters for its module and sends real-time information to the primary controller. The primary controller monitors the performance of the chiller/heat pump, activating and deactivating modules as needed to maintain the leaving fluid temperature for the chiller/heat pump.

(See the following figure for a simplified example of a typical microprocessor controller network.)

Figure 10. Typical controller network

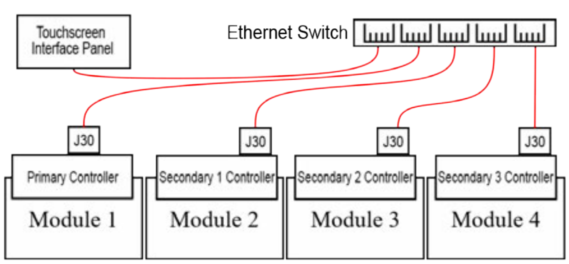


Figure 11. Carel medium c.pCO primary controller

Operating the Microprocessor

The touchscreen interface panel is ready to use when it is connected to the Ethernet switch and chiller/heat pump power is ON.

Upon initial start-up, the status line will indicate that the chiller/heat pump is OFF. Press On/Off button on the home screen to enable System On/Off control pop-up screen. Next, turn heat pump on or off manually or switch over to BMS control.

Microprocessor Functions

For practical purposes, all essential control information and operator actions are read and responded to using the touchscreen interface panel. The touchscreen interface panel is connected to the primary microprocessor controller and is the only way to access many primary controller functions.

NOTICE

Component Damage!

Failure to follow instructions could damage sensitive electronic components beyond repair.

To prevent arcing or surges of electrical current, do not use wires or cables to jump components or bypass the manufacturer's safety systems.

Password Protection

There are three levels of access to the functions displayed on the interface. The basic level, ‘user,’ does not require a password. The higher access levels are the technician (‘tech’) and administrator (‘admin’) levels that can only be accessed by Trane technical personnel. Contact Trane technical support regarding the possibility of any potential issues involving the higher-level functions.

Operator Control

A touchscreen interface panel is the primary means for the operator or maintainer to monitor and modify a host of functions involving temperatures, pressures, set points alarms, operating schedules, elapsed operating hours, etc. This touchscreen interface panel can be located within proximity of the primary microprocessor controller. It is typically located in the primary module.

The touchscreen interface is connected to and communicates with all module controllers via the Ethernet switch. It accesses overall chiller/heat pump functions and settings as well as individual module settings.

In this manual, all functions, procedures, checklists, system information, and changes in system parameters (set points, alarms, primary chiller/heat pump controls, and so forth) are written assuming the operator is using the touchscreen interface panel.

When connected to the Ethernet switch, the touchscreen interface panel displays current, real-time, information about the chiller/heat pump, as well as the status of critical parameters within each module of the chiller/heat pump system.

Touchscreen Interface Panel

The touchscreen interface panel is used to adjust set points, clear alarms, and perform detailed setup of the microprocessor controllers.

The touchscreen interface panel displays information on its touchscreen whenever specific keys and buttons are pressed by the operator (See following figure).

Basic operator tasks are described in the following sequence of illustrations that comprise a controller tutorial.

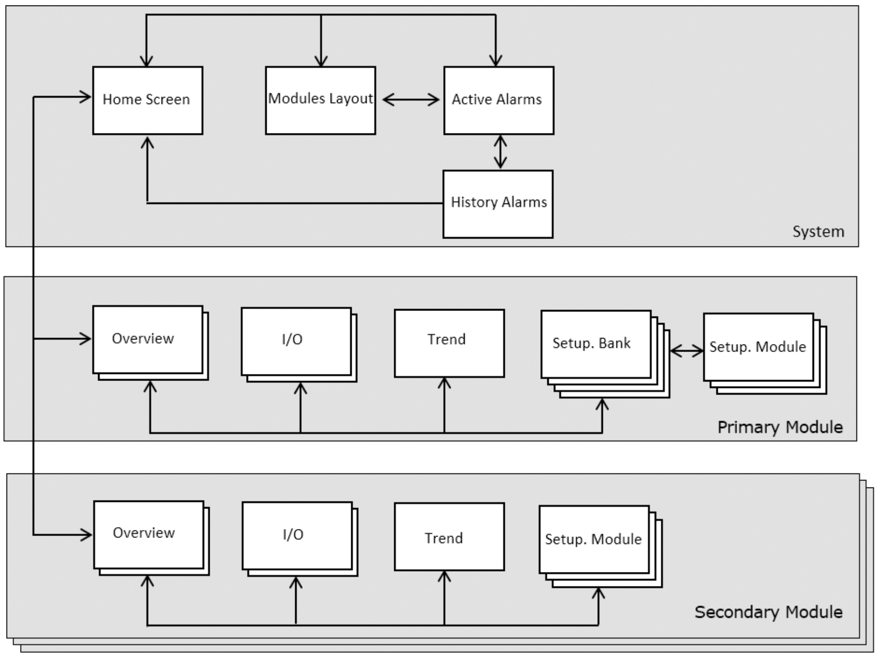
Figure 12. Touchscreen interface panel

Touchscreen Interface Tutorial

This section consists of a tutorial that first-time personnel can use to navigate through the various functions and features that are available in the interface.

Each of the main screens in the interface contains active hot spots to activate virtual buttons and switches by simply touching the screen.

Figure 13. Interface navigation scheme



Interface Menu Structure

Key interface screens are organized according to system, primary module, and secondary modules functions. See Figure 13, p. 30.

Home Screen Features

Figure 14. HMI home screen

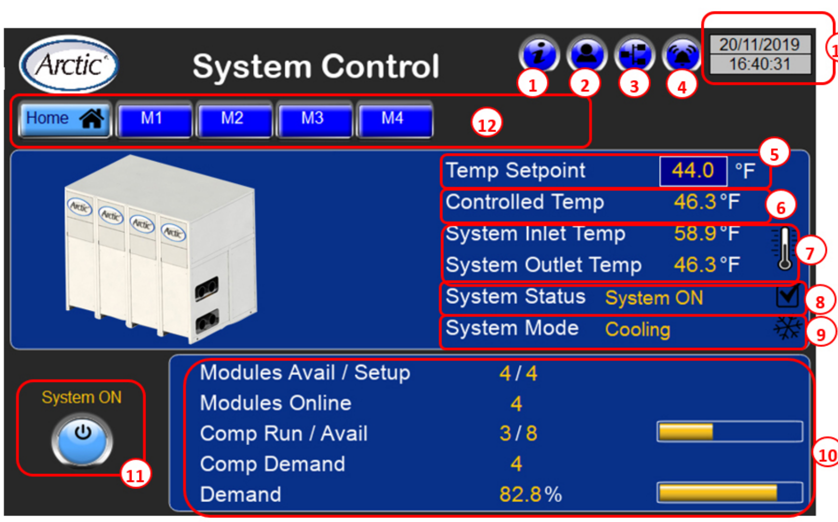


Table 6. Home screen features

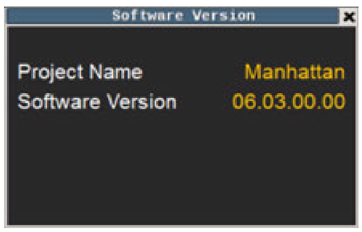
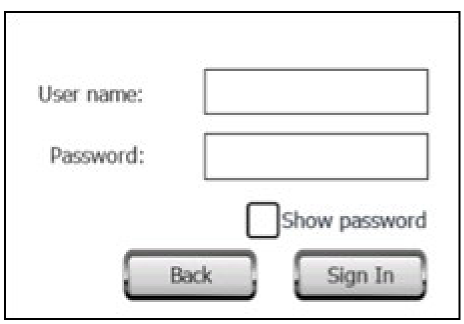
Feature	Description
1 - HMI Software Version	 Calls up the pop-up window. See figure below. • Project Name: HMI software project name • Software Version: HMI software version • Consists of 4 two-digit numbers – First two numbers stand for major and minor software revision. – Third number stands for special software revision. If any project has the special software, this number would be different from '00'. – Fourth number stands for beta software revision. 
2 - HMI User Management/ Login	 • Current User: indicates which user is currently logged in. There are three users for the HMI: user, tech, and admin. – User - (default user) has access to viewing data mostly. The only allowed controls for this user are: turning chiller bank on/off and turning compressors on/off (described below). There is no password for this user. – Tech - higher access than user but still limited. Beyond 'user' 'tech' can adjust cooling/heating setpoints, turn separate modules on/off and has access to some machine basic temperature control settings (described below). Password is 'tech2' – Admin - full access to all the settings. • Log in: Calls up user logging screen where user name and password have to be entered. • Log Out: unhidden for 'admin' and 'tech' users only. It logs out from 'admin' or 'tech' user to a default user, which is 'user.' **Figure 15. User logging screen** 
3 - Module Layout Access	 The module layout access button provides fast access to the module layout screen.
4 - Active Alarm Access	The active alarm access button provides fast access to a list of currently active system alarms.

Table 6. Home screen features (continued)

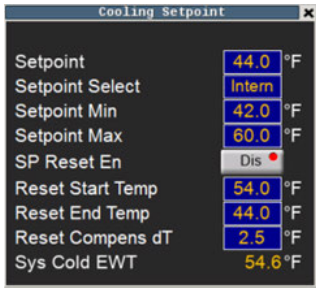
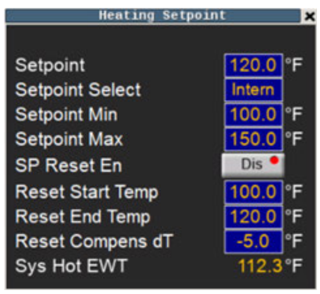
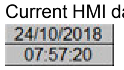
Feature	Description
5 - Setpoint	Calls up cooling/heating setpoint pop-up screens respectively depending on the Mode. Accessible for 'tech' only. These dialog boxes themselves display the resulting cooling/heating setpoint used for machine temperature control. ***Note:*** *The only box on these pop-ups accessible for 'tech' user. The other settings are view-only. See following figures below.* **Figure 16. Cooling setpoint**  **Figure 17. Heating setpoint** 
6 - Controlled Temperature Reading	
7 - System Temperature Sensors Reading	Based on chilled water entering/leaving temperatures for Cooling Mode and hot water temperatures entering/leaving for Heating Mode
8 - System Status	Possible Options: • System ON – System is operational and is not off by any of the conditions listed below. • Phase Alarm – System is off by Phase Alarm. • OFF by DI – System is off by opened state of primary PLC DI1 if corresponding option applies. • OFF by Switch – System is off by software switch. It can be turned on/off either from Home Screen (button marked 11 on Figure 14, p. 30), which all users have access to. It can also be turned on/off from BAS (Building Automation System). • OFF by switching to Cooling – System is off and is switching over to Cooling Mode. • OFF by switching to Heating – System is off and is switching over to Heating Mode. • OFF by switching Mode – System is off and is going through a change of a major parameter. For instance, Number of Refrigeration Circuits, Number of Fan Banks etc. • OFF by Condenser Pumps – System cannot run due to disabled Condenser Pump Module, if applicable. ***Note:*** *Applies only to MWC.* • OFF by Evaporator Pumps – System cannot run due to disabled Evaporator Pump Module, if applicable. ***Note:*** *Applies only to MWC.* • OFF by Hot Water – System is off by Hot Water cutout. • OFF by BMS – System is off by Building Management System.
9 - System Mode	Indicates chiller thermal mode: Cooling or Heating.

Table 6. Home screen features (continued)

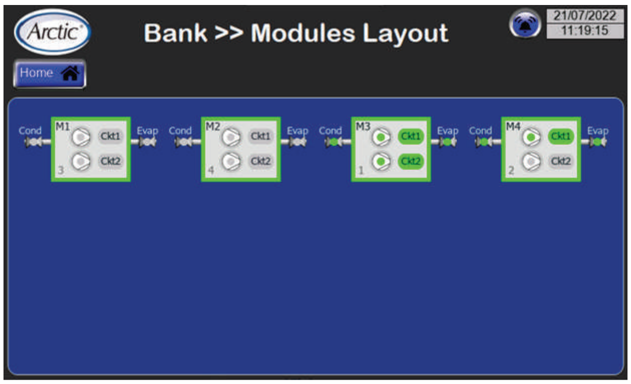
Feature	Description
10 - Module/Compressor Status	• Modules Online/Avail/Setup. Number of modules communicating with Primary Module including Primary Module/available for Primary/Secondary temperature control and number of modules set up for Primary/Secondary temperature control. • Comp Run/Avail. Number of compressors currently running and number of compressors available for Primary/Secondary temperature control. • Comp Demand and Demand. Cooling or Heating Demand value in number of requested compressors as well as continuous value in %. There is also a bar graph representation of Cooling or Heating Demand beside the % value.
11 - System ON/OFF	Button that calls up chiller on/off modes popup.  The chiller on/off options are as follows: • **OFF** – Turn off chiller bank. • **ON** – Turn on chiller bank. • **BMS** – Chiller bank is turned on/off by BMS. 
12 - Module Access	The module access buttons display the overview screen for each module. These buttons provide access to all chiller/heat pump modules screens individually. The number on the Mx button stands for the module number in the bank. Buttons are viewable (modules accessible) for modules that communicate to HMI only. 
13 - Date/Time	Current HMI date/time as set up in HMI system settings. 

Modules Layout Screen

The chiller/heat pump can be composed of up to a maximum of ten modules. Pressing the LAYOUT button displays the screen showing the status of compressors and valves in each module. See figure below.

Each module diagram is a set of symbols and colors that show the real-time status of the compressors, the refrigeration circuit, the isolation valves and the module overall. See figure below.

Figure 18. MWC modules layout screen – four compressors on four modules



Module Layout Screen Status Conditions

Each module picture is a set of images that show real-time color-coded state of compressor, refrigeration circuit, isolation valves and module.

Table 7. MWC Module status conditions

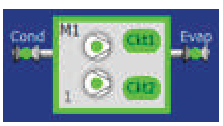
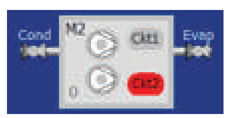
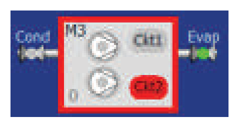
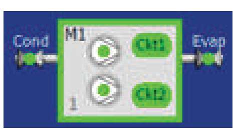
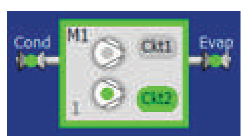
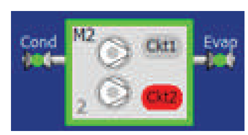
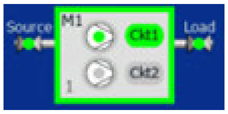
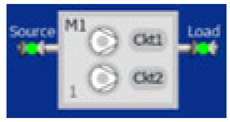
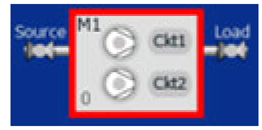
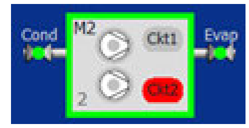
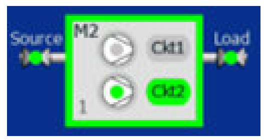
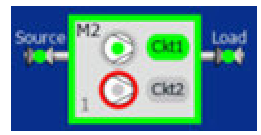
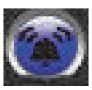
 Module is available	 Module is unavailable	 Module turned off by alarm and unavailable
 Refrigeration circuit in normal state; Compressor ON	 Refrigeration circuit is non-operational; Compressor OFF	 Refrigeration circuit in alarm state; Compressor OFF
 Isolation Valves: - Valve LED is green = valve is open - Valve LED is gray = valve is closed	 Compressor 1 is OFF; Compressor 2 is ON	 Compressor 1 is ON; Compressor 2 is in alarm

Table 8. WXM Module status conditions

 Module is available	 Module is unavailable	 Module turned off by alarm and unavailable
 Refrigeration circuit in normal state; Compressor ON	 Refrigeration circuit is non-operational; Compressor OFF	 Refrigeration circuit in alarm state; Compressor OFF
 Isolation Valves: - Valve LED is green = valve is open - Valve LED is gray = valve is closed	 Compressor 1 is OFF; Compressor 2 is ON	 Compressor 1 is ON; Compressor 2 is in alarm

Active Alarms Screen



The active alarms screen lists all active (triggered) and non-active alarms in tabular form. See following figure.

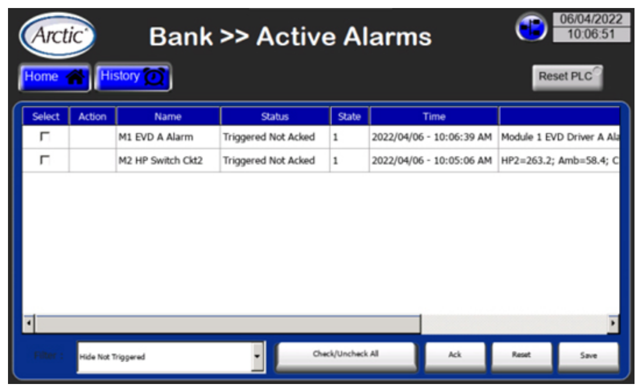
Information presented in this screen in tabular form includes:

- Alarm is considered 'Active' (Triggered) if 'Source Value' = 1, other words it's still active in the PLC.
- If alarm is 'Not Active' (Not Triggered), its 'Source Value' = 0 and it can be reset using Reset button.
- Both 'Active' and 'Not Active' alarms can be acknowledged. When 'Not Active' alarm is acknowledged, it can be reset, which will remove it from the list, to show only 'Active' alarms in the list.

Select

This column indicates if the alarm is selected or deselected for acknowledgment or resetting.

Figure 19. Active alarms for the chiller/heat pump



Name

This column gives alarm name.

Action

This column gives alarm details if applicable.

Status

This column displays the alarm state. There are five possible states for any alarm:

1. Triggered Not Acked – Alarm triggered (active) but not acknowledged
2. Triggered Acked – Alarm triggered (still active) and has been acknowledged
3. Not Triggered Not Acked – Alarm no longer appears (inactive) but not acknowledged
4. Not Triggered Acked – Alarm no longer appears (inactive) and acknowledged

5. Not Triggered – Alarm no longer appears (inactive), acknowledged, and reset (removed from Active Alarms list)

State

Alarm is considered “Active” (Triggered) if State Value = 1 (still active in the PLC).

If alarm is “Not Active” (Not Triggered), its State Value = 0 (can be reset using Reset button).

Both Active and Non Active alarms can be acknowledged. When a Non Active alarm is acknowledged, it can be reset which will remove it from the list, to show only Active alarms in the list

Time

This column is the date-time stamp indicating exactly when the alarm occurred.

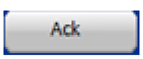
Description

This column provides alarm description or for certain alarms, snapshots of module parameters values.

Check/Uncheck All

This button is used for selecting and deselecting all listed alarms with a single action.

Ack

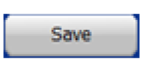


Pressing this button acknowledges the alarm and removes it from the active alarms list.

Reset PLC

This button is used to reset active alarms in the PLC, so they could be further acknowledged/reset on the HMI.

Save



Pressing this button saves the changes made to the active alarms list. Any changes that are made without saving will be lost.

Alarm History

On the active alarms screen, pressing the alarm history button displays the alarm history screen.

The alarm history screen displays the history of alarms recorded by the primary microprocessor. See the following figure.

Figure 20. Alarm history

Sorting

The alarm history list can be sorted by any column in ascending or descending order by tapping the corresponding column heading. The triangle that appears next to the heading indicates which column is being sorted and the direction of sorting.

Sorting is applied to the alarm time column in ascending order by default, which is indicated when the triangle is pointing up. Ascending order for the alarm time column requires that earlier records appear on the list first. For all other columns, alphabetical sorting applies.
History Alarms CSV Export – Generates history alarms log as CSV file that can be stored.

Duration

Allows the selection of the time period for which the alarm history is displayed. Once the selection is made from the drop-down menu, pressing the REFRESH button updates the list and then ‘From’ and ‘To’ timestamps get updated accordingly.

Time

This is the time stamp that is displayed when the alarm state was changed.

Name

This column gives alarm name.

Status

This column displays the alarm state. There are five possible states for any alarm:

1. Triggered Not Acked – Alarm triggered (active) but not acknowledged
2. Triggered Acked – Alarm triggered (still active) and has been acknowledged
3. Not Triggered Not Acked – Alarm no longer appears (inactive) but not acknowledged

4. Not Triggered Acked – Alarm no longer appears (inactive) and acknowledged
5. Not Triggered – Alarm no longer appears (inactive), acknowledged, and reset (removed from Active Alarms list)

State

Alarm is considered “Active” (Triggered) if State Value = 1 (still active in the PLC)

If alarm is “Not Active” (Not Triggered), its State Value = 0 (can be reset using Reset button)

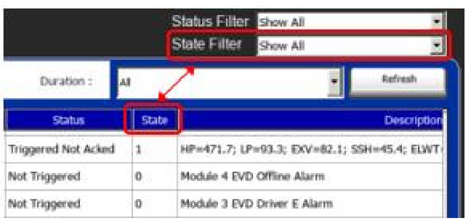
Both Active and Non Active alarms can be acknowledged. When a Non Active alarm is acknowledged, it can be reset which will remove it from the list so only Active alarms will remain on the list.

Description

This column provides alarm description or for certain alarms, snapshots of module parameters values.

Alarms Filtering

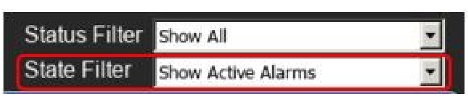
‘State Filter’ applies to **‘Alarm State’**.



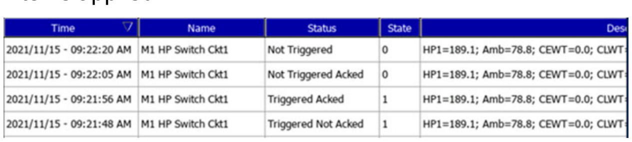
Alarm State ‘0’ – Alarm is inactive.

Alarm State ‘1’ – Alarm is active (even if it has been acknowledged).

When Show Active Alarms is selected from the State Filter drop-down list, inactive alarms (State = ‘0’) will be hidden on the list, and only active alarms (State = “1”) will appear.

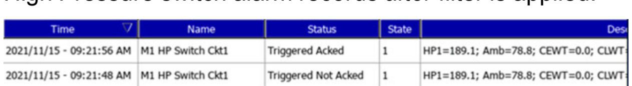


For example: High Pressure switch alarm records *before* filter is applied.



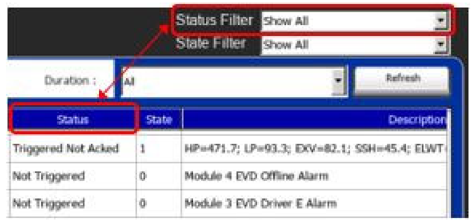
Time	Name	Status	State	Des
2021/11/15 - 09:22:20 AM	M1 HP Switch Ckt1	Not Triggered	0	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT
2021/11/15 - 09:22:05 AM	M1 HP Switch Ckt1	Not Triggered Acked	0	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT
2021/11/15 - 09:21:56 AM	M1 HP Switch Ckt1	Triggered Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT
2021/11/15 - 09:21:48 AM	M1 HP Switch Ckt1	Triggered Not Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT

High Pressure switch alarm records *after* filter is applied.



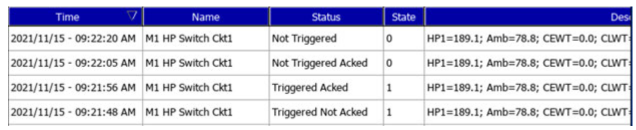
Time	Name	Status	State	Des
2021/11/15 - 09:21:56 AM	M1 HP Switch Ckt1	Triggered Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT
2021/11/15 - 09:21:48 AM	M1 HP Switch Ckt1	Triggered Not Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT

‘Status Filter’ applies to **‘Alarm Status’**.



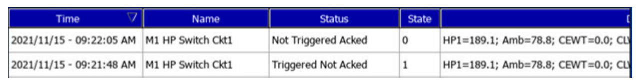
When Show Alarm Event is selected from the Status Filter drop-down list, any non-alarm events pertaining to user action (acknowledgement and reset) is filtered off the list. Only alarm-related events appear.

For example: High Pressure switch alarm records *before* filter is applied.



Time	Name	Status	State	Des
2021/11/15 - 09:22:20 AM	M1 HP Switch Ckt1	Not Triggered	0	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT
2021/11/15 - 09:22:05 AM	M1 HP Switch Ckt1	Not Triggered Acked	0	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT
2021/11/15 - 09:21:56 AM	M1 HP Switch Ckt1	Triggered Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT
2021/11/15 - 09:21:48 AM	M1 HP Switch Ckt1	Triggered Not Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; CLWT

High Pressure switch alarm records *after* filter is applied.

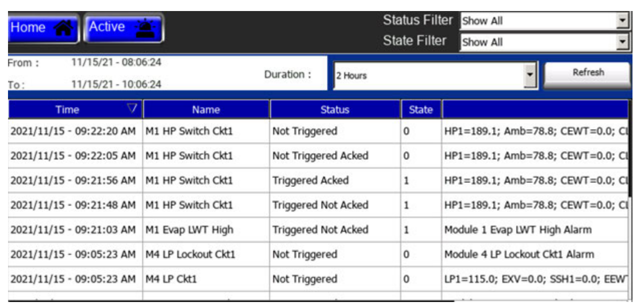


Time	Name	Status	State	
2021/11/15 - 09:22:05 AM	M1 HP Switch Ckt1	Not Triggered Acked	0	HP1=189.1; Amb=78.8; CEWT=0.0; CL
2021/11/15 - 09:21:48 AM	M1 HP Switch Ckt1	Triggered Not Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; CL

Combining both **‘State Filter’** and **‘Status Filter’** can enhance alarms viewing even more.

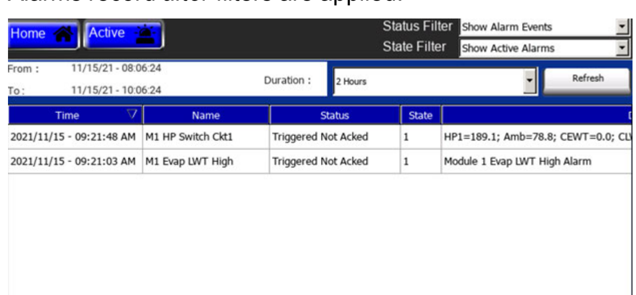
For instance, one needs to view only events when alarms occurred and hide all other ones (aka one alarm event for each alarm).

For example: Alarms record *before* filters are applied.



Time	Name	Status	State	
2021/11/15 - 09:22:20 AM	M1 HP Switch Ckt1	Not Triggered	0	HP1=189.1; Amb=78.8; CEWT=0.0; Cl
2021/11/15 - 09:22:05 AM	M1 HP Switch Ckt1	Not Triggered Acked	0	HP1=189.1; Amb=78.8; CEWT=0.0; Cl
2021/11/15 - 09:21:56 AM	M1 HP Switch Ckt1	Triggered Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; Cl
2021/11/15 - 09:21:48 AM	M1 HP Switch Ckt1	Triggered Not Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; Cl
2021/11/15 - 09:21:03 AM	M1 Evap LWT High	Triggered Not Acked	1	Module 1 Evap LWT High Alarm
2021/11/15 - 09:05:23 AM	M4 LP Lockout Ckt1	Not Triggered	0	Module 4 LP Lockout Ckt1 Alarm
2021/11/15 - 09:05:23 AM	M4 LP Ckt1	Not Triggered	0	LP1=115.0; EXV=0.0; SSH1=0.0; EEW

Alarms record *after* filters are applied.



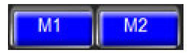
Time	Name	Status	State	
2021/11/15 - 09:21:48 AM	M1 HP Switch Ckt1	Triggered Not Acked	1	HP1=189.1; Amb=78.8; CEWT=0.0; CL
2021/11/15 - 09:21:03 AM	M1 Evap LWT High	Triggered Not Acked	1	Module 1 Evap LWT High Alarm

Module Access

Buttons to access all chiller/heat pump modules screens individually. Number on the button “M(X)” stands for the module number in the bank. Buttons are viewable (modules accessible) for modules that communicate to HMI only. Each module menu includes the following set of screens.

- Overview - overview of main chiller/heat pump module refrigeration parameters and status of its components — refrigeration circuit, heat exchangers, compressors, and module itself.
- I/O - state and description of module PLC digital/analog inputs and outputs including expansion IO (Inputs Outputs) module.
- Trend - trending curves for Cooling or Heating Demand are displayed.
- Setup - setup screens contain all the chiller/heat pump settings applied to system and is available for primary module as well as module settings. All setup screens are available for ‘admin’ user only.

Overview Module Screen



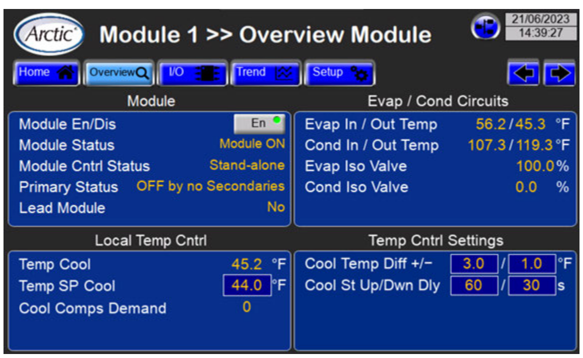
Each module controlled by the microprocessor controller has its own module screen within which the operator can monitor and maintain conditions affecting that module. Primary module access is made through the system control screen containing multiple controls and indicators:

On the home screen, pressing the **M1** button displays the Module #1 (primary module) overview 1 screen.

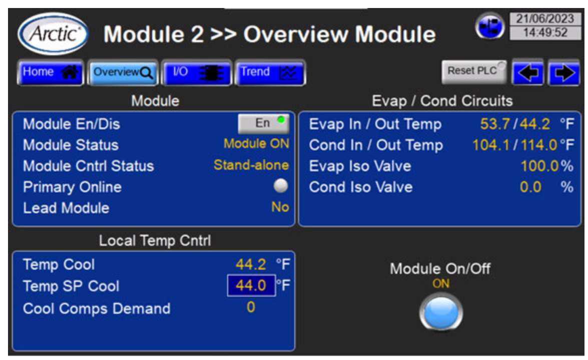
The overview menu is comprised of two screens:

Overview Module (primary and secondary) and Overview Circuits. Use the left and right scrolling buttons to scroll through the overview screens.

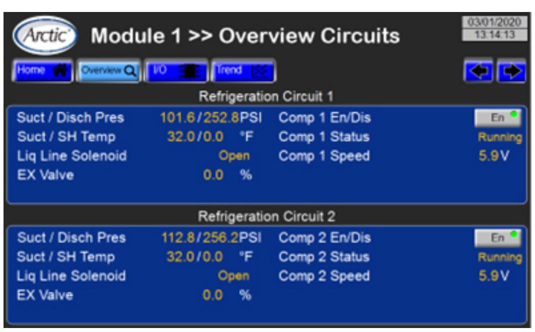
Table 9. The overview screens (MWC)



MWC – Primary Overview Module Screen

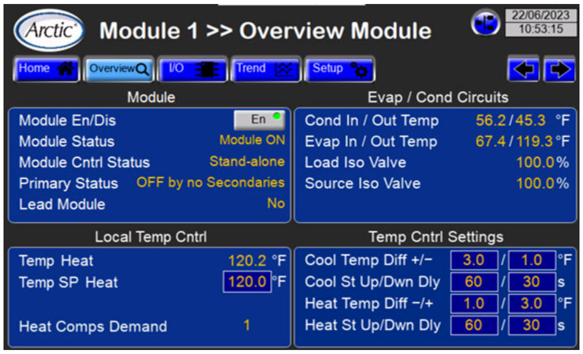


MWC – Secondary Overview Module Screen

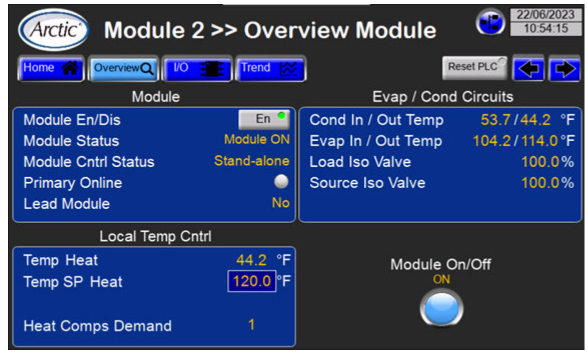


MWC – Primary/Secondary Overview Circuit Screen

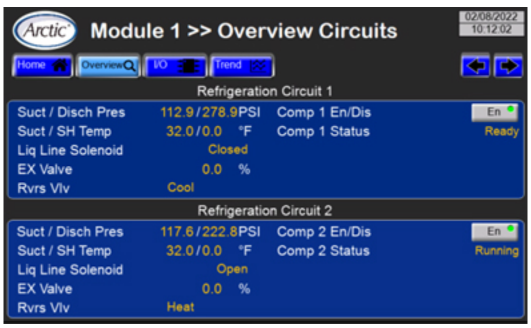
Table 10. The overview screens (WXM)



WXM – Primary Overview Module Screen



WXM – Secondary Overview Module Screen



WXM – Primary/Secondary Overview Circuit Screen

Overview Module

Module En/Dis

Pressing this button enables or disables a module. It is used for testing and maintenance purposes. If module is disabled, it is excluded from primary control compressors sequence. Not accessible for 'user.'

Module Status

Possible options:

- Module ON - Module is ready to run.
- OFF by DI - Module is off by opened state of PLC DI1.
- OFF by Switch - Module is off by Module En/Dis button.
- OFF by Alarm - Module is locked out by one of the major alarms.
- OFF by Primary - Module is switching between control states Primary/Secondary/Stand-alone.
- OFF by System - Module is off by one of the System Off conditions.
- OFF by switching to Cooling - Module is switching over to Cooling Mode.
- OFF by switching to Heating - Module is switching over to Heating Mode.
- OFF by switching Mode - Module is off and is going through a change of a major parameter. For instance, number of refrigeration circuits, number of fan banks etc.
- Refrigeration Evacuation Cycle - Module is running Refrigeration Evacuation Cycle.

  Note: *Applies only to MWC.*
- Cooling Limited - Cooling restricted on Heat Recovery units.

  Note: *Applies only to MWC.*

Module Cntrl Status

Possible options:

- Primary - Module acts as a primary module. Primary module performs temperature control for either heating or cooling loads. It also acts as a Supervisor when communicating with secondary modules and defines how many modules need to run its compressors in order to satisfy heating or cooling controlled temperatures.
- Secondary - Module acts as a secondary module. Conditions for the module to be a secondary module:
  – Its PLC has been assigned IP address from secondaries addresses range.
  – It is communicating with primary module.
  – Primary module exists on the network, in other words Primary PLC meets primary module conditions (see Primary Status below).
  – Stand-alone. Module does not meet either primary module or secondary module conditions.

Primary Status

Applies to primary PLC only. Possible options:

- Primary ON - All primary modules conditions are satisfied by module.
- Waiting - All primary modules conditions are satisfied and module is counting down a delay before acquiring primary ON status.
- OFF by Sensor - System cooling or heating temperature sensor failed.
- OFF by no secondary - Primary PLC communicates with no secondary modules.

Note: *Master Status states 3 or 4 will cause all the modules to run in Stand-alone mode. These failing conditions are false at normal primary/secondary operation.*

Primary Online

Applies to secondary PLC only. Possible options:

- LED is green - secondary PLC is communicating with primary PLC.
- LED is gray - secondary PLC is not communicating with primary PLC.

Lead Module

Indicates which module is currently a lead module in the bank.

Evap/Cond Circuits

Displays Evaporator inlet and outlet temperatures and an opening status of Evaporator Isolation Valves as well as Ambient Temperature.

Local Temp Cntrl

Applies only if module is running in stand-alone mode.

- Temp Cool/Heat - Local module hot or chilled water temperature control sensor.
- Temp SP Cool/Heat - Local module heating or cooling temperature control setpoint. Can be adjusted by **tech** user only.
- Cool/Heat Comps Demand - Cooling or Heating Demand value in number of requested compressors.

Temp Cntrl Settings

Viewable/adjustable for 'tech' user only.

- Cool Temp Diff +/- – Temperature control differential above/below setpoint or positive/negative dead band (DB) in Cooling Mode.
- Heat Temp Diff +/- – Temperature control differential below/above setpoint or positive/negative dead band (DB) in Heating Mode.

Note: *Both of them define the temperature control DB.*

- Cool St Up/Dwn Dly – When next compressor has been staged up/down, this delay has to elapse before next compressor is allowed to stage up/down in Cooling Mode.
- Heat St Up/Dwn Dly – When next compressor has been staged up/down, this delay has to elapse before next compressor is allowed to stage up/down in Heating Mode.

On/Off Button

Used to turn secondary PLC module on/off in Stand-alone Mode. For primary PLC module, On/Off Button on the Home Screen serves the same purpose.

Overview Circuits

Refrigerant temperatures/pressures are displayed: suction pressure; discharge pressure; suction temperature; suction super heat temperature.

Suct/Disch Pres and Suct/SH Temp

Refrigerant temperatures and pressures are displayed: suction pressure, discharge pressure, suction temperature, and suction super heat temperature.

Liq Line Solenoid

Status of the solenoid valve installed on the liquid line pipe.

EX Valve

Indicates the position of electronic expansion valve, if installed.

Comp (X) En/Dis

Compressor enable/disable button.

Evac Cycle (MWC)

Enable/disable evacuation cycle for the circuit – Available for ‘tech’ user only.

Comp (X) Status

- Comp OFF - Compressor is off and cannott be turned on.
- Ready - Compressor is off but can be turned on.
- OFF by Cond/Source Flow - Compressor has been called to run but waiting for Condenser Flow proof
- OFF by Evap/Load Flow - Compressor has been called to run but waiting for Evaporator Flow proof.
- OFF by Min Off - Compressor is cycling through safety Minimum Off Time.
- OFF by Switch - Compressor is off by En/Dis Switch.
- OFF by Alarm - Compressor is off by Alarm.
- Running - Compressor is running.
- ON by Min On - Compressor has been called off although it keeps running due to safety Minimum On Time.
- Start Delayed - Waiting for EXV positioning (if applicable) or going through second compressor start-up delay.
- Capacity Restricted - Module capacity restricted to a single running compressor only due to Low Chilled Leaving Water Temperature.

- OFF by Min DP - Compressor is off due to inability to build up satisfactory Suction/Discharge differential pressure.
- OFF by Low Ambient - Compressor can not start due to Low Ambient temperature restriction.

  Note: *Applies only to MWC.*
- Refrigeration Evacuation Cycle - Circuit is running Refrigeration Evacuation Cycle.

  Note: *Applies only to MWC.*

Comp (X) Speed

Can be displayed in different units.

- Volts - If PLC analog output is used to control variable speed compressor.
- RPM - Compressor speed is communicated to external variable speed drive, for instance VFD.

Rvrs Vlv (WXM)

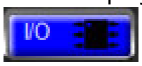
Reversing Valve position.

- Cool – module/circuit running in cooling mode or defrost cycle or compressor is off (default reversing valve position).
- Heat – module/circuit running in heating mode.

Module I/O Screens

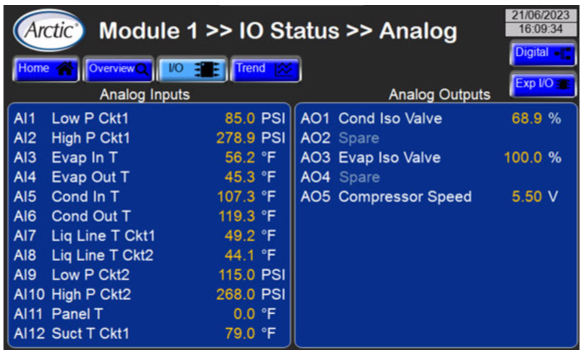
Data is collected by sensors as either analog or digital signals and displayed on the IO Status screens.

When the module screen is displayed, pressing the I/O button displays the I/O menu.

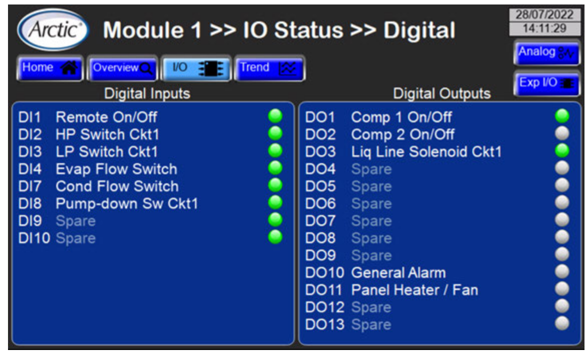


The I/O menu is comprised of four screens. Both primary and secondary modules have analog I/O (analog input and analog output) and digital I/O (digital input and digital output). The third screen, Expansion #1, applies to the primary and secondary module. The fourth screen, Expansion #2, applies only to the primary module.

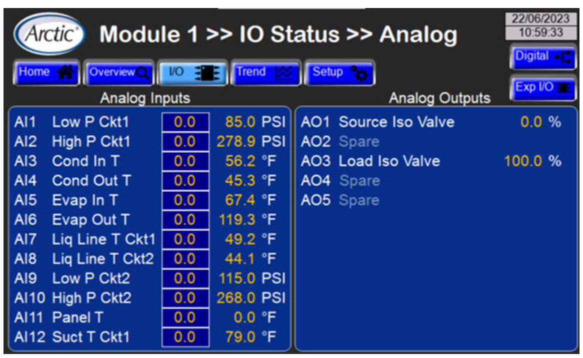
Table 11. Analog and digital input/output screens



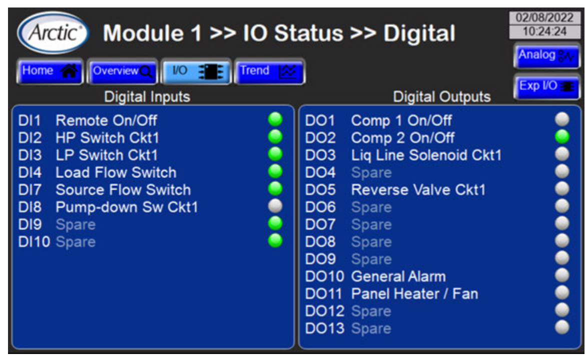
MWC – Primary/Secondary Analog I/O Screen



MWC – Primary/Secondary Digital I/O Screen



WXM – Primary/Secondary Analog I/O Screen



WXM – Primary/Secondary Digital I/O Screen

When an I/O screen is displayed, switching to other I/O screens is accomplished by pressing their respective buttons:

- The ANALOG button displays the analog screen.
- The DIGITAL button displays the digital screen.

Digital LEDs

There is an LED for each digital input that indicates its current state. For all inputs, the color of the LED signifies its current state:

Green LED — This input is energized; the connected device is closed.

Gray LED — This input is de-energized; the connected device is open.

MWC Analog Inputs

Analog input (AI) data includes these parameters:

AI1

This input indicates Suction Pressure Circuit 1.

AI2

This input indicates Discharge Pressure Circuit 1.

AI3, AI4

These inputs indicate the evaporator inlet or outlet temperatures.

AI5, AI6

These inputs indicate the condenser inlet or outlet temperatures.

AI7

This input indicates Liquid Line Temperature Circuit 1.

AI8

This input indicates Liquid Line Temperature Circuit 2.

AI9

This input indicates Suction Pressure Circuit 2.

AI10

This input indicates Discharge Pressure Circuit 2.

AI11

This input indicates the panel temperature (optional). This applies to heating mode. It is used when temperature control inside control panel is required either heating (for cold environment) or cooling (for hot environment).

AI12

This input indicates the Suction Temperature Circuit 1.

WXM Analog Inputs

Analog input (AI) data includes these parameters:

AI1

This input indicates Suction Pressure circuit 1.

AI2

This input indicates Discharge Pressure circuit 1.

AI3, AI4, AI5, AI6

These inputs indicate the evaporator/condenser inlet and outlet temperatures depending on the cooling/heating mode.

AI7, AI8

These inputs indicate Liquid Line Temperature Circuit 1/ Circuit 2.

AI9

This input indicates Suction Pressure Circuit 2.

AI10

This input indicates Discharge Pressure Circuit 2.

AI11

This input indicates the panel temperature (optional). This applies to heating mode. It is used when temperature control inside control panel is required either heating (for cold environment) or cooling (for hot environment).

AI12

This input indicates the Suction Temperature Circuit 1.

MWC Analog Outputs

Analog output (AO) data includes these parameters:

AO1

This output indicates condenser isolation valve position.

AO3

This output indicates the evaporators isolation valve position.

AO5

This output indicates the variable speed compressors hard-wired control signal.

WXM Analog Outputs

Analog output (AO) data includes these parameters:

AO1

This output indicates source isolation valve position.

AO3

This output indicates load isolation valve position.

AO5

This output indicates Variable speed compressor hard-wired control signal (if applicable).

MWC Digital Inputs

Digital input (DI) data includes these parameters:

DI1

Remote On/Off – Used to turn module on/off via input. For Primary Module toggling DI1 will turn on/off the entire chiller if respective option selected.

DI2, DI3

These inputs indicate the Discharge/Suction Pressure switches of Circuit 1. DI closed - pressure is in the normal range; DI opened - pressure is exceeding normal range threshold (faulty state).

DI4

This input shows the state of Evaporator flow switch. DI closed - flow present; DI opened - flow absent.

DI7

This input shows the state of Condenser flow switch. DI closed - flow present; DI opened - flow absent.

DI8

This input shows the Pump-down pressure switch of Circuit 1. DI closed - pressure is in the normal range; DI opened - pressure is exceeding normal range threshold (faulty state).

WXM Digital Inputs

Digital input (DI) data includes these parameters:

DI1

Remote On/Off – Used to turn module on/off via input. For Primary Module toggling DI1 will turn on/off the entire chiller if respective option selected.

DI2, DI3

These inputs indicate the Discharge/Suction Pressure switches of Circuit 1. DI closed - pressure is in the normal range; DI opened - pressure is exceeding normal range threshold (faulty state).

DI4

This input shows the state of Load flow switch. DI closed - flow present; DI opened - flow absent.

DI7

This input shows the state of the Source flow switch. DI closed- flow present; DI opened - flow absent.

DI8

This input shows the Pump-down pressure switch of Circuit 1. DI closed - pressure is in the normal range; DI opened - pressure is exceeding normal range threshold (faulty state).

MWC Digital Outputs

There is an LED for each digital output which shows its current state.

DO1, DO2

Comp On/Off – this output turns a compressor on and off.

DO3

Liq Line Solenoid – this output energizes and de-energizes the liquid line solenoid valve.

DO10

General Alarm – this output energizes when any of the following alarms occur:

- An alarm that shuts down and locks out compressor 1 or 2.
- An alarm that shuts down and locks out the entire module.

DO11

Panel Heater/Fan (optional) – this output is used when temperature control inside control panel is required.

WXM Digital Outputs

There is an LED for each digital output which shows its current state.

DO1, DO2

Comp On/Off – this output turns a compressor on and off.

DO3

Liq Line Solenoid – this output energizes and de-energizes the liquid line solenoid valve.

DO5

Reversing Valve – this output energizes and de-energizes reversing valve on Circuit 1.

DO10

General Alarm – this output energizes when any of the following alarms occur:

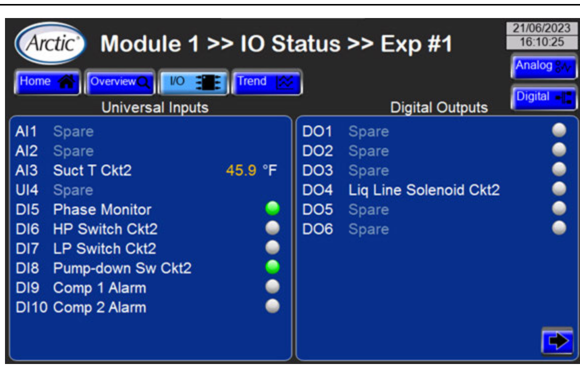
- An alarm that shuts down and locks out compressor 1 or 2.
- An alarm that shuts down and locks out the entire module.

DO11

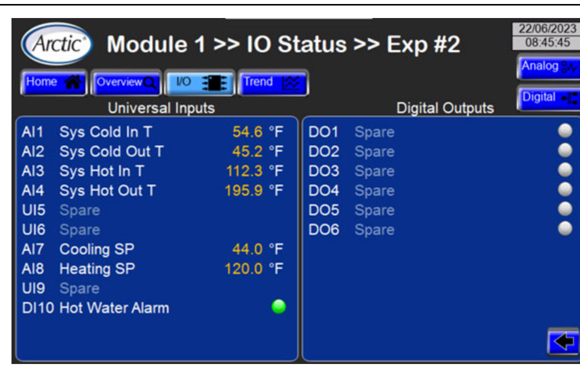
Panel Heater/Fan (optional) – this output is used when temperature control inside control panel is required.

MWC Expansion I/O Screens

Table 12. Expansion input/output screens (MWC)



MWC Primary Expansion I/O Screen#1



MWC Primary Expansion I/O Screen#2

These screens are only applicable to the primary module. The screens control analog inputs and digital requests.

Screen #1

A13

This input indicates Suction Temperature Circuit 2.

DI5

Phase Monitor – Chiller three phase power supply protection module feedback. DI closed – no power supply issues; DI opened – power supply failure has been detected. If common power supply protection module is used for the chiller, its failure will affect each module. In such a case this DI is optional for Secondary Module.

DI6, DI7

These inputs show Discharge/Suction Pressure switches of Circuit 2. DI closed – pressure is in the normal range; DI opened – pressure is exceeding normal range threshold (faulty state).

DI8

This input shows Pump-down pressure switch of Circuit 2. DI closed – pressure is in the normal range; DI opened – pressure is exceeding normal range threshold (faulty state).

DI9

This input shows Compressor 1 External Alarm. DI closed – no alarm. DI open – compressor in alarm.

DI10

This input shows Compressor 2 External Alarm.

DO4

This output indicates Liq Line Solenoid Circuit 2. It energizes/deenergizes liquid line solenoid valve.

Screen #2

AI1, AI2

These inputs show the System Chilled Entering and Leaving Water Temperature. Applies to Cooling Mode.

AI3, AI4

These inputs show the System Hot Entering and Leaving Water Temperature. Applies to Heating Mode.

AI7, AI8

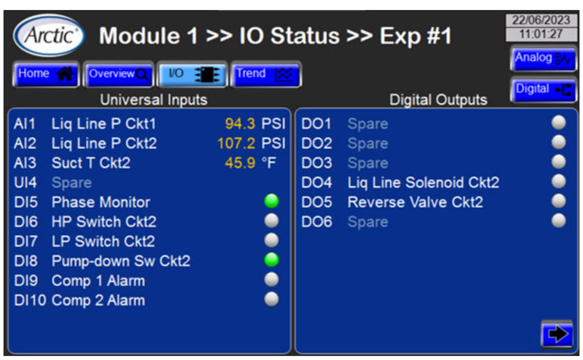
These inputs indicate Remote Cooling/Heating Setpoint.

DI10

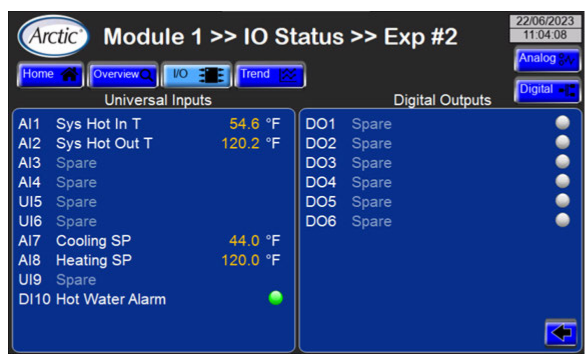
This input shows the Hot Water cutout. Shuts down the whole chiller bank if hot water temperature becomes too high.

WXM Expansion I/O Screens

Table 13. Expansion input/output screens (WXM)



WXM Primary Expansion I/O Screen#1



WXM Primary Expansion I/O Screen#2

These screens are only applicable to the primary module. The screens control analog inputs and digital requests.

Screen #1

AI1, AI2

These inputs show the Liquid Line Pressure Circuit 1/2.

AI3

This input shows the Suction Temperature Circuit 2.

DI5

Phase Monitor – Chiller three phase power supply protection module feedback. DI closed – no power supply issues; DI opened – power supply failure has been detected. If common power supply protection module is used for the chiller, its failure will affect each module. In such a case this DI is optional for Secondary Module.

DI6, DI7

These inputs show the Discharge/Suction Pressure switches of Circuit 2. DI closed – pressure is in the normal range; DI opened – pressure is exceeding normal range threshold (faulty state).

DI8

This input shows the Pump-down pressure switch of Circuit 2. DI closed – pressure is in the normal range; DI opened – pressure is exceeding normal range threshold (faulty state).

DI9

This input shows the Compressor 1 External Alarm. DI closed – no alarm. DI open – compressor in alarm.

DI10

This input shows the Compressor 2 External Alarm.

DO4

This output indicates Liq Line Solenoid Circuit 2. It energizes/deenergizes liquid line solenoid valve.

DO5

This output indicates the Reversing Valve Circuit 2.

Screen #2

AI1, AI2

These inputs show the System Chilled/Hot Entering/Leaving Water Temperature. Depending on the cooling/heating mode.

AI7, AI8

These inputs show the Remote Cooling/Heating Setpoint.

DI10

This input shows the Hot Water cutout. Shuts down the whole chiller bank if hot water temperature becomes too high.

Trend Screen

When on the primary module screen, pressing the trend button displays the trend screen. There are two trend screens: cooling and heating.

Each trend screen displays three trends: Controlled Inlet Water Temperature, Controlled Outlet Water Temperature, and Module Demand in %.

Trends can be viewed in real time and for the last two days. Each variable is trended every 3 seconds. Trending data is stored on HMI internal memory.

Apart from displaying trends, Module Trend Screen has controls for viewing, scrolling, zooming, deleting trends etc.

Figure 21. Module trend screen

Table 14. Trend screen labels

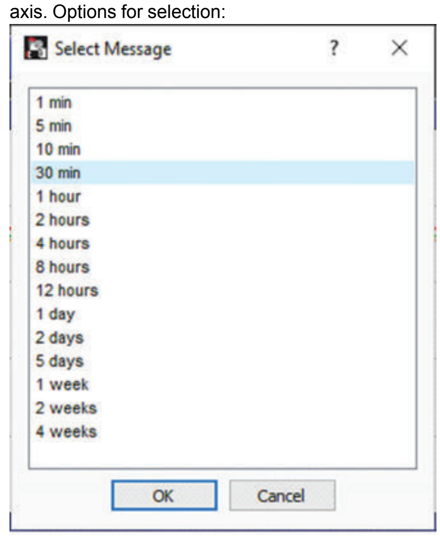
Label	Description
1	According to where the cursor is placed, it is capturing real time values of in and out water temperatures. Current cursor timestamps are displayed as well.
2	Text box to select viewing time span. It is used for zooming in on trends time axis. Options for selection: 

Table 14. Trend screen labels (continued)

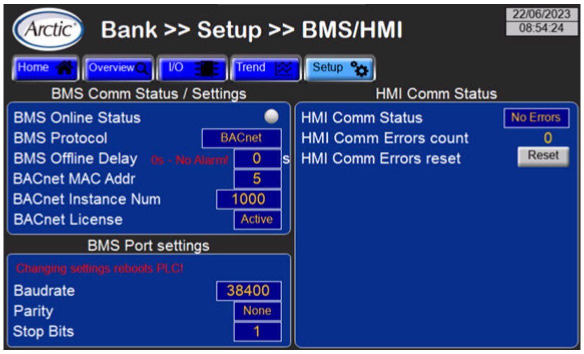
Label	Description
3	Maximum and Minimum thresholds for trends viewing. Used for zooming in on trends variables axis. Both Maximum and Minimum thresholds are adjustable via respective numeric boxes. Default Min/Max values: –10.0/160.0.. Default Span button is used to revert to defaults to reset longitudinal zooming.
4	Scroll to Time button is used to return to real time viewing.
5	Cursor positioning buttons.
6	Buttons used to scroll back and forth in time. They implement time axis trends pages scrolling.
7	Buttons used to scroll back and forth in time. High resolution time axis scrolling.
8	Button used to pause/resume real-time trending.

Setup Screen

Note: *Available for tech user only.*

When on Overview Module screen, press Setup button to go to BMS Communication Setup screen.

Figure 22. BMS Communication Setup Screen



Feature	Description
BMS Online Status	Indicates whether BMS is communicating to chiller bank or not.
BMS Protocol	Allows to select BMS communication type. The options are: • None – BMS communication disabled • BACnet – BACnet MSTP or BACnet IP BMS communication used • Modbus/Lon – Modbus RTU, Modbus IP or LonWorks BMS communication used ***Note:*** *BACnet IP, Modbus IP or LonWorks require a use of external router/gateway to implement communication channel.*
BMS Offline Delay	If BMS is not communicating to chiller bank for longer than this delay, BMS communication alarm is raised. If setting = 0, BMS communication alarm is disabled.
BACnet MAC Addr	Chiller BACnet MAC address for BACnet MSTP BMS communication.
BACnet Instance Num	Chiller BACnet Instance Number for BACnet MSTP or BACnet IP BMS communication.
BACnet License	Indicates if BACnet license has been activated on the chiller. ***Note:*** *BACnet license has to be activated on chiller bank Primary PLC in order to enable BACnet IP or BACnet MSTP BMS communication.*
Baudrate	BMS communication speed in bits/ second.

Feature	Description
Parity	BMS communication frames parity. The options are: • None • Odd • Even
Stop Bits	Number of BMS communication frames stop bits: 1 or 2
HMI Comm Status	No Errors – HMI communicating to module PLCs with no errors; Comm Error – at least a single communication error occurred.
HMI Comm Errors count	Number of occurred HMI communication errors.
HMI Comm Errors reset	Resets number of communication errors to ‘0’.

Operator Tasks

Before operating the unit, ensure that all compressor refrigeration service valves are fully back-seated counterclockwise.

Normal Power Up

The following procedure is used for a start-up resulting from scheduled seasonal or programmed cold shut down of the chiller/heat pump.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Important: *This start-up procedure is not to be used for the first-time initial start-up for a newly installed chiller/heat pump. See Preparation for Initial Start-Up in the Installation section of this manual for instructions regarding that situation.*

1. De-energize the chiller/heat pump using standard lockout/tagout procedures.
2. Using a known operational voltage meter, test and confirm the chiller/heat pump is de-energized before proceeding further.
3. Inspect power distribution fuses and overload settings to verify they are correct.
4. Verify that the oil level is correct in each compressor using the compressor sight glass.

Note: *See recommended inspection interval in the maintenance section of this manual.*

NOTICE

Compressor Failure!

Failure to follow instructions below could result in catastrophic compressor failure.
Do not operate with insufficient oil.

5. Verify that pressure and temperature switches are closed.
6. Restore power to all modules.
7. Inspect refrigerant pressures for each module using the touchscreen interface panel.
8. Verify that pressure switches and thermostats have the correct cut-in and cut-out settings using the touchscreen interface panel.
9. Verify chiller/heat pump water flow to condenser and evaporator.
10. Monitor and record temperature and refrigerant pressures registering on the touchscreen interface panel.

Emergency Power Shutdown

The chiller/heat pump does not include a disconnect to turn off the high voltage to the modules. As per NFPA 70, The National Electrical Code, a disconnect must be installed within the line of sight of the electrical and control panel. Should an emergency condition arise, the disconnect must be opened to shut down all voltage to the chiller/heat pump.

There are several ways to interrupt power to all or part of the chiller/heat pump:

- Disconnect the primary power source from the building that feeds electricity to the chiller/heat pump. This occurs in sudden emergencies (usually weather-related) or planned maintenance shut-downs.
- Press the panel disconnect switch on the exterior door of the chiller/heat pump's main power distribution panel, if so equipped.
- Move the circuit breaker switch to the OFF position (CB-1 and CB-2) on the power distribution panel. This cuts power to all of the chiller/heat pump modules.
- Move the circuit breaker switch to the OFF position (CB-1 and CB-2) on a module's electrical and control panel. This cuts power to the compressors in a single module. It does not cut power to electrical and control panel or other chiller/heat pump modules.
- Press the SYSTEM ON button on the touchscreen interface panel that is built into the power distribution panel door.

Note: *Pressing the ON-OFF button on the touchscreen interface panel does not de-energize the chiller/heat pump or the high voltage current into each module's electrical and control panel. This action sends a command to the controller in each module's compressors to discontinue electrical current to that component.*

Water Quality Guidelines

The chiller/heat pump is equipped with high efficiency compact brazed plate heat exchangers (BPHX). Water quality must be maintained periodically by the end user to avoid scaling and corrosion inside the heat exchangers.

Table 15. Water quality guidelines

Element/Compound/Property	Value/Unit
pH	7.5 - 9.0
Conductivity	< 500 µS/cm
Total Hardness	4.5 - 8.5 dH°
Free Chlorine	< 1.0 ppm
Ammonia (NH_3)	< 0.5 ppm
Sulphate (SO_4^{2-})	< 100 ppm
Hydrogen Carbonate (HCO_{3-}	60 – 200 ppm
(HCO_{3-})/(SO_4^{2-})	> 1.5
(Ca + Mg)/(HCO_{3-})	> 0.5
Chloride (Cl-)	< 200 ppm

Notes:

1. Total Hardness/corrosion: Water with high hardness can cause corrosion problems due to its high ion content (Ca+2, Mg+2, Fe+2) which also means a high electrical conductivity and a high total dissolved solid (TDS). For this reason, too high hardness values should be avoided, not only due to higher risk of scaling, but also for corrosion risk. On the other hand, soft water, but not necessarily cation exchange softened water, may in contrast have a low buffering capacity and so be more corrosive. If the hardness values are outside the recommended range, other parameters such as oxygen content, conductivity, and pH values should be considered to evaluate the corrosion risk
2. Fe3+ and Mn4+ are strong oxidants and may increase the risk for localized corrosion on stainless steels in combination with brazing material copper.

Monitor Water Quality

Maintaining water/glycol mixture quality and cleanliness is critical to chiller/heat pump maintainability. Strainers should be checked and cleaned on a regular basis. Water/glycol mixture samples should be taken and tested by a professional lab. The results will enable the accurate adjustment of quality thereby increasing the operational life of the chiller/heat pump.

Note: *Trane will not validate the chiller/heat pump warranty if the proper water/glycol mixture composition and quality is not maintained.*

Maintain Glycol Level

The temperature of the refrigerant in a brazed plate evaporator is not uniform throughout the heat exchanger. The refrigerant temperature is approximately 6 °F to 12 °F colder than the corresponding fluid temperature depending on many factors such as the heat exchanger design, glycol percentage, operating fluid temperatures, refrigerant, system flow rate, etc. When the chiller/heat pump has a set point that is within 12 °F (6.7 °C) of the freezing point of the water/glycol in use, take precautions against freezing. See Table below for the recommended glycol concentrations and performance impact.

Table 16. Glycol performance impact factors

Range Factor	Glycol Concentration Percentages and Performance Impact					
Propylene Glycol Concentration	30%		40%		50%	
Lowest Ambient Temperature	10 °F (-12 °C)		-4 °F (-20 °C)		-20 °F (-29 °C)	
Recommended Minimum Leaving Fluid Temperature	25 °F (-4 °C)		10 °F (-12 °C)		-10 °F (-23 °C)	
Leaving Temperature	Capacity Reduction Factor	Pressure Drop Factor	Capacity Reduction Factor	Pressure Drop Factor	Capacity Reduction Factor	Pressure Drop Factor
70 °F (21 °C)	0.96	1.27	0.93	1.43	0.91	1.63
60 °F (15.6 °C)	0.95	1.31	0.92	1.47	0.90	1.68
55 °F (13 °C)	0.95	1.31	0.92	1.50	0.89	1.73
50 °F (10 °C)	0.94	1.33	0.91	1.51	0.88	1.75

A 20% to 50% solution of glycol should be added to prevent pipe corrosion regardless of the fluid temperature. Propylene glycol has corrosion inhibitors that protect piping and components from corrosion and buildup of rust and other deposits. Trane recommends against using water/glycol solution in excess of 50% regardless of the ambient temperature conditions.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in permanent damage to pump and internal cooling surfaces.
Do not use automotive antifreeze.

Note: *If glycol-free solutions are mandated at the chiller/heat pump site, special inhibitors are available for rust prevention, mineral deposit inhibition, and biological suppression. Adding these inhibitors to the water solution is strongly recommended.*

Heaters, heat tracing cable, and closed cell insulation can be installed on any exposed “wet” chiller/heat pump components and tank and pump modules for protection against freezing in low ambient temperature and low refrigerant pressure conditions. However, the best freeze prevention is using the appropriate concentration of glycol. Trane does not warranty any component that fails due to freezing.

Prevent Freezing

Many liquids expand in volume upon cooling. This expansion may cause pipes and other enclosed systems containing a liquid to rupture or burst when exposed to low temperature conditions. Burst protection is needed to protect piping and other enclosed systems when they are inactive as they could rupture due to expansion during cold weather or low refrigerant pressure.

Freeze points and burst points of glycol-water solutions are shown in Table 17, p. 51.

In order to maintain a high quality glycol solution, the water used in the glycol mixture must have very few impurities. Impurities in the water can increase metal corrosion, aggravate pitting of cast iron and steel, reduce the effectiveness of the corrosion inhibitors, and increase the depletion rate of the inhibitor package.

To assure inhibitor effectiveness, the levels of chlorides and sulfates in the water should not exceed 25 ppm each. The total hardness in terms of calcium carbonate should be less than 100 ppm. For best long-term results, de-ionized or distilled water is recommended. Trane can provide concentrated solutions of Dowfrost, propylene glycol, or premixed solutions for use with the chiller/heat pump.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in permanent damage to pump and internal cooling surfaces.
Do not use automotive antifreeze.

Propylene Glycol

Glycol-based fluids provide such burst protection in water solutions due to their low freezing points. As a glycol-based fluid cools below the solutions freezing point, ice crystals begin to form, and the remaining solution becomes more concentrated in glycol. This ice/water/glycol mixture results in a flowable slush, and remains fluid, even as the temperature continues to cool.

The fluid volume increases as this slush forms and the temperature cools, flowing into available expansion volume in the chiller/heat pump. If the concentration of glycol is sufficient, no damage to the chiller/heat pump from fluid expansion should occur within the temperature range indicated in Figure 23, p. 51. When liquids are cooled they eventually either crystallize like ice or become increasingly viscous until they fail to flow and set up like glass. The first type of behavior represents true freezing. The second is known as super-cooling. Glycols do not have sharp freezing points. Under normal conditions, propylene glycol sets to a glass-like solid, rather than freezing.

The addition of glycol to water yields a solution with a freezing point below that of water. This has led to the extensive use of glycol-water solutions as cooling media at temperatures appreciably below the freezing point of water. Instead of having sharp freezing points, glycol-water solutions become slushy during freezing. As the temperature falls, the slush becomes more and more viscous and finally fails to flow.

Table 17. Freeze and burst protection chart

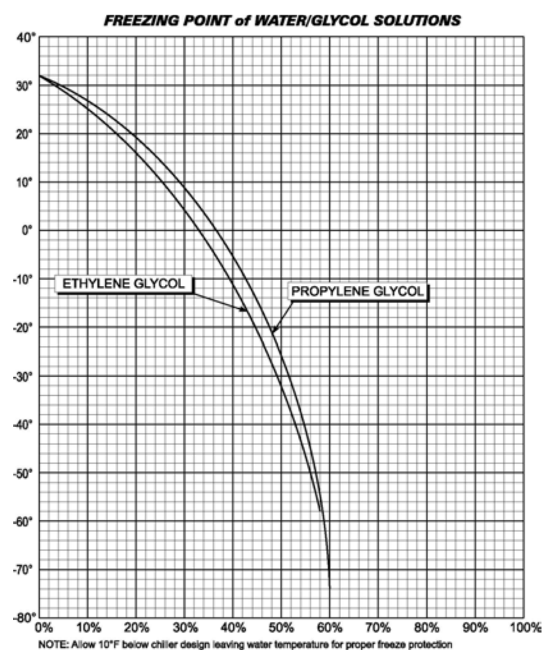
Water/Glycol Temperature	Freeze Protection	Burst Protection
20 °F (-7 °C)	18% glycol mixture	12% glycol mixture
10 °F (-12 °C)	29% glycol mixture	20% glycol mixture
0 °F (-17.8 °C)	36% glycol mixture	24% glycol mixture
-10 °F (-23 °C)	42% glycol mixture	28% glycol mixture
-20 °F (-29 °C)	46% glycol mixture	30% glycol mixture

The precise concentration of glycol for a particular chiller/heat pump is affected by several key factors such as ambient temperature extremes, entering and leaving water temperatures, and chiller/heat pump size. A chiller/heat pumps optimum glycol concentration is modified by these considerations as reflected in Table 16, p. 50. These capacity correction factors are the **best informed estimates** for chiller/heat pump with copper evaporators. The percentages may vary depending on the materials and alloys of the heat exchangers, total surface area, the amount of present or future fouling, and the brand of glycol used.

Storage Provisions

The chiller/heat pump controls are designed for storage in ambient temperatures from -20 °F (-29 °C) to 145 °F (63 ° C) with relative humidity from 0% to 100%. The glycol should be removed from the chiller/heat pump if the unit is to be stored for extended periods. Although fluids can be drained via the plug in the bottom of the evaporator, the inhibitors in an approved glycol solution will best protect the surfaces of the evaporator against oxidation if the glycol remains inside the chiller/heat pump during storage.

Figure 23. Water/Glycol concentration freezing points (in degrees fahrenheit)



Controls Interface

Microprocessor Control System

The Thermafit MWC and WXM chiller/heat pump models employ a Carel c.pCO all-digital data control system to control and report key system settings and indicators.

Primary Microprocessor Controller

Both the primary and secondary modules use a Carel c. pCO medium microprocessor controller. The primary microprocessor controller rotates the lead compressors every 168 system operating hours. See figure below.

Figure 24. c.pCO primary controller

Secondary Microprocessor Controller

In a normal configuration, a secondary controller controls the single module to which it is dedicated. The distributed primary microprocessor controller system enables the chiller/heat pump in the event the primary microprocessor controller fails. The system automatically fails over to distributed primary control where each secondary controller operates its own module but lacks the ability to rotate the lead compressors every 168 system operating hours.

Touchscreen Interface Panel

The touchscreen interface panel is the primary means for controlling and monitoring the system for the operator and maintainer. See figure below.

Figure 25. Touch interface panel

Operator Control and Monitoring

Each system is provided with a touchscreen interface panel that is used to turn the chiller/heat pump on and off, adjust set points, clear alarms, and perform detailed set-up of the microprocessor controllers.

Chiller/Heat Pump Control

The operator uses three different types of controls and indicators to monitor and maintain the desired operating parameters in the MWC and WXM chiller/heat pump - Power Distribution, Electrical Controls, and Refrigeration Controls. These controls and indicators are located in the power panels and the microprocessor controllers.

Power Distribution

There are two different electrical panels used in the Thermafit MWC and WXM chiller/heat pump. The main power distribution panel receives power from the building source and distributes it to the individual chiller/heat pump modules. The module electrical and control panel receives power from the power distribution panel and provides power to individual electrical components.

⚠ WARNING

Hazardous Voltage!

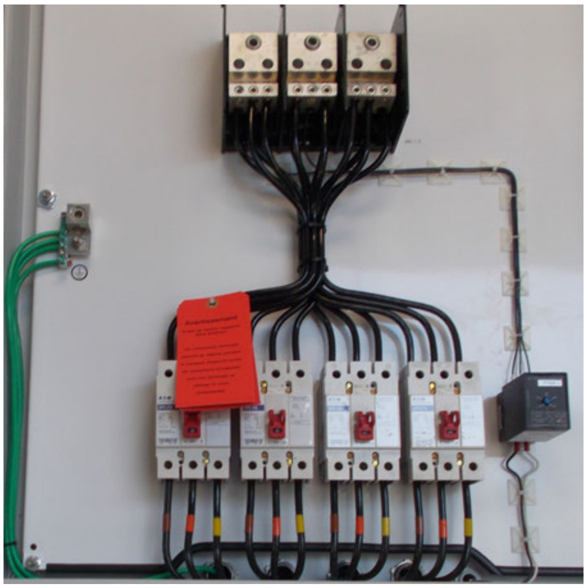
Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Main Power Distribution

The power distribution panel distributes electricity from the external building power supply. It also houses a circuit breaker for each module, a phase monitor, and an optional main power disconnect switch. See figure below.

Figure 26. Power distribution panel



Panel Disconnect

Some chiller/heat pump systems are optionally equipped with a panel-mounted disconnect switch installed on the outside of the power distribution panel. The disconnect switch must be turned to the OFF position before the panel can be opened for service.

Module Electrical and Control Panel

The Electrical and Control Panel receives power from the power distribution panel and provides power to the individual electrical components in that module. Each module has its own high voltage electrical panel and low voltage control panel that distributes electricity to individual components. It also has fuses and breakers, compressor switches, and the microprocessor controller.

Electrical Controls

The MWC and WXM chiller/heat pump is provided with controls and indicators to monitor the electrical activity and notify operators if problems arise.

Figure 27. Module electrical panel

Flow Switch

A flow switch is wired into the low voltage control circuitry used to detect the flow of liquid throughout the hydronic system. Flow switches are found on all evaporators with isolation valves. Flow switches close when flow is detected allowing compressors to start. If there is no flow, compressors cannot operate.

After every chiller/heat pump power-on, all LEDs on the flow switch illuminate and go out again in sequence. The switch is ready for operation when an amber LED is visible on the switch display:

NOTICE

Proof of Flow Switch!

Failure to provide flow switches or jumping-out of switches could result in severe equipment damage. Evaporator and condenser water circuits require proof of flow switches.

- **Failure to include the proof of flow devices and/or jumping out these devices could cause the unit to stop on a secondary level of protection.**
- **Frequent cycling on these higher level diagnostic devices could cause excessive thermal and pressure cycling of unit components (O-rings, gaskets, sensors, motors, controls, etc.) and/or freeze damage, resulting in premature failure of the chiller.**

Phase Monitor

A compressor can fail if operated in reverse for more than a minute. A phase monitor is used on three phase power systems to ensure that the electricity supplying the chiller/ heat pump is configured appropriately. A phase monitor prevents a motor from operating in reverse—if any of the three legs of power are landed incorrectly—and will shut the system down upon detection of a reversed phase condition.

Refrigeration Controls

Mechanical controls on the refrigeration system are designed to provide safety for the major components and for proper operation of the system.

Pressure transducers convert pressure into an electronic signal that the microprocessor displays in pounds per square inch (psi) or bar.

Temperature sensors transmit temperature data electronically to the microprocessor for display in either Fahrenheit (°F) or Celsius (°C).

Expansion Valve

An expansion valve is a metering device controlling the flow of refrigerant to the evaporator based on the evaporator superheat.

Superheat is factory-set for around 12 °F (6.7 °C). Close the valve to increase superheat. To accurately read superheat, install a temperature sensor at the evaporator outlet. The sensor bulb should be located at the 4 o'clock or 8 o'clock positions on the pipe for the most accurate pressure measurement.

Ensure that the closed cell insulation covers the thermal expansion valve sensing bulb. If insulation is missing, the bulb will tend to feed more refrigerant to satisfy the superheat setting.

Electronic and Manual Isolation Valves (WXM)

Each brazed plate heat exchanger branch line includes a manual inlet and an electronic discharge butterfly valve that allows system flow to each active module to match the cooling or heating requirements of the system. By isolating individual modules that are not operating, the hydronic system can have variable primary flow to water-to-water heat pump modules.

The valves are the slow opening type - to minimize the sudden change in flow to the previously active modules and have a minimum opening cycle time of 30 seconds between the fully closed and open position. The valves have a minimum close off pressure of 75 psi , have a maximum working pressure of 250 psi, and have roll grooved connections. The actuators are rated for 24 VAC.

Reversing Valves (WXM)

The water-to-water heat pump reversing valve is an electro-mechanical 4-way valve that reverses the refrigerant flow direction. It moves heat from inside the building to the outdoors (cooling mode) or removes the heat from outside the building to the indoors (heating mode).

Reversing valves are designed to lower the minimum operating pressure difference between high and low side.

Sight Glass

When the sight glass shows a green indicator, no moisture is present. When the sight glass shows a yellow indicator, there is moisture in the refrigerant line. Bubbles can be observed whenever chiller/heat pump cycling causes the pressure to change up or down.

NOTICE

Equipment Damage!

Failure to remove moisture from system could cause corrosion within the chiller/heater components, and degrade performance.
Perform vacuum evacuation of system to remove moisture.

Low Pressure Bypass

Logic that uses a time delay that temporarily bypasses the low-pressure switch for compressor start-up. Once the delay times out the normal controls are put back on line within the control circuit.

Thermal Capacity

The thermal capacity of the chiller/heat pump modules is dependent on the leaving temperature of the chilled water/ glycol mixture, maintaining a minimum flow of water through the evaporator and keeping debris out of the air-cooled condenser. In applications where it is desired to operate with a lower flow rate or higher temperature change, consult the technical support for recommendations.

Sequence of Operations

This manual describes a typical water-cooled chiller system with few, if any, optional components or devices attached.

Constant Flow Sequence

MWC Constant Flow Sequence

1. The chiller is designed to operate with consistent supply of high voltage power. This will power the compressors' crankcase heaters (air cooled modules only) and minimize liquid refrigerant migration to the compressor sumps.
2. With power on the system, the primary module microprocessor controller selects the lead chiller, and rotates this lead once every 168 hours.
3. The chiller system is enabled when the system on/system off icon on the HMI touch screen display is pressed and held for 3 seconds. In addition, the remote start/stop relay must be in the "start" position.
4. For systems with a tank and pump module, the lead chiller pump will energize when the chiller is enabled. If the flow switch within the tank and pump module closes within the time delay period, the lead pump turns on. Should the lead pump fail to start or the flow switch not close within the time delay period, the pump de-energizes and the lag pump energizes. An alarm signal is generated on the primary microprocessor controller indicating failure of the lead pump.
5. Once the flow is established and the system demand (based on leaving fluid temperature) indicates that there is a requirement for cooling, the lead compressor of the lead module energizes provided all safeties of that refrigeration circuit are satisfied.
6. As the system demand continues to increase, the leaving fluid temperature from the chiller increases slowly until the differential set point is reached (set point plus 4 °F). When the differential is reached, the compressor on the lead circuit of the next module selected to start based on the primary controller sequential operating order energizes, provided all safeties on that circuit are satisfied.
7. Regardless of demand, compressors will not turn on within 5 minutes of one another to prevent excessive compressor cycling. Each compressor runs for a minimum of 5 minutes regardless of the system leaving fluid temperature.
8. As the system demand continues to increase, the first compressor on the lead refrigeration circuit from the next module in the starting sequence (or if there is only two total modules, the second compressor on the second circuit of the lead module) will be brought on-line.
9. As the demand continue to increase and the temperature once again reaches the set point plus differential setting, a fourth compressor from the fourth sequential module (or the second compressor of the second module if there are only two modules) is brought on-line. This process occurs throughout the operating range of the chiller system when there is increasing cooling demand.
10. On a decrease in system demand such that the leaving fluid temperature reaches the set point minus the differential (set point minus 1 °F), compressor(s) de-energizes in the reverse order that they turned on after all timers have been satisfied.
11. Regardless of demand and leaving fluid temperature, there must be no less than 5 minutes between successive compressor(s) de-energizing to prevent excessive compressor cycling.
12. The microprocessor will provide a new lead chiller module once a week to even out the compressor run time between the modules.
13. For water cooled chiller systems with condenser fluid temperature that enters below 65 °F, a two-way water regulating valve must be provided on each condenser. The valve modulates to allow just enough fluid to flow through the condensers to maintain refrigeration head pressure.
14. Rarely, for water-cooled chillers with condenser fluid flow rate that must remain constant, a three-way regulating valve can be provided on each condenser to maintain refrigeration head pressure when the entering condenser fluid temperature is below 65 °F. The regulating valve bypasses some fluid away from the condensers to the fluid return pipe yet allows enough to flow through the condensers to maintain refrigeration head pressure.

MWC Variable Flow Sequence

1. The chiller is designed to operate with consistent supply of high voltage power. With power on the chiller system, the lead module's electronic isolation valves is energized and open.
2. The chiller system is enabled when the system on/system off icon on the HMI touch screen display is pressed and held for 3 seconds. In addition, the remote start/stop relay must be in the "start" position.
3. The variable frequency drives for the chiller pumps monitors the opening and closing of the electronic valves on the evaporators which are controlled based on chiller system leaving fluid temperature. The pump speed varies proportionally to the number of modules that are operating (electronic valves open) in the chiller system. The VFDs can also be controlled based on the system differential pressure - or a flow meter provided by others – but minimum pump(s) speed must not be lower than that required by the one operating module. The control of the variable primary pumps should be based on the differential pressure measured across the most remote fan coil in the hydronic system and not the

pressure differential across the chillers (the evaporator in each module contains a fine mesh strainer which can skew differential pressure readings). The VFDs allows the pumps to deliver the required flow through each operating module.

4. The electronic isolation valve of the lead chiller module identified in step 2 is already energized, therefore, the system pump must produce the minimum flow required by the lead chiller module. A system bypass with modulating valve will be provided by the customer and installed external of the chiller at the most remote fan coil or other suitable remote location from the chillers (a high-quality pressure-independent valve is recommended for this bypass so as to provide accurate bypass control regardless of system pressure differential between supply and return headers).
5. Once there is a system load, the BMS modulates the system bypass valve, decreasing the bypassed flow, as the flow rate through the fan coils increase. This control is provided by the customer external of the chiller and is presumed to be based on the pressure differential across the most remote fan coil or user.
6. Once the minimum flow is established and the system demand (based on leaving fluid temperature) indicates that there is a requirement for cooling, the lead compressor of the lead module energizes provided all safeties of that refrigeration circuit are satisfied.
7. As the system demand continues to increase, the leaving fluid temperature from the chiller increases slowly until the differential set point is reached (set point plus 4 °F). The second compressor in the lead module energizes, provided all safeties on that circuit are satisfied.

Note: *Regardless of demand, compressors do not turn on within 5 minutes of one another to prevent excessive compressor cycling. Each compressor runs for a minimum of 5 minutes regardless of the system leaving fluid temperature.*

8. As the cooling demand continues to increase, the leaving fluid temperature from the chiller system increases slowly. The first compressor on the lead refrigeration circuit from the second module in the starting sequence will be brought on-line.
9. When the leaving fluid temperature once again reaches the set point plus differential setting, the second compressor on the second module energizes.
10. With increased demand, the third module’s lead compressor and then its second compressor - as necessary - will turn on but not less then 5 minutes apart. This process occurs throughout the operating range of the chiller system.
11. On a decrease in system cooling demand, such that the leaving fluid temperature reaches the set point minus a differential (1 °F below sent point), compressor(s) de-energizes in the reverse order that they turned on after all timers have been satisfied. The electronic valve on non-operating modules will close.
12. Regardless of demand and leaving fluid temperature, there must be no less than 5 minutes between successive compressor(s) de-energizing. to prevent excessive compressor cycling.
13. The microprocessor provides a new lead chiller module once a week to even the run time between modules.

WXM Operations

1. WXM machines can operate either in Cooling or Heating Mode. Operational Thermal Mode is defined by building needs for provision of either chilled or hot water and can be commanded from BMS or local display user interface.
2. In Cooling Mode, for both refrigeration circuits, Reversing Valves connect suction side to Water Load Heat Exchanger, so it produces a cold water to satisfy cooling load. Discharge side is connected to Water Source Heat Exchanger rejecting generated heat when any refrigeration circuit is running.
3. In Heating Mode, both circuit’s Reversing Valves connect discharge side to Water Load Heat Exchanger, so it produces a hot water to satisfy heating load. Suction side, in turn, is connected to Water Source Heat Exchanger.
4. WXM Bank can be turned on and off from BMS system via communication channel or via digital input signal DI 1 on the Supervisor Controller.
    a. Besides, each WXM Module can be turned on and off individually by the same means.
5. When WXM Bank turns on, Primary Module tries to identify the required number of Secondary Modules on the communication network according to the WXM Bank number of Modules setting. Secondary Modules that respond to the Primary Controller, will become the part of the WXM Bank, otherwise, non-responding Modules, will run in stand-alone mode if corresponding conditions are met.
    a. In addition to Secondary Modules communication conditions, Primary Controller has to meet other conditions to be able to act as a Primary Module, such as, System Temperature Control Sensor has to be intact and Primary Controller itself has to communicate with other Secondary Controllers as well. When mentioned conditions are not met, all WXM modules will switch automatically to stand-alone mode.
    b. Once Primary and Secondary Modules have been claimed, Primary Controller defines the Lead Module which will keep its Load/Source Isolation Valves opened at all times to allow for flow circulation.
6. Lead Module is rotated through WXM Bank based on time period or based on the chiller demand. Both options can be enabled/disabled individually. When Time Rotation is enabled, Rotation Period has to expire

before Lead is rotated. Demand Rotation rotates Lead when the last compressor is staged off.

7. Primary Controller constantly monitors the Controlled Temperature and checks if it falls within Temperature Control Band. Temperature Control Band is the zone around Temperature Setpoint where Cooling/Heating Demand is modulating. When Load Water Controlled Temperature is below Control Band for Cooling Mode, Cooling Demand is 0%; when Load Water Controlled Temperature is above Control Band, Cooling Demand is 100%; when Load Water Controlled Temperature is changing within Temperature Control Band, Cooling Demand is modulating accordingly. The same goes for Heating Demand except for when Load Water Temperature is below Control Band, Heating Demand is 100% and when it is above Control Band, Heating Demand is 0% as heating temperature control is reversed versus cooling temperature control.
8. Compressors staging sequence always starts off from a Lead Module. When Bank Demand is 100%, compressors stage up; when Bank Demand is 0%, compressors stage down. Once next compressor comes on, Stage-up Delay has to expire before next compressor is allowed to turn on. The same goes for staging-down, Stage-Down Delay has to count down to ‘0’ before next compressor turns off.
   a. When next Heat Pump Module comes into operation, it first opens its Load and Source Isolation Valves. While Isolation Valves are opening, pumps ramp up to readdress increased flow demands. When Load Flow is confirmed by a flow switch, compressors are allowed to start.
   b. In Heating Mode Source Flow has to be confirmed before starting compressors. Running chilled water, Water Source Heat Exchanger operation in Heating Mode is more critical as opposed to Cooling Mode as it may be subject to potential freezing.
   c. When Bank Demand reaches 0%, WXM Bank goes into staging-down sequence. Staging-down always starts from the compressor that was engaged last implementing LIFO sequence (Last In First Out).
   d. When the last compressor on the Heat Pump Module stops, Isolation Valves start closing. Pumps in corresponding circuits ramp down to adjust speed to decreased flow demands.

Start-Up

Preparation for Initial Start-Up

After the system is completely installed with all wires connected and all piping securely coupled, the chiller/heat pump can be prepared for initial start-up.

Ensure there is a sufficient cooling/heating load available for proper testing of the chiller/heat pump system.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Initial Start-Up

1. Close all drain valves and header purge valves.
2. Fill the chiller/heat pump with clean fluid.
3. Inspect all connections for leaks during the filling process.
4. De-energize chiller/heat pump using industry-standard lockout/tagout procedures. Verify main power is turned off at the power distribution panel. Validate de-energization using voltage meter.
5. Inspect all electrical connections to ensure terminals are secure.
6. Inspect all fuses and overload settings to ensure they conform to specifications.
7. Inspect all refrigerant pressures for each module to ensure no refrigerant has been lost.
8. Confirm the oil level is correct in each compressor.

   Note: *If Trane pumps are provided, check that each pump's overload setting matches the nameplate amperage of the pumps as described previously.* ***Bump*** *pump motors on to verify correct rotation.*

NOTICE

Compressor Failure!

Failure to follow instructions below could result in catastrophic compressor failure.

Do not operate with insufficient oil.

9. Connect phase monitor wiring, if required.
10. Ensure refrigerant valves are open at the compressors.
11. Confirm that pressure and temperature switches are in the closed position.
12. Apply power to all modules in the system.
13. Turn on the condenser and evaporator fluid pumps and ensure there is proper flow and the pressure drop across the system is as expected.

Table 18. Initial start-up readiness checklist

☐	Start-Up Readiness Dimension
☐	Describe voltage service: ☐ Fused disconnect ☐ Non-fused disconnect ☐ 50 Hz ☐ 60 Hz
☐	Record rated power supply: __________volts_______ phase • Circuit breaker rating: _______
☐	Record supply voltage on chiller/heat pump nameplate: _________________
☐	Record power supply voltage to ground: L-1= _______, L-2 = _______, L-3 = _______
☐	Record voltage between each phase: L-1 to L-2 = ______, L-2 to L-3 = ______, L-1 to L-3 = ______ ☐ Agrees with nameplate values? ☐ Voltages must be within 2%.
☐	Check the box if all electrical connections inside the power distribution panel are tight.
☐	Check the box if all electrical connections inside each module electrical and control panel are tight. Ensure all components inside each module are securely mounted and have not shifted during shipment.
☐	Record the control voltage between TB-1-1 and TB-2-1: ________
☐	Check the box if system includes any remote panels (city water switchover, remote control panel, or customer supplied control devices). If so, voltage drops are likely to occur. Measure and record all control voltages: List devices: Voltage 1=____________________ Voltage 2=____________________ Voltage 3=__________________
☐	Check the box if there are any field-supplied wiring junction boxes located between the chiller/heat pump and any remote panels.
☐	Check the box if there are any splices made in the field-supplied wiring junction boxes.
☐	Check the box if there are any customer-supplied devices connected to the chiller/heat pump wiring. List devices: ____
☐	Check the box if there are any Trane remote devices connected to the chiller/heat pump wiring.
☐	Check the box if voltage drops are detected.
☐	Check the box if the appropriate fluid mixture has been added to the chiller/heat pump.
☐	Check the box if all chiller/heat pump modules are installed with minimum clearances available from all sides.
☐	Check the box if refrigeration gauges are indicating equal refrigerant pressures.
☐	Check the box if chilled water lines from chiller to customer’s equipment are permanently connected.
☐	Check the box if chilled water lines have been flushed clean of mud, slag, and other construction debris.
☐	Check the box if all chilled water line filters and strainers are clean.
☐	Check the box if chilled water lines have been leak tested according to pre-start-up instructions.
☐	Check the box if chiller/heat pump reservoir (if included) is at operating level with correct fluid mixture.

Table 18. Initial start-up readiness checklist (continued)

☐	**Start-Up Readiness Dimension**
☐	Check the box if high voltage wiring is installed, tested, and functional.
☐	Check the box if all water, refrigeration, and electrical connections between chiller/heat pump modules are completed.
☐	Check the box if all control wiring between modular chillers/heat pumps is installed, tested, and functional.
☐	Check the box if control wiring is complete, including any additional remote interface panel or special-purpose wiring.
☐	Check the box if all responsible installing contractors and sub-contractors have been notified to have representatives available on site to provide technical support for the initial start-up procedure.
☐	Check the box if full load will be available for chiller/heat pump on the initial start-up date.
☐	Touchscreen Interface Panel: Record version and date of the software loaded into the touchscreen interface panel: Version: ______________________________ Date: ______________ ***Note:*** *To view the software version, from the home screen, press the software button on the System Control screen.*

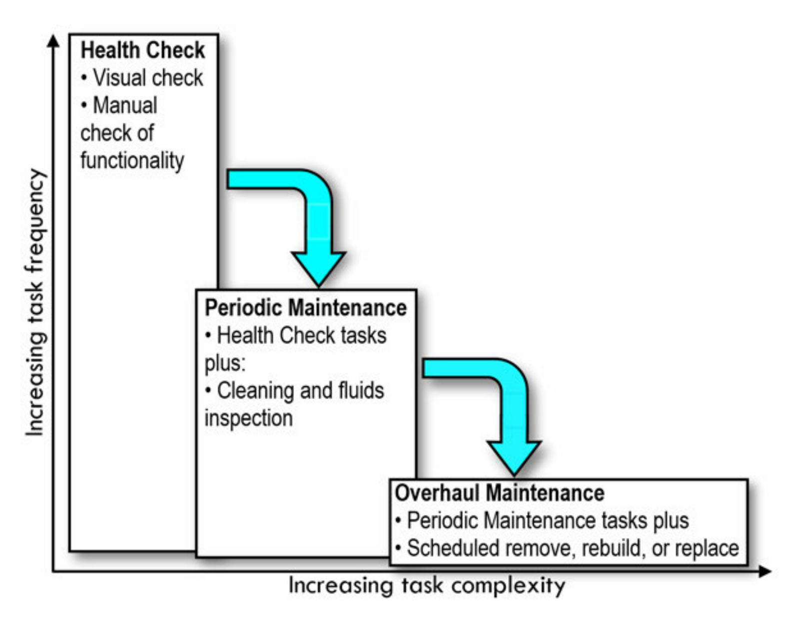
Maintenance Procedures

Maintenance Strategy

The primary goal of preventive maintenance is to avoid the consequences of failure of equipment. Trane chiller/heat pump components are designed to be easily accessed for servicing.

One approach to chiller/heat pump maintenance envisions three levels of maintenance effort reflecting frequent, periodic, and scheduled maintenance tasks, with each level building on the previous level. Finally, since all components will eventually wear out, a prudent maintenance strategy will anticipate and schedule replacement or rebuilding of critical components before they fail and require emergency response to keep chillers operational. See below figure.

Figure 28. An approach to chiller/heat pump maintenance



- A daily or weekly “health check” involves habitual visual and manual inspections of the components of the chiller/heat pump so that anomalies become evident when they occur.
- Weekly or monthly periodic maintenance involves cleaning specific components and inspecting glycol and lubrication fluids.
- Prudent maintenance strategy will anticipate and schedule replacing or rebuilding of critical components before they fail and require emergency response to keep chillers/heat pumps operational. See below figure.

Maintenance for HVAC equipment and facilities can include a “preventive maintenance checklist” which includes small checks which can significantly extend service life.

Power Disconnect Switch

Some units are optionally equipped with a panel-mounted disconnect switch installed on the outside of the power distribution panel (or on each module’s electrical and control panel if the chiller/heat pump has power supplied to each individual module). The disconnect switch must be turned to the off position before the panel can be opened for service. When the panel door is open, power can be reconnected by turning the handle located on the inside of the panel to the ON position.

⚠ WARNING

PPE for Arc/Flash Required!

Failure to wear appropriate PPE could result in death or serious injury.

On this unit, if the handle shield is cracked the circuit breaker could arc/flash when reset. To avoid being injured, technicians MUST put on all necessary Personal Protective Equipment (PPE), in accordance with NFPA70E for arc/flash protection, PRIOR to entering the starter panel cabinet.

NOTICE

Component Damage!

Failure to follow instructions could damage sensitive electronic components beyond repair.
To prevent arcing or surges of electrical current, do not use wires or cables to jump components or bypass the manufacturer's safety systems.

Federal Clean Air Act

Responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be properly certified. The Federal Clean Air Act prescribes procedures for handling, reclaiming, recovering, and recycling of refrigerants and the equipment that must be used in maintenance procedures involving potential leakage of HVAC refrigerants. State and local governments may have additional requirements that must be followed to responsibly handle HVAC refrigerants.

Inspection and Maintenance Schedule

Proactive measures should be taken to prevent potential problems with the chillers/heat pumps. These include maintaining a operational log and conducting weekly, quarterly, and annual inspections of the chiller/heat pump. See the following table.

Daily

A daily visual inspection can reveal obvious problems. Keep notes of the chiller/heat pump performance:

- Log pressures and temperatures.
- Visual inspect of the unit.

Table 19. Recommended chiller/heat pump service intervals

Task	Frequency
Visually inspect the chiller/heat pump	Daily
Log pressure and temperatures	Daily
Inspect touchscreen interface panel for alarm history	Weekly
Clean strainers on the inlet water pipe	Monthly
Check the compressor oil level sight glass	Monthly
Confirm the glycol concentration	Monthly
Confirm the refrigeration pressures	Monthly
Check the refrigeration liquid line sight glass	Monthly
Inspect refrigerant pressures and temperature set points	Quarterly
Inspect superheat (10 °F to 12 °F [5°C to 6°C]) and sub-cooling temperatures (10°F to 15°F [5°C to 8°C])	Quarterly
Inspect the evaporator entering and leaving evaporator temperature	Quarterly
Collect fluid mixture sample for analysis	Quarterly
Inspect crankcase heaters	Quarterly
Inspect piping for signs of leaks	Quarterly
Inspect refrigerant piping for oil or refrigerant leaks	Quarterly
Observe refrigeration operating pressures	Quarterly
Confirm motor amperage draw and voltage	Quarterly
Confirm chiller/heat pump superheat and sub-cooling	Quarterly
Check for worn or burned contactors	Quarterly
Inspect all electrical connections and fuses	Annually
Inspect each compressor for refrigerant pressures, overheating, oil leaks	Annually
Inspect compressor terminals for pitting, corrosion, and loose connections	Annually
Inspect compressor oil level	Annually
Confirm and record compressor amperage draw and voltage	Annually

Table 19. Recommended chiller/heat pump service intervals (continued)

Task	Frequency
Compare fluid flow against design specifications	Annually
Tighten rotalock fittings, if equipped	Annually

Weekly

Weekly inspection is a continuation and elaboration of daily best practice:

- Inspect touchscreen interface panel for alarm status and additions to the alarm history. (Do not clear alarms as this is a very important performance record if troubleshooting problems occur.)
- Notate and record any excessive vibrations or motor noise.
- Measure all refrigerant static pressure on any idle circuits. Record any significant changes or reductions in pressure.
- Initially, clean strainers weekly after start-up. Thereafter, inspect and clean strainers as needed.

Monthly

The monthly maintenance inspection examines many items that generally require frequent attention. This routine event identifies small problems early before they can become big problems requiring serious repair and refurbishment:

1. Verify that the strainer(s) are clean.
2. Check the compressor oil level sight glass. The oil should always be clear and free-flowing. Any milky appearance indicates that liquid refrigerant is making its way back into the compressor and will cause premature compressor failure.

NOTICE

Equipment Damage!

Failure to remove moisture from system could cause corrosion within the chiller/heater components, and degrade performance.
Perform vacuum evacuation of system to remove moisture.

3. When the compressor is not operating, the oil level should be at least at the bottom of the sight glass, up to two-thirds full. When the compressor is operating, the oil level will normally be at the bottom of the sight glass, or even below, but it must be visible.

NOTICE

Compressor Failure!

Failure to follow instructions below could result in catastrophic compressor failure.
Do not operate with insufficient oil.

4. Low oil sight glass conditions could signify a short cycling, an oil leak, or an undercharged chiller/heat pump that lacks proper refrigerant velocity to return oil to the compressor sump. Eventually, dry compressor starts could occur causing premature compressor failure. This may indicate that some oil has been lost from a previous refrigerant leak repair. The compressor data label indicates the correct oil type and quantity with which it should be filled.

Note: *A flashlight may be required to see the oil churning in the sump of the compressor. Adjusting the line of sight may be necessary to visually inspect the oil in the compressor sump during operation. At a minimum, the oil must be seen churning in the compressor sump. It should be clear.*

NOTICE

Compressor Failure!

Failure to follow instructions below could result in catastrophic compressor failure.
Do not operate with insufficient oil.

5. Check the glycol concentration using a refractometer.
6. Check the refrigeration pressures.

NOTICE

Compressor Damage!

Failure to follow instructions below could result in extensive compressor damage.
Verify that suction pressure is sufficient. Secure the circuit or module offline until status can be examined in detail.

Important: *Extended operation with suction pressures below 80 psi is a clear sign of insufficient refrigerant charge, refrigeration obstruction, or valve closed. This can cause extensive damage to a compressor.*

7. Check the refrigeration liquid line sight glass for persistent bubbles (**flashing**) .

Note: *Bubbles in the sight glass do not necessarily indicate loss or lack of refrigerant charge. If the refrigeration pressures are in the normal range, the unit is most likely adequately charged.*

Quarterly

The quarterly maintenance inspection is a comprehensive event that examines all aspects of the chiller/heat pump to identify early problems before they can damage the equipment and require major repair or refurbishment:

1. Inspect alarm log, refrigerant operating/static pressures, and temperature set points of each module independently.
2. Inspect chiller/heat pump superheat and sub-cooling. System superheat should be 10 °F to 12 °F (5 °C to 6 ° C). System sub-cooling should be 10+ °F (5 °C) depending on the ambient conditions.
3. Inspect the approach delta T - entering evaporator water/glycol mixture temperature and leaving refrigerant temperature.
4. Inspect strainers.
5. Collect chilled fluid mixture sample for professional analysis. Check for cleanliness. Drain and refill with clean solution if excessive sludge or dirt is present. Flush the chiller/heat pump prior to refilling.
6. Inspect fluid mixture levels. Add glycol as required.
7. If equipped, inspect crankcase heaters for proper operation.
8. Inspect the fluid piping for signs of leaks at joints and fittings.
9. Inspect refrigerant piping circuit for signs of oil or refrigerant leakage. Conduct **sniffer test** to find refrigerant leaks. Inspect all pressure switch bellows.
10. Tighten all refrigeration piping connections (e.g. rotalocks, Schrader valves, caps, and ball valves).
11. Install a manifold and gauge set to observe equipments refrigeration operating pressures.
    a. Verify that the pressure controls (low pressure and high pressure switches) are **cutting in** and **cutting out** at the appropriate pressures.
    b. Verify refrigerant charge by recording the superheat and sub-cooling temperatures.
    c. Observe head pressure for signs of improper condensing from clogged strainers, or a modulating expansion valve issue.
12. Check compressor motor amperage draws and voltage supplies and maintain a record of those values. Verify that they are within the name plate rating. Also, check for voltage imbalance. The chiller/heat pumps phase monitor will open if the voltage imbalance exceeds 4%.
13. Check for chattering, excessive wear, or burned contacts. Replace contacts, if in doubt.

Annually

The annual chiller/heat pump maintenance inspection is critical to the long-term performance of the unit. Whether the equipment has a service life of 15 years or 30 years is almost entirely dependent upon how consistently and how diligently the annual maintenance inspection and tasks are performed. The annual event is a comprehensive inspection that examines all aspect of the chiller/heat pump to identify and repair small problems before they can become major issues that damage a chiller/heat pump and require significant repair or refurbishment.

1. Inspect all electrical connections for damage and ensure terminals are tight. Inspect all contactors for pitting and corrosion and replace as necessary.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

2. Inspect fuses to ensure they are secure, of correct amperage rating, undamaged and functioning.
3. Energize each compressor and check refrigerant pressures, signs of overheating, and oil leaks. Check for noises and for leaks with an electronic or bubble leak detector. Inspect flared fittings, refrigeration gauges, compressor connections, braze joints, pressure switches, and access ports on Schrader valves.

⚠ WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage.
System contains refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

4. Follow proper “LOTO” procedures to de-energize each module and inspect terminals for pitting, corrosion, and loose connections.
5. Inspect that the oil level is visible in each compressor and not discolored. Annual oil samples should be taken to be analyzed for destructive acids, corrosive materials, or metal deposits.
6. Inspect and record the compressor amperage draws and voltage.
7. Record fluid mixture flow to ensure it meets design specifications.
8. If equipped, tighten Rotalock fittings. The recommended torque is 80 ft-lbs for 2 inch and larger and 60 ft-lbs for Rotalock fittings smaller than 2 inches.
9. Inspect all copper lines and control capillary tubing to ensure that the lines are separated and not vibrating against one another or the frame or housing.
10. Ensure all refrigeration lines are properly supported to prevent vibration from causing premature failure of copper piping.

11. Inspect all insulation on piping and control sensors. Repair and replace as necessary.
12. Inspect entire plumbing system for leaks.
13. Review logged alarms and look for repetitive trends.
14. If equipped, inspect crankcase heaters to verify proper operation.
15. Sample refrigerant to analyze for moisture or acid.
16. Inspect operating pressures and temperatures and ensure the chiller/heat pump has a full refrigerant charge.

Maintenance Tasks

The maintenance tasks described herein present the basic, minimal, steps required to successfully complete a task. Local policies and protocols may require more elaborate procedures with additional checks and inspections.

Inspection Methods

Appropriate inspection for modern chiller/heat pumps can be described as “hands on.” Where possible and appropriate, visual inspection should include touching the component or apparatus being inspection. The sense of touch provides additional feedback regarding temperature, texture, tightness, and dryness that “eyes only” inspection cannot match. Habitually touching each item to be inspected also ensures that items are not subconsciously skipped during the inspection process. For a summary of tasks, see Table 19, p. 63.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Critical Cleaning Tasks

Monitor temperature change and pressure drops across the brazed plate heat exchanger (BPHE) circuit to determine the frequency for strainer cleaning. Monitor water quality in the chiller/heat pump’s closed system to determine the optimum frequency for BPHE cleaning.

On multiple module chiller/heat pumps , Trane provides service isolation valves on each BPHE to isolate each strainer for cleaning without disrupting the operation of any remaining modules in the chiller/heat pump.

Strainer Cleaning Procedure

Strainers at each BPHE are critical for protecting the small water passages as well as maintaining fluid mixture cleanliness. Service valves on the BPHE isolate each strainer for cleaning without interrupting the operation of other modules in the chiller/heat pump bank. If a tank and pump module is provided, pot strainers are occasionally included on the pumps’ suction lines.

NOTICE

Equipment Damage!

Failure to follow instructions could result in equipment damage.
Do not operate without strainers in place.

1. De-energize power to the module containing the strainer by turning the power OFF at the breaker and/or disconnect (follow proper LOTO procedure).
2. Close the two service isolation valves between the header and the BPHE.

Note: *If this is a variable flow chiller, the outlet may be equipped with an electronic valve that must be manually locked in the closed position.*

3. Remove the insulation to expose the roll grooved blind end cap or service cap on the end of the strainer housing. Utilize a short section of hose to connect to the valve on the end cap to relieve pressure and capture fluid. Dispose or re-utilize water/glycol mixture according to local protocols.

⚠ CAUTION

Explosion Hazard!

Failure to relieve pressure gradually could result in minor to moderate injury and equipment damage.
Water/glycol mixture can be under considerable hydraulic pressure in the strainer housing. Close isolation valves fully. Relieve pressure using a boiler vale. Use extreme care to slowly remove the end cap and release pressure gradually.

4. Inspect the gasket and service cap for abrasions, tears, excessive dirt, or deterioration. Replace gasket if necessary.
5. Remove the strainer from the housing.
6. Clean the strainer inside and out using a soft natural bristle brush and water.
7. Clean the interior of the end cap (or service cap), and the gasket using a soft natural bristle brush and water. Apply a light coating of lubrication to the gasket.
8. Re-install the strainer in the housing (large end first). Replace the gasket and end cap and tighten coupling collar securely.
9. Ensure the fluid make-up system is operational to replenish the fluid mixture lost during the cleaning process.
10. Energize power to the module containing the strainer by turning power ON at the breaker and/or disconnect.

Evaporator Cleaning Procedure

Trane recommends using SWEP & Goodway® Technologies ScaleBreak-MP, an industrial biodegradable descaler which will quickly and effectively dissolve calcium, lime, rust and other water formed deposits from water cooled/heated equipment.

- When applying ScaleBreak-MP in your equipment, it should be circulated through the water passages.
- As the product comes in contact with the deposits, they are dissolved into a liquid suspension.
- Upon completion of the cleaning, the used solution is freely flushed from the system along with the dissolved deposits leaving no residual solution.
- Optimal results are achieved when you pump into the bottom of the equipment and out the top. This method ensures the area to be cleaned was flooded, allowing ScaleBreak-MP to come in contact with all the deposits.

Pump Tasks

The following section applies to those chillers/heat pumps equipped with a tank and pump module.

Removing the Pump

1. Confirm module power is OFF by testing with known operational voltmeter. Once confirmed, install lockout/ tagout equipment to ensure power is not turned on while service work is being performed.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

2. Remove electrical access cover on the pump motor.
3. Remove all electrical wiring and flex conduit from the pump. Make sure to notate all connection points for the new installation.

Note: *Be sure to document conductor/wire numbers*

4. Close valves. There are isolation valves on the suction and discharge sides of the pump as well as union connections.
5. Using appropriate wrenches, slowly break loose the union fittings at the suction and discharge piping. Capture any escaping fluids encountered during the pump change out process.

Notes:

- *Always use a second, counter, wrench, when performing plumbing tasks to firmly hold the fittings or joint while loosening or tightening.*
- *A small quantity of fluid mixture will be lost during this operation. Although propylene glycol does not pose an environmental hazard, it is the installers responsibility to adhere to local codes and ordinances involving hazardous fluids.*

6. Loosen the four bolts that attach the pump base to the frame with the appropriate size wrench or socket.
7. Remove the pump.
8. Disconnect the piping stubs from the suction and discharge connections on the old pump to be reused on the new pump.

Installing the Pump

Verify that power is disconnected from the chiller/heat pump.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

1. When installing the stubs from the old pump, apply a minimal amount of thread sealant to the threads of the suction and discharge pipe adapters and install the adapters onto the new pump.
2. Position the pump over the mounting holes. Apply anti-seize compound to the four mounting bolts, washers, and fittings before installation. Tighten fittings securely with 1/2 inch socket and wrench.

Note: *Do not over-tighten compressor mounting bolts as the threaded inserts could strip out in the frame.*

3. Loosely install the four mounting bolts onto the mounting fittings on the chiller/heat pump frame.
4. Align the pump suction and discharge unions onto the piping connections and hand tighten.

Note: *The pump suction pipe stub must be positioned 90 degrees to the right of the pump to mate up to the union on the pump suction piping.*

5. Fasten the mounting bolts to the frame using a 1/2 inch wrench or socket. Be sure to reuse the rubber isolation pads from the old pump.
6. Tighten the suction and discharge unions using large adjustable wrenches or pipe wrenches. To minimize the torque on the piping, apply an equal and opposite force to the pipe fitting with an additional adjustable wrench or pipe wrench.

Note: *Always use a second, counter, wrench, when performing plumbing tasks to firmly hold the fittings or joint while loosening or tightening.*

7. Position the conduit into the knockout of the electrical box cover.
8. Fasten the conduit to the box with the ring nut.
9. Reconnect pump electrical connections exactly as they were notated at removal.
10. Replace the cover onto the electrical box on the side of the pump motor. Ensure gasket is in place prior to replacing cover.
11. Reconnect the fitting on the strain relief connector from the motor housing using an adjustable wrench.
12. Open the ball valves on the suction and discharge sides of the pump.
13. Restore power to the module by removing the lockout/tagout equipment and turning the pump module breaker back to the ON position.
14. Observe the newly installed pump to verify that all connections have been seated and tightened correctly and not leaking.
15. Turn pump on and record amp draws for your records.

Replacing the Pump Seal

Prior to servicing the pump, verify that the power to the chiller/heat pump is disconnected.

1. Confirm module power is OFF by testing with known operational voltmeter. Once confirmed, install lockout/tagout equipment to ensure power is not turned on while service work is being performed.

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

2. Remove electrical access cover on the pump motor.
3. Remove all electrical wiring and flex conduit from the pump. Make sure to notate all connection points for the re-installation.

Note: *Be sure to document conductor/wire numbers*

4. Close valves. There are isolation valves on the suction and discharge sides of the pump as well as union connections.
5. Using appropriate wrenches, slowly break loose the union fittings at the suction and discharge piping. Capture any escaping fluids encountered during the pump change out process.

Notes:

- *Always use a second, counter, wrench, when performing plumbing tasks to firmly hold the fittings or joint while loosening the tightening the opposite side.*
- *A small quantity of water/glycol mixture will be lost during this operation. Although propylene glycol does not pose an environmental hazard, it is the installers responsibility to adhere to local codes and ordinances involving hazardous fluids.*

6. Loosen the four bolts that attach the pump base to the frame with the appropriate size wrench or socket. Keep up with rubber isolation boots for reuse on install.
7. Remove the pump from the chiller/heat pump , and take to shop bench.
8. Remove insulation from the wet end of the pump to allow volute cover access and removal.
9. Remove pump volute cover.
10. Remove retaining nut on shaft which secures seal.
11. Remove seal.
12. Remove back plate which will allow you to repair /replace water slinger.
13. Install new water slinger rubber. Replace back cover.

NOTICE

Pump Seal Damage!

Do not touch seal with bare skin, or allow any grease to come into contact with the new seal.
Even a small piece of grit of dirt can damage the pump seal. Wash hands thoroughly prior to installing the new seal. Latex gloves are suggested for handling of parts after they have been cleaned and prepped.

Note: *It is highly recommended that you gather seal replacement procedural information for your particular pump make and model.*

14. Place the seal, sleeve, spring, and seal retainer onto the shaft.
15. Position the pump impeller and secure into place with the impeller retainer bolt.

16. Replace the volute cover with new o-ring and re-insulate.
17. Re-install pump. Attach the mounting bolts to the frame using a 1/2 inch wrench or socket.
18. Push the conduit and wires into the knockout on the electrical box cover.
19. Attach the conduit to the box with the ring nut. Use a standard screwdriver to secure the nut.
20. Secure the leads with crimp-type bell caps.
21. Reconnect pump electrical connections exactly as they were notated at removal.
22. Replace the cover onto the electrical box on the side of the pump motor. Ensure gasket is in place prior to replacing cover.
23. Reconnect suction and discharge at unions with appropriate size wrenches as with the removal process.
24. Open the ball valves on the suction and discharge sides of the pump.
25. Observe the newly installed pump to verify that all connections have been seated and tightened correctly and not leaking.
26. Restore power to the module by removing the lockout/tagout equipment and turning the pump module breaker back to the on position.
27. Turn pump on and record amp draws for your records.

Controller Tasks

Replace PLC Logic Controller

Prior to servicing the controller, verify that the power to the chiller/heat pump is disconnected.

1. Remove all quick-connect black plugs and the one orange plug (power supply 24 Vac).

⚠ WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

2. The PLC logic controller is DIN rail-mounted. Once plugs are removed, this will expose the gray secure tabs on the bottom rear of the PLC.
3. Using a flathead screwdriver, insert screwdriver into the slotted holes on the gray tabs and use downward force to release PLC.
4. Remove the PLC by lifting the bottom out and then up, off of the DIN rail.
5. Replace new controller in reverse fashion.

Note: *On a multiple modular system with multiple PLC's, it is imperative that the new PLC has the exact same programming as the remaining PLC's or it will not be compatible and would create havoc within the other PLCs.*

6. Energize power to the module by turning power ON at the breaker and/or disconnect.

Chiller/Heat Pump Troubleshooting

General Approach to Fault Isolation

Trane manufactures chillers/heat pumps with embedded fault detection and diagnostics in each module's controller that offers continuous dedicated monitoring to record and report faults as they occur in real time allowing repairs to be performed in a timely manner.

Various faults occurring in a building's HVAC system can lead to unnecessary energy consumption and poor thermal comfort for a building's occupants. Fault detection and isolation plays a significant role in monitoring, maintaining, and repairing chillers/heat pumps to improve operator safety and minimize operating costs.

Fault detection is recognizing that a problem has occurred, even if the root cause is not yet known. Fault isolation is the process of reducing potential causes to determine the most likely source of chiller/heat pump failure.

Controller Diagnostic Codes

The following table assists in explaining the alarm codes that appear in the remote interface panel in the event of an alarm. The alarm history is accessed by pressing the alarm log key.

Table 20. MWC interface panel diagnostic code key

Alarm	Type	Action
UI1 sensor failure	Auto Reset	Shuts down Circuit 1[(a)]
UI2 sensor failure	Auto Reset	Shuts down Circuit 1
UI3 sensor failure	Auto Reset	Shuts down local cooling control[(b)]
UI4 sensor failure	Auto Reset	Locks out module
UI5 sensor failure	Auto Reset	Shuts down local heating control[(b)]
	Auto Reset	Warning
UI6 sensor failure	Auto Reset	Shuts down local heating control[(b)]
	Auto Reset	Shuts down Free Cooling control[(c)]
UI7 sensor failure	Auto Reset	Warning
UI8 sensor failure	Auto Reset	Warning
UI9 sensor failure	Auto Reset	Shuts down Circuit 2[(a)]
UI10 sensor failure	Auto Reset	Shuts down Circuit 2
UI11 sensor failure	Auto Reset	Control panel heating/cooling control is disabled
UI12 sensor failure	Auto Reset	Warning
cpCOe #1 UI1 sensor failure	Auto Reset	Warning
cpCOe #1 UI2 sensor failure	Auto Reset	Warning
cpCOe #1 UI3 sensor failure	Auto Reset	Warning
cpCOe #1 Offline Alarm	Auto Reset	Warning
cpCOe #1 wrong config Alarm	Auto Reset	Warning
cpCOe #2 UI1 sensor failure	Auto Reset	Modules switch into Stand-alone Mode[(d)]
cpCOe #2 UI2 sensor failure	Auto Reset	Modules switch into Stand-alone Mode[(d)]
cpCOe #2 UI3 sensor failure	Auto Reset	Modules switch into Stand-alone Mode[(d)]
cpCOe #2 UI4 sensor failure	Auto Reset	Modules switch into Stand-alone Mode[(d)]
cpCOe #2 UI5 sensor failure	Auto Reset	Warning
cpCOe #2 UI6 sensor failure	Auto Reset	Warning
cpCOe #2 UI7 sensor failure	Auto Reset	Switches from Remote SP to Local if used
cpCOe #2 UI8 sensor failure	Auto Reset	Switches from Remote SP to Local if used
cpCOe #2 Offline Alarm	Auto Reset	Modules switch into Stand-alone Mode[(d)]
cpCOe #2 wrong config Alarm	Auto Reset	Warning
Compressor 1 External Fault	Auto Reset	Shuts down compressor 1

Table 20. MWC interface panel diagnostic code key (continued)

Alarm	Type	Action
CoreSense 1 Warning	Auto Reset	Warning
CoreSense 1 Fault	User Reset	Shuts down compressor 1
CoreSense 1 Failure	User Reset	Shuts down compressor 1
CoreSense 1 Lockout	User Reset	Shuts down Circuit 1
CoreSense 1 Offline	Auto Reset	Shuts down compressor 1
Compressor 2 External Fault	Auto Reset	Shuts down compressor 2
CoreSense 2 Warning	Auto Reset	Warning
CoreSense 2 Fault	User Reset	Shuts down compressor 2
CoreSense 2 Failure	User Reset	Shuts down compressor 2
CoreSense 2 Lockout	User Reset	Shuts down Circuit 2
CoreSense 2 Offline	Auto Reset	Shuts down compressor 2
ABB VFD 1 Warning	Auto Reset	Warning
ABB VFD 1 Fault	User Reset	Shuts down compressor 1
ABB VFD 1 Lockout	User Reset	Shuts down compressor 1
ABB VFD 1 Offline	Auto Reset	Shuts down compressor 1
ABB VFD 2 Warning	Auto Reset	Warning
ABB VFD 2 Fault	User Reset	Shuts down compressor 2
ABB VFD 2 Lockout	User Reset	Shuts down compressor 2
ABB VFD 2 Offline	Auto Reset	Shuts down compressor 2
Evaporator Freezing Alarm	User Reset	Locks out module
Phase Monitor Alarm	Auto Reset	Shuts down chiller bank[e]
Evaporator Flow Alarm	User Reset	Locks out module[f]
	User Reset	Shuts down Circuits[g]
Condenser Flow Alarm	User Reset	Shuts down Circuits/Circuit 1[g]
	User Reset	Locks out module[h]
Source Flow Alarm	User Reset	Shuts down Circuits
HP Alarm	User Reset	Shuts down Circuit 1/2
HP Switch Alarm	Auto Reset	Shuts down Circuit 1/2
LP Alarm	Auto Reset	Shuts down Circuit 1/2
LP Lockout Alarm	User Reset	Shuts down Circuit 1/2
Secondary 1 communication lost	Auto Reset	Warning
Secondary 2 communication lost	Auto Reset	Warning
Secondary 3 communication lost	Auto Reset	Warning
Secondary 4 communication lost	Auto Reset	Warning
Secondary 5 communication lost	Auto Reset	Warning
Secondary 6 communication lost	Auto Reset	Warning
Secondary 7 communication lost	Auto Reset	Warning
Secondary 8 communication lost	Auto Reset	Warning
Secondary 9 communication lost	Auto Reset	Warning
Secondary 10 communication lost	Auto Reset	Warning
Secondary 11 communication lost	Auto Reset	Warning
Primary communication lost	Auto Reset	Secondary Modules switch into Stand-alone Mode

Table 20. MWC interface panel diagnostic code key (continued)

Alarm	Type	Action
BMS offline	Auto Reset	Warning
System Chilled LWT too high	Auto Reset	Warning
System Hot LWT too low	Auto Reset	Warning
Condenser LWT too low	Auto Reset	Warning
Evaporator LWT too high	Auto Reset	Warning
Error in the number of retain memory writings	User Reset	Warning
Error in retain memory writings	User Reset	Warning
Wrong Primary rotation control parameters	Auto Reset	Warning
Wrong temperature control parameters	Auto Reset	Warning
Circuit 1 Differential Pressure low	Auto Reset	Warning
Circuit 2 Differential Pressure low	Auto Reset	Warning
Low Differential Pressure Lockout	User Reset	If Circuit 1/2 Low DP Warnings occurred
Hot Water Temperature too high	Auto Reset	Shuts down chiller bank
No Available Modules	Auto Reset	Warning
Evaporator Pumps Offline	Auto Reset	Warning[i]
Condenser Pumps Offline	Auto Reset	Warning[i]
Compressor 1 Short-cycling	Auto Reset	Warning
Compressor 1 Short-cycling Lockout	User Reset	Locks out compressor 1
Compressor 2 Short-cycling	Auto Reset	Warning
Compressor 2 Short-cycling Lockout	User Reset	Locks out compressor 2
Circuit 1 Evacuation Cycle	Auto Reset	Warning
Circuit 2 Evacuation Cycle	Auto Reset	Warning

(a) If low pressure sensor selected for suction pressure alarm.
(b) If module is in stand-alone mode and respective entering/leaving water sensor selected for temperature control.
(c) For models with integrated free cooling.
(d) If both respective cooling/heating mode selected and respective entering/leaving water sensor selected for temperature control.
(e) If a single phase monitor per chiller bank selected.
(f) For variable flow systems.
(g) For constant flow systems.
(h) For variable flow, heating mode systems.
(i) If evaporator/condenser pumps module used.

Table 21. WXM interface panel diagnostic code key

Alarm	Type	Action
UI1 sensor failure	Auto Reset	Shuts down Circuit 1[a]
UI2 sensor failure	Auto Reset	Shuts down Circuit 1
UI3 sensor failure	Auto Reset	Shuts down local cooling control[b]
	Auto Reset	Shuts down local heating control[b]
UI4 sensor failure	Auto Reset	Locks out module
	Auto Reset	Warning
UI5 sensor failure	Auto Reset	Warning
	Auto Reset	Locks out module
UI7 sensor failure	Auto Reset	Warning
UI8 sensor failure	Auto Reset	Warning
UI9 sensor failure	Auto Reset	Shuts down Circuit 2[a]
UI10 sensor failure	Auto Reset	Shuts down Circuit 2

Table 21. WXM interface panel diagnostic code key (continued)

Alarm	Type	Action
UI11 sensor failure	Auto Reset	Control panel heating/cooling control is disabled
cpCOe #1 UI1 sensor failure	Auto Reset	Warning
cpCOe #1 UI2 sensor failure	Auto Reset	Warning
cpCOe #1 Offline Alarm	Auto Reset	Warning
cpCOe #1 wrong config Alarm	Auto Reset	Warning
cpCOe #2 UI1 sensor failure	Auto Reset	Modules switch into Stand-alone Mode[c]
cpCOe #2 UI2 sensor failure	Auto Reset	Modules switch into Stand-alone Mode[c]
cpCOe #2 UI7 sensor failure	Auto Reset	Switches from Remote SP to Local if used
cpCOe #2 UI8 sensor failure	Auto Reset	Switches from Remote SP to Local if used
cpCOe #2 Offline Alarm	Auto Reset	Modules switch into Stand-alone Mode[c]
cpCOe #2 wrong config Alarm	Auto Reset	Warning
Compressor 1 External Fault	Auto Reset	Shuts down compressor 1
CoreSense 1 Warning	Auto Reset	Warning
CoreSense 1 Fault	User Reset	Shuts down compressor 1
CoreSense 1 Failure	User Reset	Shuts down compressor 1
CoreSense 1 Lockout	User Reset	Shuts down Circuit 1
CoreSense 1 Offline	Auto Reset	Shuts down compressor 1
Compressor 2 External Fault	Auto Reset	Shuts down compressor 2
CoreSense 2 Warning	Auto Reset	Warning
CoreSense 2 Fault	User Reset	Shuts down compressor 2
CoreSense 2 Failure	User Reset	Shuts down compressor 2
CoreSense 2 Lockout	User Reset	Shuts down Circuit 2
CoreSense 2 Offline	Auto Reset	Shuts down compressor 2
EVD offline	Auto Reset	Warning
EVD System Alarm	Auto Reset	Warning
EVD Driver A Alarm	Auto Reset	Warning
EVD Driver B Alarm	Auto Reset	Warning
EVD 2 offline	Auto Reset	Warning[d]
EVD 2 System Alarm	Auto Reset	Warning[d]
EVD 2 Driver A Alarm	Auto Reset	Warning[d]
EVD 2 Driver B Alarm	Auto Reset	Warning[d]
Evaporator Freezing Alarm	User Reset	Locks out module
Phase Monitor Alarm	Auto Reset	Shuts down chiller bank[e]
Load Flow Alarm	User Reset	Locks out module
Source Flow Alarm	User Reset	Shuts down Circuits
	User Reset	Locks out module
HP Alarm	User Reset	Shuts down Circuit 1/2
HP Switch Alarm	Auto Reset	Shuts down Circuit 1/2
LP Alarm	Auto Reset	Shuts down Circuit 1/2
LP Lockout Alarm	User Reset	Shuts down Circuit 1/2
Secondary 1 communication lost	Auto Reset	Warning
Secondary 2 communication lost	Auto Reset	Warning

Table 21. WXM interface panel diagnostic code key (continued)

Alarm	Type	Action
Secondary 3 communication lost	Auto Reset	Warning
Secondary 4 communication lost	Auto Reset	Warning
Secondary 5 communication lost	Auto Reset	Warning
Secondary 6 communication lost	Auto Reset	Warning
Secondary 7 communication lost	Auto Reset	Warning
Secondary 8 communication lost	Auto Reset	Warning
Secondary 9 communication lost	Auto Reset	Warning
Secondary 10 communication lost	Auto Reset	Warning
Secondary 11 communication lost	Auto Reset	Warning
Primary communication lost	Auto Reset	Secondary Modules switch into Stand-alone Mode
BMS offline	Auto Reset	Warning
System Chilled LWT too high	Auto Reset	Warning
System Hot LWT too low	Auto Reset	Warning
Condenser LWT too low	Auto Reset	Warning
Evaporator LWT too high	Auto Reset	Warning
Error in the number of retain memory writings	User Reset	Warning
Error in retain memory writings	User Reset	Warning
Wrong Primary rotation control parameters	Auto Reset	Warning
Wrong temperature control parameters	Auto Reset	Warning
Circuit 1 Differential Pressure low	Auto Reset	Warning
Circuit 2 Differential Pressure low	Auto Reset	Warning
Low Differential Pressure Lockout	User Reset	If Circuit 1/2 Low DP Warnings occurred
Hot Water Temperature too high	Auto Reset	Shuts down chiller bank
No Available Modules	Auto Reset	Warning
Evaporator Pumps Offline	Auto Reset	Warning[f]
Condenser Pumps Offline	Auto Reset	Warning[f]
Compressor 1 Short-cycling	Auto Reset	Warning
Compressor 1 Short-cycling Lockout	User Reset	Locks out compressor 1
Compressor 2 Short-cycling	Auto Reset	Warning
Compressor 2 Short-cycling Lockout	User Reset	Locks out compressor 2

(a) If low pressure sensor selected for suction pressure alarm.
(b) If module is in stand-alone mode and respective entering/leaving water sensor selected for temperature control.
(c) If both respective cooling/heating mode selected and respective entering/leaving water sensor selected for temperature control.
(d) For heat pump special application that uses 4 EXVs per module.
(e) If a single phase monitor per chiller bank selected.
(f) If evaporator/condenser pumps module used.

Compressor Diagnostic Codes

Copeland compressors used in Trane chillers/heat pumps are highly automated with digital capability to record and report a range of operating parameters and critical events. This technology can be employed to assist in troubleshooting compressor faults and potential corrective action.

CoreSense™ Flash Codes

If equipped, the CoreSense technology in the Copeland compressor will communicate an abnormal system condition through a unique flash code:

The flash code number corresponds to the number of LED flashes, followed by a pause, and then the flash code is repeated.

A lockout condition produces a red flash, followed by a pause, a solid red, a second pause, and then repeated.

Table 22. CoreSense™ communications LED flash code information

Status	Fault Condition	Code Fault Description	Code Reset Description	Trouble Shooting Information
Solid Green	Normal Operation	Module is powered and operation is normal	N/A	N/A
Solid Red	Module Malfunction	Module has internal fault	N/A	1. Reset module by removing power from T2-T1 2. Replace module
Warning LED Flash				
Green Flash Code 1	Loss of Communication	Module and master controller have lost communications with each other for more than 5 minutes	When communications are confirmed	1. Check the control wiring 2. Verify dipswitch 8 is “on”
Green Flash Code 2	Future Use	N/A	N/A	N/A
Green Flash Code 3	Short Cycling	Run time of less than 3 minutes; number of short cycles exceeds 48 in 24 hours	< 48 short cycles in 24 hours	1. Check system charge and pressure control setting. 2. Adjust set-point of temperature controller. 3. Install anti-short cycling control.
Green Flash Code 4	Open/Shorted Scroll Thermistor	Ω > 370K or Ω < 1K	5.1K < Ω < 370K	1. Check for poor connections at module and thermistor fusite. 2. Check continuity of thermistor wiring harness.
Green Flash Code 5	Future Use	N/A	N/A	N/A
Alert/Lockout LED Flash				
Red Flash Code 1	Motor High Temperature	Ω > 4.5K ± 25%; lockout after 5 alerts	Ω < 2.75K and 30 minutes	1. Check supply voltage. 2. Check system charge and superheat. 3. Check contactor
Red Flash Code 2	Open/Shorted Motor Thermistor	Ω > 220K or Ω < 40; lockout after 6 hours	40 < Ω < 2.75K and 30 minutes	1. Check for poor connections at module and thermistor fusite. 2. Check continuity of thermistor wiring harness.
Red Flash Code 3	Short Cycling	Run time of less than 3 minutes; lockout if the number of alerts exceeds the number configured by the user in 24 hours	Interrupt power to T2-T1 or perform Modbus reset command	1. Check system charge and pressure control setting. 2. Adjust set-point of temperature controller. 3. Install anti-short cycling control.
Red Flash Code 4	Scroll High Temperature	Ω < 2.4K; lockout if the number of alerts exceeds the number configured by the user in 24 hours	Interrupt power to T2-T1 or perform Modbus reset command	1. Check system charge and superheat. 2. Check system operating conditions 3. Check for abnormally low suction pressure

Table 22. CoreSense™ communications LED flash code information (continued)

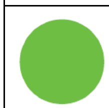
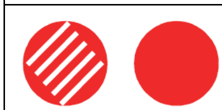
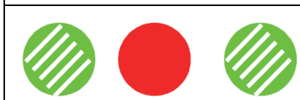
Status	Fault Condition	Code Fault Description	Code Reset Description	Trouble Shooting Information
Red Flash Code 5	Future Use	N/A	N/A	N/A
Red Flash Code 6	Missing Phase	Missing phase	After 5 minutes, missing phase condition is not present	1. Check incoming power. 2. Check fuses/breakers. 3. Check contactor.
Red Flash Code 7	Reverse Phase	Reverse phase; Lockout after 1 Alert	Interrupt power to T2-T1 or perform Modbus reset command	1. Check incoming phase sequence. 2. Check contactor. 3. Check module phasing wires A-B-C.
Red Flash Code 8	Future Use	N/A	N/A	N/A
Red Flash Code 9	Module Low Voltage	Low voltage on T2-T1 terminals1	After 5 minutes, the voltage is back in the normal range	1. Verify correct module p/n. 2. Check VA rating of transformer. 3. Check for blown fuse in transformer secondary.

Phase Monitor Protection

If the chiller/heat pump fails to power up, eliminate electrical phase issues by inspecting the phase monitor device located in the power distribution panel.

When all voltages are acceptable and the phase sequence is correct the output relay is energized and the LED glows green. Under-voltages and unbalanced voltages must be sensed for a continuous trip delay period before the relay de-energizes. Reset is automatic upon correction of the fault condition. The output relay will not energize if a fault condition is sensed as power is applied. The LED flashes red during the trip delay, then glows red when the output de-energizes. The LED flashes green/red if phase reversal is sensed.

Table 23. LED phase monitor diagnostic codes

LED Display	Indication
	Glowing green: All voltages are acceptable and phase sequence is correct.
	Flashing red: Trip delay prior to de-energizing. Glowing red: Output has been de-energized upon fault detection.
	Flashing red and green: Phase reversal is detected.
	No power to phase monitor.

If the phase monitor fails to energize (the LED glows red) check wiring of all three phases, voltage, and phase sequence. If phase sequence is incorrect, the LED flashes green/red. To correct this, swap any two line voltage connections at the mounting socket. No further adjustment should be required.

Symptoms and Solutions

This section lists the most common troubleshooting symptoms and the closest potential solution for each. This is not an exhaustive listing of all potential causes or resolutions, but represents the best direction in which to initiate a solution.

Note: *An anti-short cycle timer is included in the primary microprocessor controller to prevent the compressors from starting until the delay has elapsed. The microprocessor also provides minimum compressor run timers. Take these fixed timer parameters into consideration when conducting a fault isolation process.*

1. Symptom: Compressor will not start	
Possible Causes	**Potential Solutions**
Temperature control not in demand	Check setpoint.
Flow switch open due to low water flow	Check flow switch functionality; check flow rate.
Low pressure, high pressure sensor/switch open	Low/high pressure event has occurred; obstructed BPHE; check sensor functionality.
High pressure switch open	High pressure event has occurred; check obstructed BPHE; check pressure switch functionality.
Compressor overload opened	Allow motor to cool and reset; high amp load/floodback; compressor operating outside of operating envelope.
No power to module	Check breakers and fuses; energize from module electrical and control panel.
Phase monitor open or tripped	Check phase sequence, unbalanced voltage, overvoltage, undervoltage; loss of phase.
Breaker tripped	Reset breaker/check amp draw.

2. Symptom: Compressor will not run	
Possible Causes	**Potential Solutions**
Breakers and switches are off	Assure all breakers and switches are on.
Main switch open or circuit breakers open	Check circuits and motor winding for shorts or grounds.
Fuse is blown	Replace fuse or reset breakers after fault is corrected.
Investigate for possible overloading	Overloads are auto-reset. Monitor to assure the overload does not re-occur.
Defective contactor or coil	Determine type and cause. Correct fault before resetting safety.
Motor electrical trouble	Tighten all terminal screws.

3. Symptom: Compressor has excessive noise or vibration	
Possible Causes	**Potential Solutions**
Flooding of refrigerant into crankcase	Check setting of expansion valve; check crankcase heater.
Improper or worn compressor support (vibration-isolating mounting)	Replace support.
Worn compressor	Replace or rebuild compressor.
Improper phase sequence	Check phase sequence.

4. Symptom: Compressor Loading/Unloading Cycles Too Short	
Possible Causes	**Potential Solutions**
Temperature differential set too low	Ramp/set temperature differential setpoint; check stage up/down settings.
Incorrect liquid temperature settings	Select proper control settings.
Insufficient evaporator water flow	Adjust flow rate.
Low system liquid/water volume	Water system volume needs to be increased.

5. Symptom: Compressor loses oil	
Possible Causes	**Potential Solutions**
Low refrigerant charge	Check for leaks and repair. Add refrigerant to proper charge.
Gas velocity in risers too low	Check riser sizes against compressor gas flow.
Defective crankcase heater	Replace crankcase heater.

5. Symptom: Compressor loses oil	
Possible Causes	**Potential Solutions**
Oil trapped in the system	Check operating condition to assure compressor runs inside map.
Compressor short cycling	Adjust proper control settings for Min. ON/OFF runtime.
Liquid refrigerant	Check compressor superheat. Superheat at the compressor suction should be approximately 12° F (8.3° C).

6. Symptom: Low refrigeration suction pressure	
Possible Causes	**Potential Solutions**
Lack of refrigerant	Check for leaks. Repair and add charge.
Evaporator dirty	Clean with chemical.
Suction line blockage	Check suction line for any obstacle.
Condensing temperature too low	Check condensing temperature; Check control valves on condenser.
Low water temperature	Raise set point; check design specification.
Low discharge pressure	Refrigerant charge; replace compressor.
Improper expansion valve settings	Check EXV functionality and settings.
Mis-adjusted or defective TXV	Adjust or replace valve.
Receiver service valve closed	Turn counterclockwise completely. Do not fully backseat if pressure switch is installed on service port.
Clogged liquid line filter-drier	Replace filter drier or cartridges.
Excessive glycol concentration	Charge to proper glycol concentration.
Liquid line solenoid restricted or faulty	Replace solenoid valve, coil, or internals as necessary.
Insufficient chilled water	Adjust flow rate through evaporator.
Restricted water/glycol line	Clean strainers; check manual and electronic valves.
Water/glycol mixture contaminated	Intensive cleanup effort needed to identify source of contamination; external filter may be required.
Evaporator tubing clogged or fouled	Reverse flush with appropriate chemical solutions.

7. Symptom: High refrigeration suction pressure	
Possible Causes	**Potential Solutions**
Expansion valve opened too far	Check EXV settings and functionality.
Excessive refrigerant charge	Reclaim excess refrigerant and verify proper sub-cooling and superheat.
High water temperature	Low refrigerant charge; faulty; excessive load compressor; check design specifications.

8. Symptom: Low refrigerant discharge pressure	
Possible Causes	**Potential Solutions**
Insufficient refrigerant in chiller	Check for leaks. Repair and add refrigerant as needed.
Faulty compressor	Check compressor.
Low condenser temperature	Check condenser rating tables.
Low suction pressure	See ‘low refrigeration suction pressure’.
Condenser pressure regulating valve(if provided) not properly adjusted	Refer to OEM manufacturer manual for default settings; replace condenser head pressure control valve (if installed).

9. Symptom: High refrigerant discharge pressure	
Possible Causes	**Potential Solutions**
System overcharged with refrigerant	Remove excess refrigerant.
Condenser tubes clogged or fouled	Reverse flush with appropriate chemical solution.
Non-condensables in chiller	Purge non-condensables.
Improper water flow in condenser	Check condenser flow rate.
Not enough heat transfer in cooling tower	Inspect cooling tower for biofilm, fouling, clogged tower (due to dirt particles), scaling, and corrosion; check functionality and performance of cooling tower.
Restricted water in condenser	Clean strainers; check control valve settings and functionality.
EXV/TXV does not function properly	Check EXV/TXV functionality; check SSH settings.
Overshooting LWT temperature in heating mode	Water system volume needs to increase; check stage band control settings

10. Symptom: Low chilled water temperature	
Possible Causes	**Potential Solutions**
Temperature controllers set too low	Reset temperature controllers to correct design specifications.
Low water flow	Clean strainer; check pump, VFD, and differential pressure settings; check to ensure electric and manual water valves are fully open.
Faulty system temperature sensor	Replace temperature sensor.

11. Symptom: High chilled water temperature	
Possible Causes	**Potential Solutions**
Load higher than capacity of chiller/heat pump	Refer to chiller/heat pump design specifications.
Loss of refrigeration charge	Check refrigerant charge.
Fouled evaporator	Reverse flush evaporator; check strainer for debris.
High water flow rate	Check pump, VFD, and differential pressure settings.
Faulty system temperature sensor	Replace temperature sensor.

12. Symptom: Compressor thermal protector switch open	
Possible Causes	**Potential Solutions**
Operating beyond design conditions or compressor envelop	Check chiller settings; refer to design specification.
Faulty compressor overload	Replace overload if external type provided.

13. Symptom: No low voltage (24 Vac)	
Possible Causes	**Potential Solutions**
Transformer primary side fuse open	Check fuse prong contact points; replace fuse.
Transformer defective	Replace transformer.
No primary voltage on transformer	Check breakers, fuses; check power supply specifications.

14. Symptom: Thermal Expansion valve superheat too high	
Possible Causes	**Potential Solutions**
Water/glycol temperature too warm	Check setpoints; check charge.
Obstructed filter dryer	Replace dryer core.

14. Symptom: Thermal Expansion valve superheat too high	
Possible Causes	**Potential Solutions**
Low refrigerant charge	Recharge refrigerant as per unit nameplate.
Defective or improper settings of EXV	Reset valve settings to factory specifications.
Sensing bulb incorrectly located	Check if secured to pipe or insulated; check sensor position on pipe.

15. Symptom: Thermal expansion valve superheat too low	
Possible Causes	**Potential Solutions**
Sensing bulb not properly located	Check if secured to pipe or insulated; check sensor position on pipe.
Defective thermostatic element (if it is applicable)	Replace power head.
EXV/TXV valve superheat setting is too low or not functioning properly.	Check EXV/TXV settings and functionality.

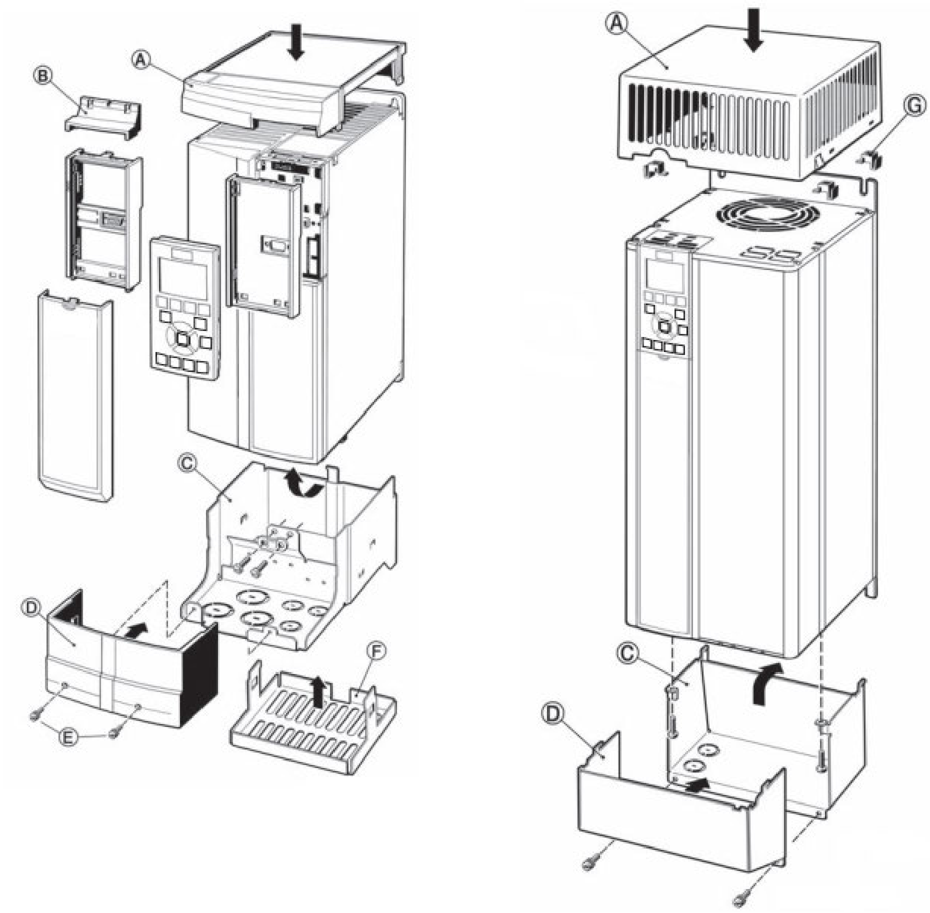
16. Symptom: Contactor/relay inoperative	
Possible Causes	**Potential Solutions**
Coil shorted or open	Replace coil
Mechanical parts broken or jammed	Replace assembly
Contacts pitted or burned	Replace contactors
No 24 Vac to coil	Replace secondary fuse to transformer; check transformer.

17. Symptom: Freeze protection safety activated	
Possible Causes	**Potential Solutions**
Chiller setpoint is too low	Use a proper setpoint.
Low water flow	Clean strainer; check pump, VFD, and differential pressure settings.
Low suction pressure	See **low suction pressure**.

Appendix A. Optional Variable Frequency Drive

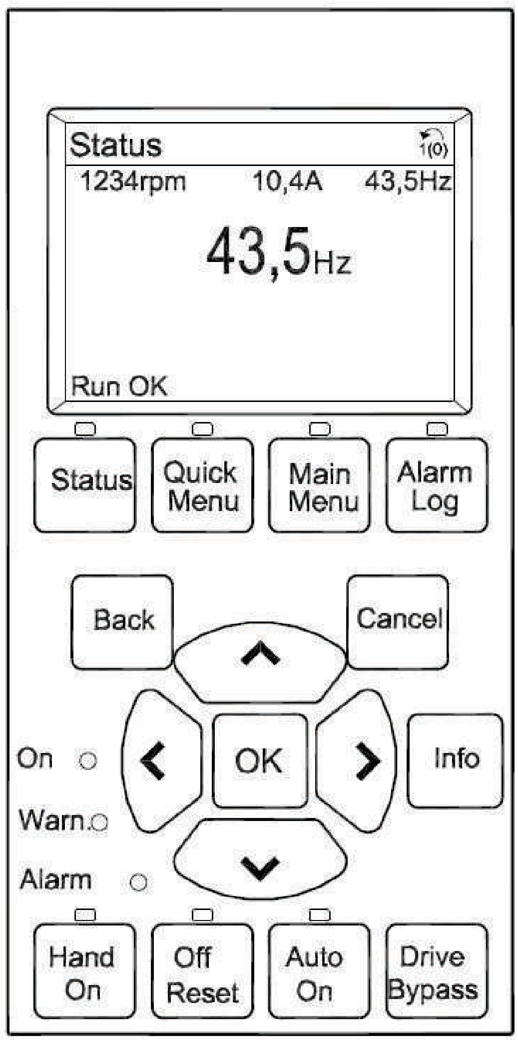
Thermafit™ MWC and WXM modulars are optionally equipped with a Trane TR200 VFD. The lead chiller module or all chiller modules can have a variable speed drive (VSD) on the lead scroll compressor and standard scroll compressor on the lag circuit. The VSD scroll compressor provides smooth and efficient operation from 45 Hz to 60 Hz for close temperature control. This part load operation can lower the compressor condensing temperatures thereby lowering power consumption during variable load or low cooling load demands.

Figure 29. Trane TR200 variable frequency drive



Local Control Panel (LCP)

Local control panel (LCP) is a combined display and keypad on the front of the unit. The LCP is the user interface to the frequency converter.



The LCP has several user functions.

- Start, stop, and control speed when in local control.
- Display operational data, status, warnings, and cautions.
- Programming frequency converter functions.
- Manually reset the frequency converter after a fault when auto-reset is inactive.

Warnings and Alarms

The frequency converter monitors the condition of its input power, output, and motor factors as well as other system performance indicators. A warning or alarm may not necessarily indicate a problem internal to the frequency converter itself. In many cases, it indicates failure conditions from input voltage, motor load or temperature, external signals, or other areas monitored by the frequency converter's internal logic. Be sure to investigate those areas exterior to the frequency converter as indicated in the alarm or warning.

Warnings

A warning is issued when an alarm condition is impending or when an abnormal operating condition is present and may result in the frequency converter issuing an alarm. A warning clears by itself when the abnormal condition is removed.

Alarms/Trips

An alarm is issued when the frequency converter is tripped, that is, the frequency converter suspends operation to prevent frequency converter or system damage. The motor will coast to a stop. The frequency converter logic will continue to operate and monitor the frequency converter status. After the fault condition is remedied, the frequency converter can be reset. It will then be ready to start operation again.

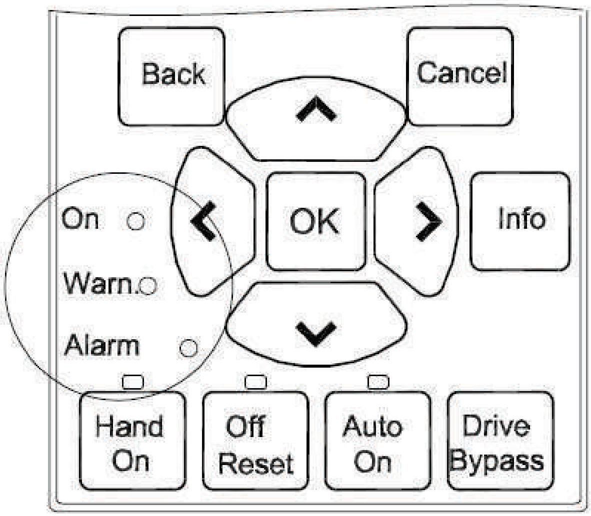
A trip can be reset in any of 4 ways:

- Press (Reset) on the LCP
- Digital reset input command
- Serial communication reset input command
- Auto reset

An alarm that causes the frequency converter to trip-lock requires that input power is cycled. The motor will coast to a stop. The frequency converter logic will continue to operate and monitor the frequency converter status. Remove input power to the frequency converter and correct the cause of the fault, then restore power. This action puts the frequency converter into a trip condition as described above and may be reset in any of those 4 ways.

Warning and Alarm Displays

An alarm or trip-lock alarm will flash on display along with the alarm number. In addition to the text and alarm code on the frequency converter LCP, there are three status indicator lights.



	Warning LED	Alarm LED
Warning	On	Off
Alarm	Off	On (Flashing)
Trip-Lock	On	On (Flashing)

Warning and Alarm Definitions

The warning/alarm information below defines each warning/alarm condition, provides the probable cause for the condition, and details a remedy or troubleshooting procedure.

⚠ WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

Table 24. Warning and alarm definitions and troubleshooting

Warning/Alarm	Description / Probable Cause	Troubleshooting
WARNING 1, 10 Volts low	The control card voltage is below 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω. This condition can be caused by a short in a connected potentiometer or improper wiring of the potentiometer.	Remove the wiring from terminal 50. If the warning clears, the problem is with the customer wiring. If the warning does not clear, replace the control card.
WARNING/ALARM 2, Live zero error	This warning or alarm only appears if programmed by the user in 6-01 Live Zero Timeout Function. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. Broken wiring or faulty device sending the signal can cause this condition.	• Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. MCB 101 terminals 11 and 12 for signals, terminal 10 common. MCB 109 terminals 1, 3, 5 for signals, terminals 2, 4, 6 common. • Check that the frequency converter programming and switch settings match the analog signal type. • Perform Input Terminal Signal Test.
WARNING/ALARM 4, Mains phase loss	A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the frequency converter. Options are programmed at 14-12 Function at Mains Imbalance.	Check the supply voltage and supply currents to the frequency converter.
WARNING 5, DC link voltage high	The intermediate circuit voltage (DC) is higher than the high voltage warning limit. The limit is dependent on the frequency converter voltage rating. The unit is still active.	
WARNING 6, DC link voltage low	The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the frequency converter voltage rating. The unit is still active.	
WARNING/ALARM 7, DC overvoltage	If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.	• Connect a brake resistor. • Extend the ramp time. • Change the ramp type. • Activate the functions in 2-10 Brake Function. • Increase 14-26 Trip Delay at Inverter Fault. • If the alarm/warning occurs during a power sag, the solution is to use kinetic back-up (14-10 Mains Failure).
WARNING/ALARM 8, DC under voltage	If the intermediate circuit voltage (DC link) drops below the under-voltage limit, the frequency converter checks if a 24 V DC backup supply is connected. If no 24 V DC backup supply is connected, the frequency converter trips after a fixed time delay. The time delay varies with unit size.	• Check that the supply voltage matches the frequency converter voltage. • Perform input voltage test. • Perform soft charge circuit test.
WARNING/ALARM 9, Inverter overload	The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection issues a warning at 98% and trips at 100%, while giving an alarm. The frequency converter cannot be reset until the counter is below 90%. The fault is that the frequency converter has run with more than 100% overload for too long.	• Compare the output current shown on the LCP with the frequency converter rated current. • Compare the output current shown on the LCP with measured motor current. • Display the Thermal Drive Load on the LCP and monitor the value. When running above the frequency converter continuous current rating, the counter increases. When running below the frequency converter continuous current rating, the counter decreases.
WARNING/ALARM 10, Motor overload temperature	According to the electronic thermal protection (ETR), the motor is too hot. Select whether the frequency converter issues a warning or an alarm when the counter reaches 100% in 1-90 Motor Thermal Protection. The fault occurs when the motor runs with more than 100% overload for too long.	• Check for motor overheating. • Check if the motor is mechanically overloaded. • Check that the motor current set in 1-24 Motor Current is correct. • Ensure that Motor data in parameters 1-20 to 1-25 are set correctly. • If an external fan is in use, check in 1-91 Motor External Fan that it is selected. • Running AMA in 1-29 Automatic Motor Adaptation (AMA) tunes the frequency converter to the motor more accurately and reduces thermal loading.

Table 24. Warning and alarm definitions and troubleshooting (continued)

Warning/Alarm	Description / Probable Cause	Troubleshooting
WARNING/ALARM 11, Motor thermistor over temp	Check whether the thermistor is disconnected. Select whether the frequency converter issues a warning or an alarm in 1-90 Motor Thermal Protection	• Check for motor overheating. • Check if the motor is mechanically overloaded. • When using terminal 53 or 54, check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply). Also check that the terminal switch for 53 or 54 is set for voltage. • Check 1-93 Thermistor Source selects terminal 53 or 54. • When using digital inputs 18 or 19, check that the thermistor is connected correctly between either terminal 18 or 19 (digital input PNP only) and terminal 50. Check 1-93 Thermistor Source selects terminal 18 or 19.
WARNING/ALARM 12, Torque limit	The torque has exceeded the value in 4-16 Torque Limit Motor Mode or the value in 4-17 Torque Limit Generator Mode. 14-25 Trip Delay at Torque Limit can change this from a warning only condition to a warning followed by an alarm.	• If the motor torque limit is exceeded during ramp up, extend the ramp up time. • If the generator torque limit is exceeded during ramp down, extend the ramp down time. • If torque limit occurs while running, possibly increase the torque limit. Make sure that the system can operate safely at a higher torque. • Check the application for excessive current draw on the motor.
WARNING/ALARM 13, Over current	The inverter peak current limit approximately 200% of the rated current) is exceeded. The warning lasts about 1.5 s, then the frequency converter trips and issues an alarm. This fault can be caused by shock loading or quick acceleration with high inertia loads. It can also appear after kinetic back-up if the acceleration during ramp up is quick. If extended mechanical brake control is selected, trip can be reset externally.	• Remove power and check if the motor shaft can be turned. • Check that the motor size matches the frequency converter. • Check parameters 1-20 to 1-25 for correct motor data.
ALARM 14, Earth (ground) fault	There is current from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself.	• Remove power to the frequency converter and repair the earth fault. • Check for earth faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohmmeter.
ALARM 15, Hardware mismatch	A fitted option is not operational with the present control board hardware or software.	Record the value of the following parameters and contact your Trane supplier: • 15-40 FC Type • 15-41 Power Section • 15-42 Voltage • 15-43 Software Version • 15-45 Actual Typecode String • 15-49 SW ID Control Card • 15-50 SW ID Power Card • 15-60 Option Mounted • 15-61 Option SW Version (for each option slot)
ALARM 16, Short circuit	There is short-circuiting in the motor or motor wiring.	Remove power to the frequency converter and repair the short circuit.
WARNING/ALARM 17, Control word timeout	There is no communication to the frequency converter. The warning is only active when 8-04 Control Timeout Function is NOT set to [0] Off. If 8-04 Control Timeout Function is set to [5] Stop and Trip, a warning appears, and the frequency converter ramps down until it stops then displays an alarm.	• Check connections on the serial communication cable. • Increase 8-03 Control Timeout Time. • Check the operation of the communication equipment. • Verify a proper installation based on EMC requirements.
ALARM 18, Start failed	The speed has not been able to exceed 1-77 Compressor Start Max Speed [RPM] during start within the allowed time (set in 1-79 Compressor Start Max Time to Trip). This may be caused by a blocked motor.	

Table 24. Warning and alarm definitions and troubleshooting (continued)

Warning/Alarm	Description / Probable Cause	Troubleshooting
WARNING 23, Internal fan fault	The fan warning function is an extra protective function that checks if the fan is running/ mounted. The fan warning can be disabled in 14-53 Fan Monitor ([0] Disabled). For the D, E, and F Frame filters, the regulated voltage to the fans is monitored.	• Check for proper fan operation. • Cycle power to the frequency converter and check that the fan operates briefly at start-up. • Check the sensors on the heatsink and control card.
WARNING 24, External fan fault	The fan warning function is an extra protective function that checks if the fan is running/ mounted. The fan warning can be disabled in 14-53 Fan Monitor ([0] Disabled).	
WARNING/ALARM 28, Brake check failed	The brake resistor is not connected or not working.	Check 2-15 Brake Check.
ALARM 29, Heatsink temp	The maximum temperature of the heatsink has been exceeded. The temperature fault will not reset until the temperature falls below a defined heatsink temperature. The trip and reset points are different based on the frequency converter power size.	Check for the following conditions. • Ambient temperature too high. • Motor cable too long. • Incorrect airflow clearance above and below the frequency converter. • Blocked airflow around the frequency converter. • Damaged heatsink fan. • Dirty heatsink.
ALARM 30, Motor phase U missing	Motor phase U between the frequency converter and the motor is missing.	• Remove power from the frequency converter and check motor phase U. • Remove power from the frequency converter and check motor phase V. • Remove power from the frequency converter and check motor phase W. • Let the unit cool to operating temperature.
ALARM 31, Motor phase V missing	Motor phase V between the frequency converter and the motor is missing.	Remove power from the frequency converter and check motor phase V.
ALARM 32, Motor phase W missing	Motor phase W between the frequency converter and the motor is missing.	Remove power from the frequency converter and check motor phase W.
ALARM 33, Inrush fault	Too many power-ups have occurred within a short time period.	Let the unit cool to operating temperature.
WARNING/ALARM 34, Fieldbus communication fault	The fieldbus on the communication option card is not working.	
WARNING/ALARM 36, Mains failure	This warning/alarm is only active if the supply voltage to the frequency converter is lost and 14-10 Mains Failure is NOT set to [0] No Function.	Check the fuses to the frequency converter and mains power supply to the unit.
ALARM 38, Internal fault	When an internal fault occurs, a code number defined in Table 8.3 is displayed.	• Cycle power. • Check that the option is properly installed. • Check for loose or missing wiring. • It may be necessary to contact your Trane supplier or service department. Note the code number for further troubleshooting directions.
ALARM 39, Heatsink sensor	No feedback from the heatsink temperature sensor. The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.	
WARNING 40	Overload of digital output terminal 27	Check the load connected to terminal 27 or remove short circuit connection. Check 5-01 Terminal 27 Mode.
WARNING 41	Overload of digital output terminal 29	Check the load connected to terminal 29 or remove short circuit connection. Check 5-02 Terminal 29 Mode.

Table 24. Warning and alarm definitions and troubleshooting (continued)

Warning/Alarm	Description / Probable Cause	Troubleshooting
WARNING 42	Overload of digital output on X30/6 or overload of digital output on X30/7.	• For X30/6, check the load connected to X30/6 or remove the short-circuit connection. Check 5-32 Term X30/6 Digi Out (MCB 101). • For X30/7, check the load connected to X30/7 or remove the short-circuit connection. Check 5-33 Term X30/7 Digi Out (MCB 101).
ALARM 45 Earth fault 2	Earth (ground) fault on start-up.	• Check for proper earthing (grounding) and loose connections. • Check for proper wire size. • Check motor cables for short-circuits or leakage currents.
ALARM 46, Power card supply	The supply on the power card is out of range. There are three power supplies generated by the switch mode power supply (SMPS) on the power card: 24 V, 5 V, ±18 V. When powered with 24 V DC with the MCB 107 option, only the 24 V and 5 V supplies are monitored. When powered with three phase mains voltage, all three supplies are monitored.	• Check for a defective power card. • Check for a defective control card. • Check for a defective option card. • If a 24 V DC power supply is used, verify proper supply power.
WARNING 47 24 V supply low	The 24 Vdc is measured on the control card.	
WARNING 48 1.8 V supply low	The 1.8Vdc supply used on the control card is outside of allowable limits. The power supply is measured on the control card.	Check for a defective control card. If an option card is present, check for an overvoltage condition.
WARNING 49, Speed limit	When the speed is not within the specified range in 4-11 Motor Speed Low Limit [RPM] and 4-13 Motor Speed High Limit [RPM], the frequency converter shows a warning. When the speed is below the specified limit in 1-86 Trip Speed Low [RPM] (except when starting or stopping) the frequency converter will trip.	
ALARM 50, AMA calibration failed		Contact your Trane supplier or Trane Service Department
ALARM 51, AMA check Unom and Inom	The settings for motor voltage, motor current and motor power are wrong.	Check the settings in parameters 1-20 to 1-25.
ALARM 52, AMA low Inom	The motor current is too low.	Check the settings.
ALARM 53, AMA motor too big	The motor is too big for the AMA to operate.	
ALARM 54, AMA motor too small	The motor is too small for the AMA to operate.	
ALARM 55, AMA parameter out of range	The parameter values of the motor are outside of the acceptable range. AMA will not run.	
ALARM 56, AMA interrupted by user	The user has interrupted the AMA.	
ALARM 57, AMA internal fault		Try to restart AMA again. Repeated restarts can overheat the motor.
ALARM 58, AMA Internal fault		Contact your Trane supplier.
WARNING 59, Current limit	The current is higher than the value in 4-18 Current Limit.	Ensure that Motor data in parameters 1-20 to 1-25 are set correctly. Possibly increase the current limit. Be sure that the system can operate safely at a higher limit.
WARNING 60, External interlock	A digital input signal is indicating a fault condition external to the frequency converter. An external interlock has commanded the frequency converter to trip.	Clear the external fault condition. To resume normal operation, apply 24 Vdc to the terminal programmed for external interlock. Reset the frequency converter.

Table 24. Warning and alarm definitions and troubleshooting (continued)

Warning/Alarm	Description / Probable Cause	Troubleshooting
WARNING 62, Output frequency at maximum limit	The output frequency has reached the value set in 4-19 Max Output Frequency.	Check the application to determine the cause. Possibly increase the output frequency limit. Be sure the system can operate safely at a higher output frequency. The warning will clear when the output drops below the maximum limit.
WARNING/ALARM 65, Control card over temperature	The cut-out temperature of the control card is 80 °C.	• Check that the ambient operating temperature is within limits. • Check for clogged filters. • Check fan operation. • Check the control card.
WARNING 66, Heatsink temperature low	The frequency converter is too cold to operate. This warning is based on the temperature sensor in the IGBT module.	Increase the ambient temperature of the unit. Also, a trickle amount of current can be supplied to the frequency converter whenever the motor is stopped by setting 2-00 DC Hold/Preheat Current at 5% and 1-80 Function at Stop
ALARM 67, Option module configuration has changed	One or more options have either been added or removed since the last power-down.	Check that the configuration change is intentional and reset the unit.
ALARM 69, Power card temperature	The temperature sensor on the power card is either too hot or too cold	• Check that the ambient operating temperature is within limits. • Check for clogged filters. • Check fan operation. • Check the power card.
ALARM 70, Illegal FC configuration	The control card and power card are incompatible.	Contact your supplier with the type code of the unit from the nameplate and the part numbers of the cards to check compatibility.
ALARM 78, Tracking error Drive initialized to default value	Parameter settings are initialized to default settings after a manual reset.	Reset the unit to clear the alarm.
ALARM 92, No flow	A no-flow condition has been detected in the system. 22-23 No-Flow Function is set for alarm.	Troubleshoot the system and reset the frequency converter after the fault has been cleared.
ALARM 93, Dry pump	A no-flow condition in the system with the frequency converter operating at high speed may indicate a dry pump. AP-26 Dry Pump Function is set for alarm.	Troubleshoot the system and reset the frequency converter after the fault has been cleared.
ALARM 94, End of curve	Feedback is lower than the set point. This may indicate leakage in the system. 22-50 End of Curve Function is set for alarm.	Troubleshoot the system and reset the frequency converter after the fault has been cleared.
ALARM 95, Broken belt	Torque is below the torque level set for no load, indicating a broken belt. 22-60 Broken Belt Function is set for alarm.	Troubleshoot the system and reset the frequency converter after the fault has been cleared.
ALARM 96, Start delayed	Motor start has been delayed due to short-cycle protection. 22-76 Interval between Starts is enabled.	Troubleshoot the system and reset the frequency converter after the fault has been cleared.
WARNING 97, Stop delayed	Stopping the motor has been delayed due to short cycle protection. 22-76 Interval between Starts is enabled.	Troubleshoot the system and reset the frequency converter after the fault has been cleared.
WARNING 98, Clock fault	Time is not set or the RTC clock has failed.	Reset the clock in 0-70 Date and Time.
WARNING 200, Fire mode	This warning indicates the frequency converter is operating in fire mode. The warning clears when fire mode is removed.	See the fire mode data in the alarm log.
WARNING 201, Fire mode was active	This indicates the frequency converter had entered fire mode.	Cycle power to the unit to remove the warning. See the fire mode data in the alarm log.
WARNING 202, Fire mode limits exceeded	While operating in fire mode one or more alarm conditions have been ignored which would normally trip the unit. Operating in this condition voids unit warranty.	Cycle power to the unit to remove the warning. See the fire mode data in the alarm log.

Table 24. Warning and alarm definitions and troubleshooting (continued)

Warning/Alarm	Description / Probable Cause	Troubleshooting
WARNING 203, Missing motor	With a frequency converter operating multi-motors, an under-load condition was detected. This could indicate a missing motor.	Inspect the system for proper operation.
WARNING 204, Locked rotor	With a frequency converter operating multi-motors, an overload condition was detected. This could indicate a locked rotor.	Inspect the motor for proper operation.
WARNING 250, New spare part	A component in the frequency converter has been replaced.	Reset the frequency converter for normal operation.
WARNING 251, New typecode	The power card or other components have been replaced and the typecode changed.	Reset to remove the warning and resume normal operation.

Appendix B. Request for Initial Start-Up

MWC and WXM Chiller/ Heat Pump

As part of a continuous commitment to quality, initial start-up of this chiller/heat pump by a factory-certified technician may be purchased from Trane. No initial start-up will be scheduled without a Request for Initial Start-Up form completed and on file with the Trane customer service department. Submitting this form indicates that all critical work described on the form has been completed. To prevent additional charges for aborted start-ups, the following items must be completely functional and operating and this form signed and returned to Trane at least 10 working days prior to the scheduled initial start-up date.

Table 25. Chiller/heat pump initial start-up data

Model Number:	Primary Module Serial Number:
Primary Contact Name:	Primary Contact Phone:
Primary Contact FAX:	Primary Contact Mobile:
Name of Chiller/Heat Pump Site:	
Physical Location of Chiller/Heat Pump:	
Requested Date for Initial Start-Up: **Requested Time for Initial Start-Up:**	

Table 26. Mandatory initial start-up requirements

Mandatory Tasks	Date Completed	Completed By (Initials)
All chiller/heat pump modules are installed with minimum clearances available from all sides.		
Refrigeration gauges are indicating equal pressures.		
Chilled water lines from chiller/heat pump to customer's equipment are permanently connected.		
Chilled water lines have been flushed clean of mud, slag, and other construction debris.		
All chilled water line filters and strainers are clean.		
Chilled water lines have been leak tested according to prestart instructions.		
Chiller/heat pump reservoir (if included) is at operating level with correct water/glycol mixture.		
High voltage wiring is installed, tested, and functional.		
All water, refrigeration, electrical, and control connections between chiller/heat pump modules are completed.		
All control wiring between modular chillers/heat pumps is installed, tested, and functional.		
Control wiring is complete, including any remote interface panel or special-purpose module wiring.		
Automatic City Water Switchover (if included) is installed, flushed, and leak-tested.		
Condenser, if applicable, is installed, piped, wired, and leak-tested.		
All responsible installing contractors and sub-contractors are notified to have representatives available on site to provide technical support for the initial start-up procedure.		
Full load is available for chiller/heat pump on the initial start-up date.		

Initial Startup Agreement

By signing this form, you agree the chiller/heat pump is ready for initial startup. It is understood that, if the unit is not ready for initial startup due to site problems, the initial startup will be aborted at the discretion of the designated startup technician. Payment for an aborted startup will be forfeited. Rescheduled initial startups are subject to any additional costs that may have been incurred by the technician. An approved purchase order or payment in advance will be required to reschedule an aborted initial startup.

Name (Printed): ___________________________________ Date: _____________________________________

Signature: ____ Company: _________________________________

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